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Training, performance and dynamic capabilities: New insights from absorptive, innovative, adaptative and learning capacities

Edited by
Juan Moreno-Garcia, Felipe Hernández-Perlines, Benito Yáñez-Araque and Murad Ali

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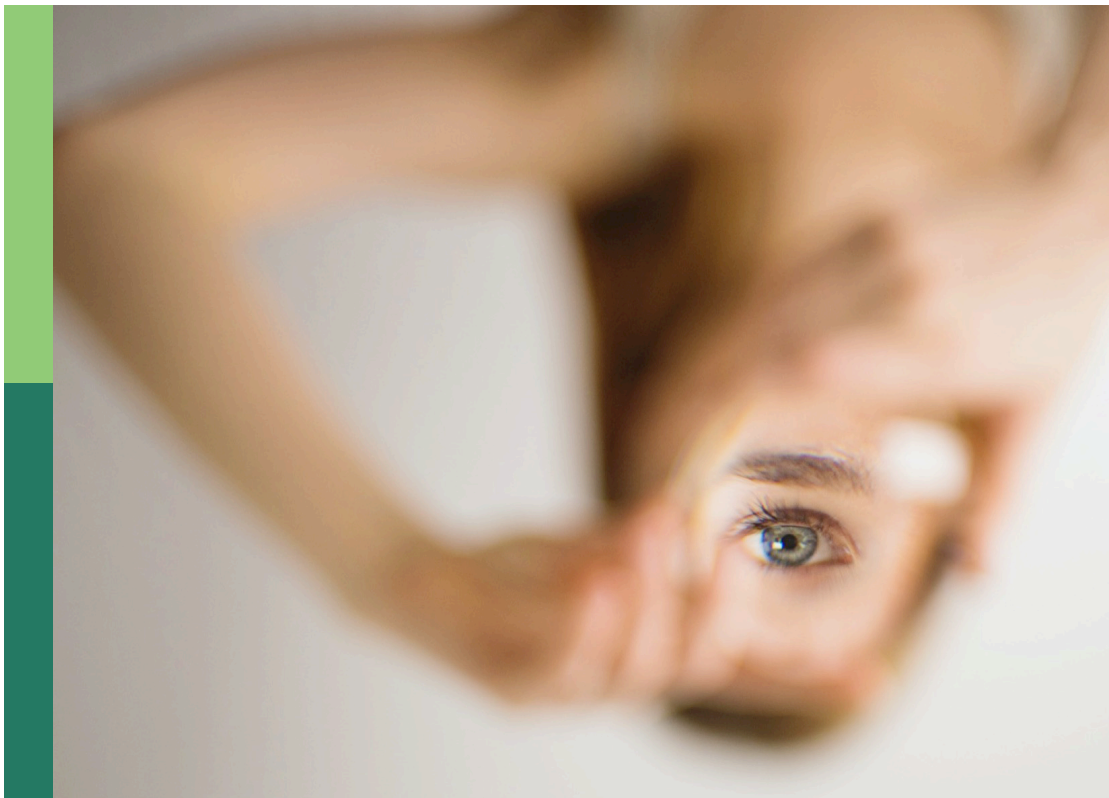

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Training, performance and dynamic capabilities: New insights from absorptive, innovative, adaptative and learning capacities

Topic editors

Juan Moreno-Garcia — University of Castilla-La Mancha, Spain
Felipe Hernández-Perlines — University of Castilla-La Mancha, Spain
Benito Yáñez-Araque — University of Castilla-La Mancha, Spain
Murad Ali — Northumbria University, United Kingdom

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EDITED BY
Kittisak Jermsittiparsert,
University of City Island, Cyprus

REVIEWED BY
Ahmad Harakan,
Muhammadiyah University of Makassar, Indonesia

*CORRESPONDENCE
Benito Yáñez-Araque
benito.yanez@uclm.es

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Editorial: Training, performance, and dynamic capabilities: new insights from absorptive, innovative, adaptative, and learning capacities

Benito Yáñez-Araque[1]*, Juan Moreno-Garcia[2] and Felipe Hernández-Perlines[1]

[1]Department of Business Administration, Faculty of Law and Social Science, University of Castilla-La Mancha, Toledo, Spain, [2]Department of Information Systems and Technologies, School of Industrial and Aerospace Engineering, University of Castilla-La Mancha, Toledo, Spain

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training, education, performance, learning, innovation, absorptive capacity, adaptative capacity

Editorial on the Research Topic
Training, performance, and dynamic capabilities: new insights from absorptive, innovative, adaptative, and learning capacities

The coronavirus disease 2019 (COVID-19) pandemic has precipitated the adoption of online teaching-learning methodologies at all educational levels worldwide, affecting all types of training (formal, non-formal, compulsory, non-compulsory, and lifelong). This has given rise to a seemingly new debate on the effectiveness of training that the call for face-to-face training has provoked. However, this debate, apart from the online face-to-face dilemma or their combination, is familiar.

The problem of the transfer of training has been of concern to both academics and practitioners. However, only a small percentage of what is learned during training applies to jobs. Consequently, there is a paradox, an explanatory gap in the relationship between training and performance. With the transfer of training, training efforts can contribute to organizational effectiveness (Kozlowski et al., 2000). However, how, or by what mechanism, does training transfer happen? What is the real relationship?

There is a need for new approaches to training that are different from conventional approaches, which will make it possible to explain and implement the education and training systems that produce a transfer.

In this sense, we found an innovative proposal: a dynamic capability-based view of training (Hernández-Perlines and Yáñez-Araque, 2015; Hernández-Perlines et al., 2016a,b; Yáñez-Araque et al., 2017). Henseler and Schuberth (2020) recently cited this proposal as a novel application of educational management.

There has been exponential growth in the number of publications on dynamic capabilities in the last two decades, and it continues to be one of the most prolific streams (Albort-Morant et al., 2018). Originally, Teece et al. (1997, p. 516) defined dynamic capabilities as the ability of a firm to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. However, dynamic capabilities theory has some aspects related to its conceptualization that could be clearer, specifically to the factors that compose it.

In the literature, we can find the identification of up to four main components of dynamic capabilities that explain the mechanisms linking the advantages of internal resources to the external market-based competitive advantage of firms: adaptive capacity or flexibility, absorptive capacity, and innovative capacity, which are correlated (Wang and Ahmed, 2007), as well as learning capacity, which was considered by Zollo and Winter (2002). This dynamic capability framework includes absorptive capacity, innovative capacity, flexibility, and learning.

Yáñez-Araque et al. (2017) focused on absorptive and innovative dynamic capacities to explain the transfer process from training to results. It is difficult for training to affect outcomes directly when it is performed through a chain of intermediate variables. Although the study was conducted in a business environment, it can be perfectly extrapolated to the field of education. First, training is indirectly related to performance through absorptive capacity followed by innovative capacity. Training efforts do not translate into tangible benefits if the dynamic absorptive and innovative capabilities are not mediated.

States invest in public education policies to improve the welfare of their citizens. The greatest asset of an organization is its people. Despite evidence of the benefits of training for individuals, teams, organizations, and society (Aguinis and Kraiger, 2009), there is a belief that a student is trained at the individual level with the expectation of a better job and a better future salary. An organization invests in training its workers with expectations to improve its productivity and results. However, more than the mere introduction of training is required to improve performance. The expected benefits of training cannot be obtained without mediating absorptive and innovative capabilities.

Other training problems related to the appropriability of training (e.g., retention of best-trained employees or avoiding brain drain from a country), depreciation of training, technological advances, and issues of equality, diversity, and inclusion are also considered.

The papers selected in this research address the latest research framed in new approaches to training and education from the perspective of public policy, prospective organizations, and individuals. Considering the role of higher education, Yahiaoui et al. investigated the impact of total quality management practices in higher education institutions; Sánchez-Prieto et al. and Procopio et al. focused on novel approaches in higher education and more active and participatory teaching innovation methods. The authors presented a competitive debate regarding gamification among teams with university students, a didactic experience of implementing a methodological approach based on cooperative learning, and a review of the literature on neuroeducation. Gradellini et al. examined the content and knowledge of cultural competence and intercultural communication offered in higher education in nursing courses. Barba-Sánchez et al. developed a model for assessing the impact of secondary school information technology (IT) capacities on smart city business development based on the IMD Smart City Index, PISA, and World Bank reports. Gómez-Cantarino et al. presented a narrative review of health education models, conceptual frameworks, and the importance of information and communication technology (ICT) in a transdisciplinary approach to child abuse. The impact of human resource management practices was discussed by Xie et al., where the impact of human resource management practices and training and development types in multinational enterprises was considered; Xiao et al. studied how supervisors' developmental feedback affects creativity at the team level. Noman et al. examined the moderating role of cross-cultural training in the adjustment of self-initiated and organizational expatriates. Based on dynamic capability theory, Wang et al. researched the effect of a high-performance work system on organizational performance, the mediating role of strategic flexibility, and the moderating role of an enterprise's social network in this relationship. Zhiqiang et al. examined how high-performance work practices (HPWPs) affected employees' in-role performance (EIRP) and task performance (ETP) during the COVID-19 pandemic.

Understanding the state of research on organizations is fundamental to this special issue. Peng et al. conducted a bibliometric study on innovation research in organizations within the three levels (i.e., individual, work team, and organizational) using the CiteSpace software to analyze 6,354 academic articles from the year 2000 to 2020. Respect for ecology within organizations is important in both training and education. Baeshen et al. discussed a study to develop a comprehensive model by integrating the natural resource-based view (NRBV) and triple bottom line (TBL) framework. The influence of absorptive capacity and innovativeness on business performance was analyzed by Sancho-Zamora et al., considering the relationships between the different dimensions of absorptive capacity and innovativeness.

This research combines high-quality research with different quantitative and qualitative methodologies and mixed-methods studies. It also includes reviews that follow quality criteria, and research projects that adopt multisectoral and transdisciplinary approaches.

Author contributions

BY-A, JM-G, and FH-P contributed to conception and design of the study and wrote sections of the manuscript. BY-A wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Re-Engineering the Human Resource Strategies Amid and Post-Pandemic Crisis: Probing into the Moderated Mediation Model of the High-Performance Work Practices and Employee's Outcomes

Ma Zhiqiang[1], *Hira Salah ud din Khan*[1]*, *Muhammad Salman Chughtai*[2] *and Li Mingxing*[1]*

[1] School of Management, Jiangsu University, Zhenjiang, China, [2] Faculty of Management Sciences, International Islamic University, Islamabad, Pakistan

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Edited by:
Murad Ali,
King Abdulaziz University, Saudi Arabia

Reviewed by:
Nilesh Kumar,
Huazhong University of Science and Technology, China
Mohsin Shabir,
University of International Business and Economics, China

***Correspondence:**
Li Mingxing
mingxingli6@ujs.edu.cn
Hira Salah ud din Khan
hirakhan@ujs.edu.cn

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By incorporating the conservation of resource theory, this study examines how high-performance work practices (HPWPs) affect the employee's in-role performance (EIRP) and employee's task performance (ETP) during the coronavirus disease 2019 (COVID-19) pandemic. Furthermore, this study investigates how organization-based self-esteem (OBSE) and positive psychological capital (PPC) affect the relationship between HPWPs and outcomes of employees such as EIRP and ETP. A quantitative technique based on the survey method was used to gather the primary data of the investigation. Two hundred and eleven bank employees working in different banks of Punjab and Pakistan participated in the survey process. The PROCESS-macro was used to test the relationship among the study constructs. Our results supported all the study hypotheses, however positive psychological capital did not moderate the indirect effect of high performance work practices on employee's task performance via organization based self-esteem. This study is the earliest of its kind that focuses on HPWPs and outcomes of employees amid the COVID-19 pandemic in a developing country like Pakistan. The findings of this study provide practical implications in the post and continuing pandemic situation for organizations to human resource management to redesign workforce strategies to increase their contribution and responses to realize organizational priorities. Although researchers have explored the topic in different sectors, scant studies have investigated the potential impact, barriers, and enabling mechanisms that function as a catalyst in HPWPs during the pandemic situation.

Keywords: high-performance work practices, organization-based self-esteem, positive psychological capital, employee's in-role performance, employee's task performance, COVID-19 pandemic

INTRODUCTION

Novel coronavirus disease 2019 (COVID-19) epidemic broke out in China (Wuhan) in December 2019 (Zhu et al., 2020), which was declared a pandemic by WHO in January 2020. It spread increasingly all over the world and hit Pakistan in March 2020. This worldwide outbreak led countries to lockdown everything to control the possible spread of fatal diseases.

These drastic measures affected the major sectors of the economy, which are considered the economy of the lifeblood of every country, for instance, financial institutions (Disemadi et al., 2020). During this pandemic, the workforce of these institutions had to perform their jobs despite the threat of catching the contagious virus (Zhu et al., 2020). The employees of these organizations are at high risk as this virus is present on currency notes, checks, and demand drafts, which survive longer than a common virus. This situation leads to physical illnesses and affects the psychological health of employees (Zhu et al., 2020), especially in financial institutions. These circumstances have adversely influenced the developing countries leading to massive economic crises due to increased downsizing by the private sector organizations; thus, it developed uncertainty and job insecurity giving rise to intolerant and depressive behaviors (Godinic et al., 2020). They lack appropriate resources, such as practical skills, strategies, and policies, that boost the morale of employees (Alatailat et al., 2019; Diogo and Da Costa, 2019; Kumar et al., 2020), essential for high performance in work.

The current scenario of COVID-19 has drawn the focus of the organizations to reengineer strategies in high-risk environments (Kumar and Reddy, 2019). The financial institutions (i.e., banking sector) especially need to develop and implement such human resource policies and performances that enable employees to perform their roles and tasks efficiently in an unfavorable atmosphere (Al-Dalahmeh et al., 2018; Aeknarajindawat et al., 2020). Effective policies that cover the overall management of the resources, especially human resources, bring productivity, high performance, and organizational success (Obeidat et al., 2016).

This study sheds light on the utmost important role of high-performance work practices (HPWPs) by employing the conservation of resource (COR) theory in organizations to help achieve organizational objectives. COR (Hobfoll, 1989) theory suggests that resources (i.e., physical, psychological, organizational, and emotional) are the significant aspects of well-being and satisfaction and are beneficial for individuals to gain more resources (Hobfoll, 1989). Studies indicated that HPWPs are associated with motivation, resilience, self-assurance, and confidence of an individual, resulting in positive outcomes of employees (Alatailat et al., 2019; Arefin et al., 2019; Diogo and Da Costa, 2019; Ismail et al., 2021). HPWPs through their interaction between organization and employees rise the mutually beneficial impact (Boon et al., 2019) that resultantly increases the positive outcomes and reduces the adverse ones. Organizations use HPWPs as an imperative management tool for maximization of the performance of individuals (Karatepe and Olugbade, 2016), which not only increase the profitability of the firm but also increase the intellectual capital level of the organization through the enhancement of competencies (Boon et al., 2019). Achievement of competitive advantage and strength is possible through the development of human capital of the organization (Khan et al., 2019b); for that purpose and for the optimization of the performance of individuals, organizations adopt HPWPs (a list of human-related policies and practices), e.g., job design, extensive training and development, attractive reward and compensation system, and information sharing (Alatailat et al., 2019; Zhang et al., 2019; Rubel et al., 2020).

However, few studies have focused on how organizations could incorporate and introduce HPWPs in the banking industry (Huo and Boxall, 2018; Cooper et al., 2019) and its potential impact on the outcomes of employees, i.e., employee's in-role performance (EIRP) and employee's task performance (ETP).

Accordingly, this study focused on the supportive organizational mechanisms, such as organization-based self-esteem (OBSE), which can serve as a mediator between HPWPs and EIRP and ETP. Scholars characterized OBSE as the extent to which the workforce perceives that they are appreciated and valued by the organization (Pierce et al., 1989). HPWPs are employee-oriented strategies that improve individual skills (Chughtai, 2017; Zhang et al., 2018; Diogo and Da Costa, 2019). Given this, OBSE is an element that cultivates motivation and self-confidence that further translates into extra EIRP and ETP (Pierce et al., 1989; Yang et al., 2019). Therefore, in the circumstances of the COVID-19 pandemic, employees need organizational support to reduce the stress; if organizations extend their support in the form of self-esteem, the EIRP and ETP increase.

Furthermore, this study tries to understand the positive psychology approach by pinpointing the positive psychological capital (PPC) that acts as a personal resource for the individuals, enabling them in a challenging working environment (Luthans et al., 2007). Scholars ordained that PPC, also known as a workforce positive emotional condition, allows personal development (Luthans et al., 2007; Luthans and Youssef-Morgan, 2017). Past studies revealed that PPC positively affects work engagement, job performance, attitudes, and behaviors (Luthans et al., 2007; Luthans and Youssef-Morgan, 2017; Kotzé, 2018). Based on this, PPC could help meet the challenging environment for employees amid COVID 19, since the pandemic has affected the well-being of employees and drained their energies to perform efficiently (Mao et al., 2020). Thus, we proposed that PPC can act as a moderating construct between HPWPs and OBSE relationship and the outcomes of employees (i.e., EIRP and ETP) in the COVID-19 epidemic situation (Kim, 2020). This study attempts to answer the following questions: "How do HPWPs influence the performance-related outcomes of employees?" and "How do OBSE and PPC influence the HPWPs and link outcomes of employees amid and post-pandemic times?"

The objectives and manifold contribution of this study are as follows: first, this study investigates the direct influence of HPWPs on the outcomes of employees (i.e., EIRP and ETP). Second, we explored the mediating role of OBSE in the link between HPWPs and outcomes of employees (i.e., EIRP and ETP). Third, this study examined the moderating effect of PPC on the link between HPWPs and outcomes of employees. Fourth, the moderated mediation impact of PPC and OBSE was tested in the link between HPWPs and outcomes of employees. Additionally, in this study, we overcame the gap suggested by Gahan et al. (2020), Nasurdin et al. (2020), and Rubel et al. (2020), as these authors advanced to use the supervisor-subordinate and self-assessed data for the validation of the outcomes and to explore under which circumstance

HPWPs produce better performance. Additionally, this study also responds to the studies by Han et al. (2020), Iyanda Ismail et al. (2020), and Nasurdin et al. (2020), where they suggested to explore the influence of HPWPs on psychological capital (Okun, 2020) in other organizational setups with different outcomes of employees. Finally, employing COR theory adds to the literature of organizational behavior by examining the current framework field in the developing country, i.e., Pakistan, particularly in the COVID-19 pandemic, as shown in **Figure 1**.

THEORETICAL FOUNDATION

Conservation of resource theory provides the foundation for the support of this study model that establishes that resources are the ideal set of skills helping employees to accomplish workplace tasks (Hobfoll, 1989; Hobfoll et al., 2018). At present, in high work demand conditions as faced by organizations globally due to the COVID-19 epidemic, employees need to develop self-protective strategies to protect their existing resources (Hobfoll et al., 2018). Finally, scholars explained that instituting HPWPs culture in organizations enables the workforce to develop skills aligned with the organizational goals and strategies (MacDuffie, 1995). Empirical studies have suggested that implementing HPWPs in the organizational arena (Kim and Liu, 2017; Iqbal, 2019; Kumar and Reddy, 2019; Nansubuga et al., 2019; Ogbonnaya and Messersmith, 2019) leads to different positive consequences such as increased well-being, knowledge sharing behavior (Ali et al., 2021), and high individual and organizational performance (Khan et al., 2021). Furthermore, HPWPs enable employees to gain resources that increase EIRP and ETP through ability, motivation, and participation at the workplace.

According to the COR theory, social, physical, supportive environmental, and cognitive resources are the significant resources that helps to protect and enhance well-being (Hobfoll, 1989; Hobfoll et al., 2018), also become valuable, especially in the current scenario of the COVID-19 pandemic. Given this, we argued that OBSE acts as a conduit in a psychological and organizational resource that spurs self-determination and value for the entity (Pierce et al., 1989). OBSE is also an essential occupational resource that aids in positive outcomes (Hobfoll et al., 2018). Following this, employees are likely to demonstrate more work activities and put extra effort in performing their duties efficiently, especially in uncertain circumstances.

Additionally, personal resources empower individuals to manage and cope with environmental stressors (Hobfoll, 1989; Hobfoll et al., 2018; Khan et al., 2019a). Based on this, PPC is a beneficial cognitive resource that demonstrates the characteristics of dealing with occupational demands (Siu et al., 2014), especially in the environment of uncertainty caused by the pandemic. Researchers elaborated that PPC is a collection of positive elements that include resilience, self-efficacy, optimism, and hope, reducing the adverse outcomes (Luthans et al., 2007; Kim and Beehr, 2018b). Concerning the disruptive COVID-19 pandemic, the major stress-causing factor is the absence of positive resources that led employees to feel demotivated (Kim, 2020). Furthermore, through COR theory, we unveiled the importance of specific resources that protect employees from emotional loss (Hobfoll et al., 2018), which employees face in accomplishing their professional responsibilities (i.e., EIRP and ETP).

High-Performance Work Practices, EIRP, and ETP

The burgeoning literature advocated that organizations following HPWPs indicated improved motivation, high-quality services, products, increased innovative task behaviors, creativity, job crafting, efficiency, low levels of absenteeism, and turnover of employees (Kim et al., 2015; Messersmith et al., 2018; Ali et al., 2019; Chughtai and Rizvi, 2019; Aeknarajindawat et al., 2020; He et al., 2021; Li et al., 2021). Additionally, HPWPs augment the skills, capabilities, and intellectual capital of employees, especially in service industries (Ali et al., 2018; Rehman et al., 2020). Recent studies revealed the influential role of HPWPs in human resource management strategies in Western culture; however, limited studies have explored its impact on developing economies (Cooke, 2018; Cooke et al., 2019). Past literature emphasized the potential effect of HPWPs on task performance (Topcic et al., 2016; Cooper et al., 2019; Jeong and Shin, 2019; Yang et al., 2019). Furthermore, researchers conceded a need to explore how HPWPs facilitate extra roles and performances of employees (Karadas and Karatepe, 2019). Thus, this study focused on the

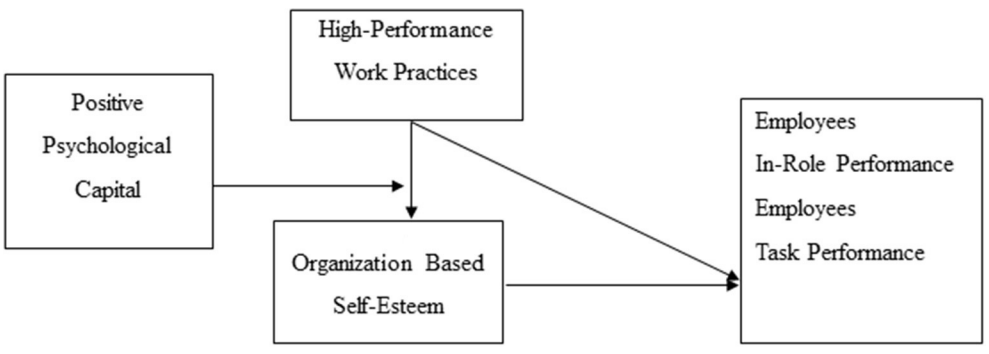

FIGURE 1 | Conceptual model.

impact of HPWPs as recommended by researchers (Chamberlin et al., 2018; Huang et al., 2018; Murphy et al., 2018; Pak and Kim, 2018). Therefore, we investigated the link between HPWPs and performance-related outcomes of employees amid the COVID-19 situation. Thus, it is postulated that

Hypothesis 1a *HPWPs positively affect EIRP.*

Hypothesis 1b *HPWPs positively affect ETP.*

Organization-Based Self-Esteem as Mediator

Researchers characterized OBSE as a mechanism that helps employees realize their personal and organizational goals (Pierce et al., 1989). Scholars expressed that organizational support increases the level of self-esteem of employees and improves their behaviors toward their jobs (Tetteh et al., 2019). Self-esteem represents the self-concept of individuals, which plays a vital role in the lives of everyone, affecting psychological, physical well-being, enthusiasm, and life satisfaction (Cameron and Granger, 2019). In addition, earlier studies revealed that OBSE engenders many positive outcomes, i.e., stress management (Costantini et al., 2019), individual performance (Hahn and Mathews, 2018) and organizational citizenship behaviors (Kim and Beehr, 2018a), and innovative behaviors (Ali, 2021; Wen et al., 2021). Moreover, OBSE reduces uncertainty (Neves et al., 2020), as individuals having OBSE can handle stressful situations effectively (Costantini et al., 2019). Further studies on OBSE concerning the implementation of HPWPs can be favorable for organizations that are looking to have improved performance (Zheng et al., 2019; Carrion, 2020). Based on the above discussion, this study attempts to investigate the mediating role of OBSE in the link between HPWPs and EIRP and ETP. Thus, it is postulated that

Hypothesis 2a *OBSE mediates the relationship between HPWPs and EIRP.*

Hypothesis 2b *OBSE mediates the relationship between HPWPs and ETP.*

Positive Psychological Capital as a Moderator

Positive psychological capital is defined as "positive psychological state of development of an individual which is characterized by (1) having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks, (2) making a positive attribution (optimism) about succeeding at present and in the future, (3) persevering toward goals and, when necessary, redirecting paths to goals (hope) to succeed, and (4) when beset by problems and adversity, sustaining and bouncing back and even beyond (resilience) to attain success" (Luthans et al., 2007). Accordingly, the banking industry has to deal with highly challenging work conditions that give rise to a stressful atmosphere to meet organizational competitiveness (Goetz et al., 2019). In the scenario of the COVID-19 pandemic, the performance of financial institutions is adversely affected (Disemadi et al., 2020), and the workforce of these institutions suffers from stress, anxiety, and psychological and emotional loss (Sembiring et al., 2020). Additionally, scholars expressed that PPC increases interpersonal citizenship behaviors (Khliefat et al., 2021) and innovative behaviors (Mutonyi, 2021) and decreases job insecurity (Wang et al., 2021). Given this, employees who possess high PPC can perform any demanding tasks and are ready to adjust to new practices and procedures. With this viewpoint, it can be anticipated that HPWPs stimulate the confidence of employees in an organization and result in increased OBSE when PPC is high. Thus, it is hypothesized that

Hypothesis 3 *PPC moderates the positive relationship between HPWPs and OBSE.*

An Integrative Moderated Mediation Model

This integrative model hypothesized that HPWPs could promote EIRP and ETP (Hypothesis 1a and 1b). This study also proposes that the influence of HPWPs increases extra role performances of employees indirectly through OBSE (Hypothesis 2a and 2b). Moreover, it is anticipated that the strength of the link between HPWPs and OBSE would be contingent on the PPC level (Hypothesis 3). Additionally, based on the above discussion, we proposed a moderated mediation framework in which PPC moderates the indirect effect of HPWPs on EIRP and ETP *via* OBSE. Thus, it is hypothesized,

Hypothesis 4a *PPC moderates the indirect positive effect of HPWPs and EIRP via OBSE in the sense that a higher level of PPC will strengthen the indirect impact of HPWPs.*

Hypothesis 4b *PPC moderates the indirect positive effect of HPWPs and ETP via OBSE in the sense that a higher level of PPC will strengthen the indirect impact of HPWPs.*

MATERIALS AND METHODS

Sample and Procedures

This study targeted the banking sector due to the ongoing economic crisis (amid pandemic) that has globally affected human and financial resources. It is imperative to study the factors that help understand and realign the strategies to improve the banking sector workforce performance in Pakistan. The data were collected through social contacts with bank staff and random personal visits of public and private banks. Each survey was attached with a cover letter to elucidate the aim of this study to the respondents and ensure confidentiality. The temporal separation method was adopted in this study to overcome the issues related to common method bias (Podsakoff et al., 2012). The 1-month temporal separation method was used in this study as suggested by (Podsakoff et al., 2012). In the first lag, the data were collected for independent and mediating variables from employees. In the second lag, we invited employees to fill the survey regarding the moderating variable. The dependent variable questionnaires were filled by the immediate officers of those employees who participated at the

first lag. All questionnaires were marked with specific codes of identification to match the surveys of both time periods. A total of 400 questionnaires were distributed through self-administered data collection method and 290 questionnaires received at the end of the first lag, which were correctly filled; at the end of the second lag, 211 responses were finalized for further analysis that constituted a response rate of 52.75%.

Measures

All the measures of this study were assessed on a 5-point Likert scale starting from 1 ("strongly disagree") to 5 ("strongly agree"). The measures used for this study are as follows: ***HPWPs:*** this scale comprised of 10 items developed by Sun et al. (2007) was used that indicated the reliability of 0.92. ***OBSE:*** 10-item scale developed by Pierce et al. (1989) was adopted to measure OBSE, showing the reliability of 0.94. ***PPC:*** this scale was assessed by Luthans et al. (2007), which comprises 10 items to measure PPC that demonstrated the reliability of 0.94. ***EIRP*****:** the 7-item scale was used, which was developed by Williams and Anderson (1991). The Cronbach's alpha indicated a value of 0.94. ***ETP:*** the 7-item scale developed by Koopmans et al. (2014) was used, indicating the reliability of 0.93.

RESULTS

Analysis Strategy

We used PROCESS-macro to test the relationship between the study variables. It was employed to test the complex moderated mediation as suggested by Hayes (2018). Additionally, it enables testing the complex relationship among the variables related to organizational behavior studies (Hayes, 2018).

Demographics

Most of the participants were males, i.e., 148 (70.1%), whereas 64 (29.9%) were females. The age distribution indicated that 111 (52.6%) participants were between 20 and 30 years, 92 (43.6%) were between 31 and 40 years, and 8 (3.8%) were between 41 and 50 years. Educational qualification showed that 29 (13.7%) participants had MS/MPhil, 135 (64.0%) master's degree, and 47 (22.3%) had a graduate degree. The information of work experience consisted of 43 (20.4%) participants having "<1 year," 105 (49.8%) having "1–5 years," 49 (23.2%) having "6–10 years," 12 (5.7%) having "11–15 years," and 2 (1.0%) having "21 years above."

Descriptive Statistics and Correlations

Table 1 presents the correlation coefficients and a descriptive statistic of the constructs. The results demonstrated that all variables of this study were positively correlated with each other at the significance level of 0.01.

Hypotheses Testing

Table 2 indicated that there was a positive influence of HPWPs on EIRP (where $b = 0.20$, $t = 3.61$, and $p < 0.001$) and a positive impact on ETP (where $b = 0.11$, $t = 2.47$, and $p < 0.001$). Further bootstrapping has also been conducted to test the indirect effects. By using PROCESS-macro, we computed a 95% CI through 5,000 samples for each mediation effect as suggested by Hayes (2018). The indirect impact of HPWPs on EIRP *via* OBSE was significant as 95% CI did not contain zero and $b = 0.18$ (95% CI ranging from 0.05 to 0.33); thus, H2a received further support. Similarly, the indirect impact of HPWPs on ETP *via* OBSE is insignificant as 95% CI did not contain zero and $b = 0.12$ (95% CI ranging from 0.01 to 0.25); thus, H2b also found further support.

Moderation Analysis

Furthermore, the moderating effect of PPC has also been tested between the link of HPWPs and OBSE (mediating variable). As shown in **Table 3**, the interaction of HPWPs and PPC was significantly related to OBSE ($b = 0.12$ and $p < 0.001$), which provides support for H3. Moreover, we also plotted the slopes for the interaction effect (HPWPs × PPC) on OBSE, as shown in **Figure 2**, which revealed that a higher level of PPC with a higher level of HPWPs increases the OBSE of employees.

Moderated Mediation Analysis

This study also examined the conditional indirect effects using the PROCESS Model-07 (Hayes, 2018). Furthermore, **Table 4** demonstrates that PPC moderates the indirect effect of HWPSs on EIRP *via* OBSE; it is significant for the high/low level of PPC because it does not contain zero. Moreover, **Table 4** demonstrates that PPC did not moderate the indirect effect of HPWPs on ETP *via* OBSE because it was not found significant for the high/low level of PPC, as zero was found between the upper and lower level CI. Moderated mediation index, as depicted in **Table 4**, showed $b = 0.03$, boot SE = 0.01, and LL (lower

TABLE 1 | Correlations, descriptive, and reliability statistics.

		Mean	SD	α	1	2	3	4	5
1	HPWPs	3.74	0.8257	0.92		0.301**	0.422**	0.470**	0.305**
2	OBSE	4.01	0.8139	0.94			0.480**	0.478**	0.314**
3	PPC	3.85	0.8542	0.94				0.502**	0.315**
4	EIRP	4.05	0.6713	0.94					0.384**
5	ETP	4.06	0.6158	0.93					

*HPWPs, high-performance work practices; EIRP, employee's in-role performance; ETP, employee's task performance; OBSE, organizational based self-esteem; PPC, positive psychological capital; SD, standard deviation; α, reliabilities. **p < 0.01.*

TABLE 2 | Direct and indirect effect results (both dependent variables).

Model	HPWPs → OBSE → EIRP			
	b	**SE**	**LL**	**UL**
Direct Effect (Bootstrap)	0.20	0.05	0.09	0.30
Indirect Effect (Bootstrap)	0.18	0.07	0.05	0.33
Model	**HPWPs → OBSE → ETP**			
	b	**SE**	**LL**	**UL**
Direct Effect (Bootstrap)	0.11	0.05	0.02	0.2
Indirect Effect (Bootstrap)	0.12	0.07	0.01	0.25

HPWPs, high-performance work practices; EIRP, employee's in-role performance; ETP, employee's task performance; OBSE, organizational based self-esteem; PPC, positive psychological capital; bootstrap sample size = 5,000; SE, standard error; LL, lower limit; UL, upper limit.

TABLE 3 | Moderation Results.

Variable			Organization based Self-Esteem		
	b	**SE**	***t*-value**	***p*-value**	**LL/UL**
Intercept	4.09***	0.02	210.46	0.00	4.05/4.12
HPWPs	0.15***	05	3.30	0.00	0.06/0.25
PPC	0.57***	0.04	12.89	0.00	0.48/0.66
HPWPs x PPC	0.12***	0.01	9.72	0.00	0.15/0.10
R^2 *Change*	0.03				
F	94.54***				

HPWPs, high-performance work practices; EIRP, employee's in-role performance; ETP, employee's task performance; OBSE, organizational based self-esteem; PPC, positive psychological capital; SE, standard error; LL, lower limit; UL, upper limit.

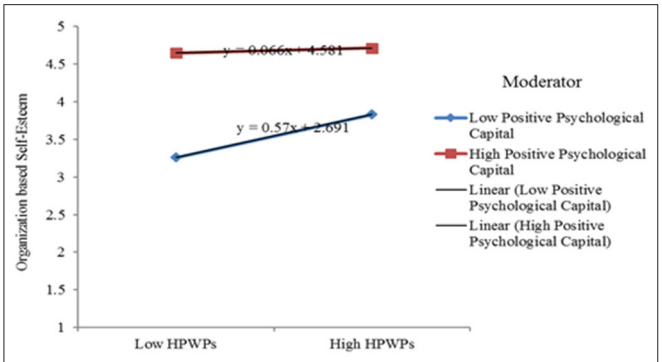

FIGURE 2 | Interaction effects.

limit)/UL (upper limit) = 0.05/0.01; thus, H4a was supported. This result indicated that PPC moderated the indirect effect of HPWPs on EIRP *via* OBSE in such a way that the higher the level of PPC will shape, the higher the level of EIRP. Additionally, **Table 4** depicted b = 0.02, boot SE = 0.01, and LL/UL = 0.04/0.00); thus, H4b did not get support. This result indicated that PPC did not moderate the indirect effect of HPWPs on EIRP *via* OBSE.

DISCUSSION

This study investigated the impact of HPWPs concerning performance-related outcomes of employees with mediating impact of OBSE and moderating impact of PPC. Furthermore, this study also examined the moderated mediation link between the variables in the banking industry of Pakistan amid the COVID-19 pandemic.

Generally, the results of this study provided support for most of our proposed hypotheses. The findings of our first hypothesis that proposed HPWPs positively influencing the outcomes of employees were supported and consistent with earlier studies (Edgar et al., 2019). The results suggest that performance-related measures of employees are significant indicators of HPWPs. The second hypothesis that postulated the positive indirect influence of OBSE between the relationship of HPWPs and outcomes of employees was also supported. The findings of this hypothesis were in line with the findings of Yang et al. (2019). Furthermore, COR theory also supported that vital resources produce a positive impact on the work outcomes of employees. Moreover, this finding established that OBSE is an essential source of internal motivation associated with workforce attitudinal and behavioral consequences (Pierce et al., 1989). The next hypothesis regarding the moderating role of PPC on the link between HPWPs and OBSE was also found significant and supported by previous studies (Aybas and

TABLE 4 | Conditional indirect effects (PPC as moderator).

Mediator (EIRP as *Dependent Variable*)	**PPC**	**Effect**	**Boot SE**	**Boot LL and UL**	
OBSE	(−1 SD)	−0.85	0.06	0.03	0.02,0.13
OBSE	(+1 SD)	0.85	0.01	0.01	0.01,0.05
Mediator (ETP as *Dependent Variable*)	**PPC**	**Effect**	**Boot SE**	**Boot LL and UL**	
OBSE	(−1 SD)	−0.85	0.04	0.02	0.00,0.09
OBSE	(+1 SD)	0.85	0.01	0.02	0.00,0.04
Moderated Mediation Index					
Mediator (PPC as Moderator)	**b**	**Boot SE**	**Boot LL and UL**		
OBSE (*EIRP-Dependent Variable*)	0.03	0.01	0.05,0.01		
OBSE (*ETP-Dependent Variable*)	0.02	0.01	0.04,0.00		

PPC, positive psychological capital; HPWPs, high-performance work practices; OBSE, organizational based self-esteem; EIRP, employee's in-role performance; ETP, employee's task performance.

Acar, 2017). The results showed that PPC has a substantial moderating impact on HPWPs and OBSE relationships. Thus, high PPC strengthens the association between HPWPs and OBSE, which is evident in the pandemic situation that PPC provides psychological support to employees that positively influence the perception of self-esteem about their organizations. Our final hypothesis concerning the moderated mediation model with both dependent variables (i.e., EIRP and ETP) demonstrated that PPC moderates the indirect effect of HPWPs on EIRP *via* OBSE. In other words, a higher level of PPC with OBSE provides psychological resources to employees to perform better EIRP in the presence of HPWPs, especially in stressful circumstances, e.g., COVID-19. Contrarily, PPC did not moderate the indirect effect of HPWPs on ETP *via* OBSE, which revealed that some factors affected the motivation of employees to perform their tasks efficiently. Subsequently, the COR theory elaborated that resource losses in the work environment have more significant influence than appreciated gains. Thus, we approbated that due to some resource loss, the ETP was not improved as it was anticipated.

Theoretical Contributions

The findings of this study contribute to the literature on organizational behavior and human resource management in many ways. First, the results indicated a significant and positive link between HPWPs and performance-related outcomes of employees. Although previous studies focused on the relationship between HPWPs and organizational performance, its effect on performance-related measures of employees was not investigated. The positive impact of HPWPs on EIRP and ETP demonstrated that organizational investment in human resource practices is essential to gain, sustain, and improve the skills of employees to enhance productivity and efficiency.

Furthermore, this study extended by investigating the mediating role of OBSE in the link between HPWPs and employee performance. OBSE contributed to spurring HPWPs at the workplace, which eventually affects the EIRP and ETP. As the pandemic situation has caused high stress, low morale, and general well-being, we revealed that OBSE acts as a vital psychological resource nurtured by the organizations to their workforce to accomplish their goals. Moreover, this study contributed by exploring the moderating role of PPC on the link between HPWPs and OBSE. Consequently, PPC proved to be an essential psychological resource that results in high productivity and efficiency, such as EIRP and ETP. Additionally, the moderated mediation link was unveiled between the variables that demonstrated how vital resources (i.e., OBSE and PPC) aid in achieving and cultivating positive employee performance.

Our holistic model in the current pandemic scenario presents a unique model that further helps scholars carry out future studies. Finally, we examined the study variables and their relationships in a non-Western context in Pakistan. Also, we investigated banking sector employees in pandemic situations where resource loss is an inevitable element. To overcome this situation, the impact of necessary personal/organizational resources was explored that helps employees perform better.

Practical Implications

Our findings present numerous implications for the researchers, practitioners, and management of different organizations on how to enhance the performance of employees amid and post-pandemic situations. As scholars, Hobfoll et al. (2018) advocated that organizations intend to increase their chance of meeting their goals and they must create an atmosphere loaded with resources that empower the workforce to grow (Khan et al., 2017). Our findings are in line with this standpoint by signifying that HPWPs are associated with psychological resources of employees related to performance (Luthans et al., 2007; Hobfoll et al., 2018). Executives and higher management can create an atmosphere that increases self-esteem of individuals and values

their participation. The organizations could arrange workshops to train their workforce to develop personal skills such as PPC. This resource increases the motivation of employees to work efficiently in critical times. Policymakers of the organizations must pay attention to the physical and psychological health of their workforce through OBSE and by enhancing their level of psychological capital, which increase their efficacy level and resulted in higher outcomes (Ali et al., 2020) especially in the post-pandemic situation that requires a strong psychological state of workforce.

Limitations and Future Directions

The limitations of this study are as follows: first, this study focused on the banking industry; the findings may not be generalized in other occupational areas like manufacturing, service sectors such as textiles, telecommunication, and public sector organizations in Pakistan. Thus, future studies can be carried out in other sectors of the economy. Second, we collected data from a developing economy; future studies replicate our findings in another cultural context to examine the influence of cultural settings. Third, we used OBSE as the mediator and PPC as the moderator; future researchers are encouraged to examine some other moderators and mediators between HPWPs and outcomes of employees, for instance, personal initiative, leadership, and perceived organizational support from other theoretical viewpoints.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Faculty of Management Sciences, International Islamic University, Islamabad, Pakistan. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MZ and HK: definition of research objectives, models, and hypotheses. MC: the provision of materials (i.e., questionnaires) and data collection. LM: article revision and proofreading. All the authors contributed and approved the final draft for publication.

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Positive and Negative Supervisor Development Feedback, Team Harmonious Innovation Passion and Team Creativity

Yuchun Xiao[1], Shuwei Liu[1,2] and Ting Dai[3†]*

[1] School of Business Administration, Zhejiang Gongshang University, Hangzhou, China, [2] School of Security Management, Zhejiang College of Security Technology, Wenzhou, China, [3] Department of Accounting, School of Business, The Hong Kong University of Science and Technology, Kowloon, Hong Kong

In modern organizations, creative work is usually carried out by teams, and the study of team creativity will therefore have meaningful implications for organization innovation research. The improvement of team creativity is a key management challenge for organization leaders. But our knowledge of how teams respond to and benefit from the supervisor's developmental feedback is limited. This paper draws on the interdependence and knowledge density of team creativity to study how the supervisor's developmental feedback influences creativity at the team level. Our statistical analysis of 94 supervisors and 330 employees finds that positive and negative development feedback from the supervisor both have a positive impact on team creativity, the impact from the negative development feedback is even stronger, and we also finds that the team's harmonious innovation passion mediates the relationship between the supervisor's developmental feedback and team creativity. In addition, we conclude that proactive personality activity moderates the relationship between the supervisor's positive (negative) developmental feedback and the team's harmonious innovation passion. Our research promotes the development of the study of team creativity in the Chinese cultural context and it is also an important application of developmental feedback that can be incorporated into management practices to enhance team creativity.

Keywords: supervisor developmental feedback, team harmony innovation passion, team creativity, proactive personality, innovation

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****Correspondence:***
Shuwei Liu
shuweiliu2021@163.com

†ORCID:
Ting Dai
orcid.org/0000-0001-9163-7549

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INTRODUCTION

Creativity enables organizations to innovate and maintain a competitive advantage in a complex and rapidly changing business world. The question of how to improve creativity in an organization preoccupies both industry managers and management scholars. The lack of creativity in some organizations is due to a lack of proper feedback, which creates information asymmetry in the team. Feedback is commonly used to motivate and guide employee's behavior (Kluger and DeNisi, 1996). Creative research defines "feedback" as information provided by others that helps to judge "creativity" against a relative or absolute standard (Zhou, 1998). The complexity of the

creative task often makes employees feel "blind" or unsure about how to work on their job. Employee creativity often occurs in short and unplanned interactions between team members (George and Zhou, 2007). High-quality supervisor feedback can help the team to understand, correct and improve the progress of the creative task in a timely manner (Peng and Chiu, 2010). In Eastern culture, supervisor feedback is viewed as more important by employees than subordinates or colleagues (Ashford and Tsui, 1991), and it is the most commonly used communication method in organizations (Majumdar, 2015). Supervisor Developmental Feedback (SDF) is a typical leadership feedback behavior, which seeks to provide employees with helpful and valuable information that enables them to learn, develop and improve during their work (Zhou, 1998). SDF also encourages employees to improve their own abilities by setting higher goals (Zhou, 2003; Guo and Liao, 2014). Organizations increasingly realize the importance of SDF, especially in comparison to traditional performance feedback methods, and they also apply it widely to contemporary creative tasks.

Feedback, one of the five core work characteristics proposed in the Hackman's Job Characteristics Model, has been (relatively) insufficiently engaged by Chinese scholars (Guo and Liao, 2014). However, in recent years, SDF has begun to receive attention in China. Some studies discuss the effects of SDF on employees, its effect on knowledge sharing between subordinates (Su and Lin, 2020), involvement in creative work (Hao and Sun, 2020), role in opinion-linked behavior (Liu and Gu, 2018), link to organizational citizenship behavior (Yin and Zheng, 2011), contribution to subordinate evasive behavior by subordinates (Song and Wang, 2015), relation to innovative behavior (Su and Lin, 2018b) and impact on performance (Zheng et al., 2015). But the relationship between SDF and creative work in China background remains under-studied, the only studies are from the paper of Geng et al. (2020) (about the mechanism between SDF and Employee Creativity), the paper of Xu et al. (2018) (regarding Supervisor Developmental Feedback and Creativity), the paper of Wang et al. (2017) (about influence of SDF on Individual Creativity), and the paper of Yin and Zheng (2011) (for the Citizenship Behavior forested by SDF).

The conclusions of above papers are also inconsistent. Some indicate that the relationship between SDF and employee's creativity is not significant (George and Zhou, 2007), and others suggest they are positively related (Yin and Zheng, 2011; Yanhong et al., 2014; Xu et al., 2018). Other papers also study the relationship between valence of feedback and creativity, such as the discussion about the effect of positive(negative) feedback on team motivation and performance (Van Dijk and Kluger, 2011); the discussion regarding how new or existing negative feedback affect corporate actions and subsequent performance (Eggers and Suh, 2019), and the discussion about the impact of negative feedback on recipient's creativity (Kim and Kim, 2020), etc. Regarding the relationship between positive feedback (negative feedback) and creativity, scholars' views are inconsistent as well. Some existing theories and empirical evidence are contradictory. They mainly focus on SDF effects at the individual level and do not sufficiently consider the effect on teams level. We have found one paper studies the relationship between feedback valence and creativity which is applied on a team-centered theoretical perspective (Hoever et al., 2018), but this paper used a random experimental method. Feedback in that paper was given in the ongoing task (experiment). Since the team was organized temporarily, this paper did not study how the feedback valence from a completed task affects the team creativity (TC). Meanwhile, this paper focuses on the regular feedback valence rather than developmental feedback. Therefore, it is necessary for us to further develop the theory of supervisor development feedback valence at the team level.

Team Creativity refers to the ability of team members to generate novel and useful ideas through cooperation (Wang et al., 2016). Both individual and TC focus on the joint novelty and practicality of ideas and solutions (George, 2007). In contrast to individual creativity, the solution of TC consists of multiple interdependent participants (Hoever et al., 2012). Previous research conclusions about the effect of SDF on individual creativity may not be fully applicable to TC. Research into the antecedents of TC addresses various factors, including: (1) team structural factors, such as the cognitive diversity of a team (Li et al., 2012) and gender diversity (Zhang and Zhang, 2012); (2) team processes, such as team conflict (Fairchild and Hunter, 2014) and knowledge-sharing (Zhu et al., 2015); (3) cognition, such as an interactive memory system (Wang and Xue, 2011); collective psychological ownership (Wei et al., 2019); (4) emotional and intrinsic motivation (Tang et al., 2011); and (5) leadership characteristics (Wang and Chen, 2010) and style (Chen et al., 2013). At the global level, there are also relatively few studies of supervisor behavior. Just one paper studies the relationship between SDF and TC (Joo et al., 2012), and there is no study of the distinguishing features of SDF valence and the interactive effects of SDF on TC. In addition, none of these papers refer to the Chinese context.

Chinese "face" culture (Mianzi Culture), which establishes a series of culturally appropriate behaviors and customs that relate to individual status, reinforces the tendency for Chinese supervisors to provide feedback to subordinates through positive means. This raises the important question of how positive and negative SDF affects TC, which strongly depends on interactions among team members. Feedback is an universal management tool. What impact does SDF have on TC? Using SDF to improve TC raises an important question: For positive and negative feedback, which one is more effective (Hoever et al., 2018)? SDF is a type of feedback aiming to enhancing creativity. Our study intends to further verify the different valences of SDF (positive and negative) on the effect TC. We hope to provide a theoretical basis to help manger select a proper feedback method to improve creativity at team level. Hence, we draw on Control Theory and Feedback Intervention Theory (Kluger and DeNisi, 1996) to establish a model of creativity and innovation (Amabile, 1997; Hennessey and Amabile, 1988) as the overall framework. We studied how the positive and the negative feedback which originated from same source predict TC, and which valence (positive or negative) of supervisor development feedback has more impact on TC. We added an explanation of the impact of supervisor developmental feedback on TC from the perspective of valence. This distinction and synchronization

verification is very important. In real practice, supervisors used to provide both positive and negative development feedback to subordinates. Meanwhile, we use non-random empirical methods to examine the mechanism and the impact of positive and negative SDF effects on creativity at the team level. We engage a stable team of employees and supervisors and focus on the core role of the Team's Harmonious Innovation Passion (THIP), which is the highest expression of team motivation (Wei and Zhang, 2018). We address TC, and ask how positive and negative SDF affects the creative outcome for different team characteristics (high and low initiative personality). We seek to: (1) explore if SDF at different valences can all positively affect TC; (2) use THIP to reveal the affects path through which positive and negative SDF influences TC; and (3) adopt a Proactive Personality (PP) perspective to explore the boundary conditions that enable positive and negative SDF to influence TC.

THEORETICAL BACKGROUND AND HYPOTHESES

Hypothesis

Positive/Negative Supervisor Development Feedback (PSDF and NSDF) and Team Creativity (TC)

Supervisor Development Feedback provides employees with valuable information that can be used to effectively improve their capabilities; describe current work and performance and provide benign suggestions that will assist the future development of employees (Zhou, 2003). Employees will be able to develop their potential without restrictions on their freedom of thought and they will not be subject to the will of other people (Zhou, 1998); SDF will enable employees to generate more inspiration and creativity by devoting themselves to creative tasks (Jia et al., 2014) and it will also promote creativity by generating new ideas that can be applied to challenging tasks (An et al., 2020).

Zheng et al. (2015) was the first to divide SDF into positive and negative in accordance with valence, Positive/Negative Supervisor Development Feedback (PSDF and NSDF) are different but related concepts. PSDF means that the individual's ideas are more creative than the standard, and it is a positive incentive method (which is known as "giving face" in China) that helps employees complete their task to a higher standard of performance (Ma and Yan, 2020). In NSDF, the individual's ideas are less creative than the standard (Zhou, 1998). The purpose of negative feedback is to correct employees' bad or ineffective behavior (Zheng et al., 2015). Both positive and negative SDF enable development expectations to be conveyed from supervisors to employees, and they also enable employees to establish individual innovative standards; it also improves their creative capability, including the generation of creative ideas.

As mentioned in the previous section, there is no clear consensus on the relationship between PSDF (NSDF) and creativity. The existing theory and empirical evidence are even contradictory. Some researchers claim that positive feedback benefits employee creativity (Zhou, 1998), others suggest that it inhibits the development of creativity. This also applies to the relationship between negative feedback and creativity, as some scholars point to a positive (Vuori and Huy, 2016) or negative relationship, claim there is no direct effect (George and Zhou, 2001), hold there is no relationship or claim that negative Feedback will hinder creativity (Van Dijk and Kluger, 2011). The literature contains evidence of a positive, negative and null relationship between negative feedback and recipient creativity (Kim and Kim, 2020). **Table 1** lists some scholars' views on the impact of positive feedback and negative feedback on creativity.

Positive Supervisor Development Feedback means that the individual's ideas are more creative than the standard required. PSDF is a positive incentive method (which is known as "giving face" in China) which encourage employees do their task with a higher quality standard (Ma and Yan, 2020). NSDF is provided when the individual's ideas are less creative than the standard required (Zhou, 1998). The purpose of negative feedback is to correct employees' bad or ineffective behavior (Zheng et al., 2015).Negative feedback has a positive impact on creativity as it makes employees dissatisfied with the current level of creativity and in turn encourages feedback recipients to treat involved creativity tasks more carefully (Kim and Kim, 2020).

Control Theory can effectively explain the purpose of human behavior. The main idea of Control Theory is that when employees see the difference between their actual performance and standard requirements, employees will be motivated to take action (we also call this behavior flow as feedback loop). The job of a supervisor is to promote and strengthen the differences of perception among employees in order to improve team members' performance. The feedback loop can be either a positive or negative feedback (Stallings, 1974). An example of negative feedback is that supervisor send a signal to employees when their performance is below the standard requirement, the employee will take action to improve his performance until the performance requirement is reached. The positive feedback example is that supervisors used to send a positive signal to employees to encourage them continue outperforming from standards. Individuals would adjust their performance to eliminate the gap between the actual and expected performance from supervisors. Meanwhile, we also suggest future research "to examine the parallel use of positive and negative feedback loops to shape human behavior toward expected performance standards" (Jeffrey A. Miles, 40 must-read theories in organization and management research, M, 2017).

In some creative work, the supervisor deliberately use negative feedback to stimulate TC and avoid employee complacency. This negative feedback may not be the true evaluation to subordinates. Indeed, regardless PSDF or NSDF, SDF reflects the development expectations of employees by conveying information related to their future learning, work, and development to employees. SDF helps to build up employees' learning and innovation channels, and to reduce risks and uncertainty for new tasks. SDF helps individuals to establish innovation requirement, to increase creative thinking, and to generate creativity. Though both forms of SDF have positively

effect on TC, the boundary conditions are different. We therefore predict:

Hypothesis1a: PSDF positively affects TC
Hypothesis1b: NSDF positively affects TC

The Mediating Role of Team Harmony Innovation Passion (THIP)

Harmonious passion is one of the most important driving forces of creativity and innovation (Wei and Zhang, 2018), and it can enhance the level of creativity level (Qin and Zhao, 2015). The harmonious innovation passion is an innovation motivation that the whole team possesses, and it is likely to mediate the relationship between positive (negative) SDF and TC. There are a number of reasons for this:

First, SDF can effectively enhance employees' intrinsic motivation and help them generate creative ideas and behaviors (Ryan and Deci, 2000). Harmonious passion is the autonomous motivation for SDF that is influenced by contextual factors (Vallerand et al., 2003). These factors can mutually internalize team members' independent creativity, and can also enhance the team's harmonious innovation passion. SDF is an autonomous support factor that does not only stimulate employees' harmonious passions, but also encourages team members to share their identities and internalize each others' creativity on the basis of positive (negative) SDF. The development feedback generates team identities and forms a harmonious innovation passion at the team level (Wei and Zhang, 2018).

Second, THIP helps to enhance TC. Intrinsic and autonomously formed motivation is the driving force that encourages employees to engage in creative activities (Shin and Zhou, 2007). When the subordinates' intrinsic work motivation is stimulated, their creativity capability simultaneously improves (Amabile, 1997). Those with intrinsic motivation prefer complexity and novel tasks, seek a higher level of challenge and are more likely to identify alternative solutions (Shin and Zhou, 2007). Motivated team members are more likely to generate new and useful insights (Dugosh and Paulus, 2005). In a team setting, THIP enhances TC and makes employees more willing to share and discuss information and produce novel and useful solutions (van Knippenberg et al., 2004).

Finally, employee motivation plays a very important mediating role in the relationship between supervisor behavior and employee creativity/innovation (George and Zhou, 2007; Hirst et al., 2009). Under appropriate conditions, SDF promotes employee creativity performance by enhancing TC (Amabile, 1983). Appropriate leadership behaviors (such as positive or negative SDF) in a passionate team can make a positive contribution to TC (Wei and Zhang, 2018) and Positive (negative) SDF can increase THIP. And THIP also generates an internal force that leads the team to internalize innovation and develop a shared team identity. They will invest time and energy

TABLE 1 | Summary of research on PSDF(NSDF) and creativity.

Valence of feedback	Author, years	Direction of effect	Conclusion
PSDF	Zhou, 1998	Positive	Positive feedback is conducive to employee creativity
	George, 2007	Positive	Positive feedback could bring positive common belief in team creativity
	Li et al., 2012	Positive	Subordinates will show the highest level of creativity when they receive positive feedback from the leader
	Vandenberghe et al., 2019	Positive	Positive feedback can strengthen and develop employee in achieving success contentiously
	Ma and Yan, 2020	Negative	Positive feedback is detrimental to creativity. Frequent use of positive supervisor feedback will increase unhealthy self-esteem, strengthen the dependence of employee behavior on external feedback, and guide individuals towards safe and conservative performance goal, which inhibit creativity
PSDF	Fodor and Carver, 2000; George and Zhou, 2001	Null	Negative feedback has no direct effect on the recipient's creativity
	Ford and Gioia, 2000; Fang et al., 2014; Vuori and Huy, 2016	Positive	Negative feedback is a hard to accept but effective communication tool
	Ilies and Judge, 2005; Van Dijk and Kluger, 2011	Negative	Negative feedback hinders creativity
	Jaussi and Dionne, 2003; Wang and Yan, 2010	Negative	Behaviors such as strict control of employees by supervisors (i.e., negative supervisor development feedback) will inhibit employees creativity
	Kim and Kim, 2020	Positive,Negative, Null	In the bottom-up feedback flow, negative feedback makes employees dissatisfied with the current level of creativity. This dissatisfaction in turn encourages feedback recipients to processes creativity task more carefully In the top-down feedback flow, negative feedback hinders the recipient's creativity due to the meta-process (the mental state of the negative feedback threat felt by the recipient)

in innovation and generate novel and useful solutions (Wei and Zhang, 2018) that enhance TC. On this basis, we predict:

Hypothesis2: THIP will mediate the relationship between PSDF (NSDF) and TC.

The Moderating Effect of Proactive Personality

In considering the influence of feedback recipients on the feedback process, we identify that it is important to study individual differences in feedback recipients (Linderbaum and Levy, 2010). PP is a stable individual difference variable that affects individual proactive behavior, and it has a positive effect on individual innovation behavior. PP is an important predictor of innovation behavior or creativity (Strauss et al., 2015), as employees with high PP are usually highly committed to work goals, and are willing to apply a proactive work attitude to the achievement of these goals (Su and Lin, 2018a). These employees would therefore take NSDF as diagnostic information that helps to correct errors and develop required capabilities. NSDF will not create social embarrassment for these employees and it will not result in threats against them.

Employees with low active personality tend to passively adapt to environmental changes and have an intimate working style. However, they have a weak understanding and acceptance of NSDF, which means that PP is more likely to affect the relationship between PSDF (NSDF) and THIP. We predict that THIP will mediate the impacts of PSDF (NSDF) on TC and also predict that PP will affect TC by changing the THIP driven by PSDF (NSDF). On this basis, we propose the following hypotheses:

Hypothesis3a: *For teams with low PP, the impacts of PSDF on TC will be enhanced through the indirect effects of THIP.*

Hypothesis3b: *For teams with high PP, the impacts of NSDF on TC will be enhanced through the indirect effects of THIP.*

On the basis of the above research hypotheses, we construct the research model shown in **Figure 1**.

Sample Selection and Data Collection

The data of this research is collected from eight enterprises located in Guangdong, Zhejiang, Jilin and Hebei that work in the energy, finance, manufacturing, medical care, and education industries. We collect data by applying the Supervisors-Employees matching method and conducting a two-part survey. Team supervisors first evaluate TC and the subordinates then complete an evaluation report that refers to SDF (positive and negative), THIP and their personalities. Interviewees also provide their demographic information in the survey. A total of 115 questionnaires are distributed to team supervisors and 397 questionnaires to subordinates. The response rate of effective questionnaires for supervisors is 81.7%, and 83.1% for subordinates. Finally, 424 valid questionnaires are obtained (94 from supervisors and 330 from employees). There are 185 male (56.0%) and 145 female (44%) employees; those aged under 30 years-of-age account for 33.3% and those aged over 30 years-of-age for 66.7%. Three hundred twenty-six employees (70.3%) have an undergraduate degree or above; 108 employees (32.7%) have more than 5 years of working experience and there is an average of 4.51 employees in each team.

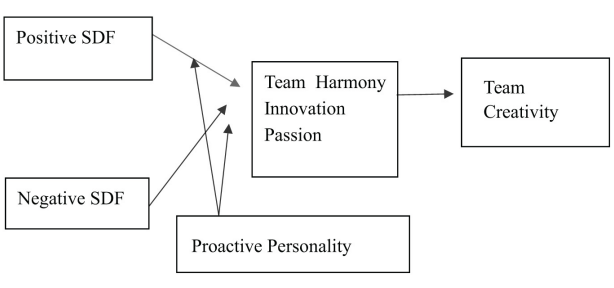

FIGURE 1 | Research model.

Variable Measurement

Our study mainly uses a Likert 7-point scale for analysis. With the exception of the control variables, all variables are evaluated by this scale, which ranges from 1 ("completely inconsistent") to 7 ("completely consistent"). A higher value indicates a greater degree of recognition.

Supervisor Developmental Feedback is evaluated by the eight-item scale developed by Zheng et al. (2015). Five items are used for PSDF and three for NSDF. Typical test items include: (1) "When giving feedback, my supervisor recognizes my ability and provides useful information on how to improve my work performance" and (2) "When giving feedback, my supervisor will criticize my weakness by comparing with other colleagues, and would provide me with useful information on how to improve work performance."

Team Creativity is measured by applying Shin and Zhou's (2007) four-item scale. Typical test items include "we have a lot of creative ideas."

Team's Harmonious Innovation Passion is measured by the scale developed by Vallerand et al. (2003). We ask each team member to evaluate THIP by referring to seven items. Typical test items include: (1) "Innovation gives our team various working experiences." (2) "Innovation is in harmony with other activities in our team." (3) "For our team, innovation is a passion that we can manage it."

Proactive Personality is measured by Seibert et al. (1999)'s scale, which has a total of 10 items. Typical test items include: (1) "I am constantly looking for new ways to improve myself." and (2) "I will find a way to make a work done if I am believe in no matter hard the work is."

Control Variables

Both demographic variables (Bernerth and Aguinis, 2016), and the average job tenure of a supervisor (Shin and Zhou, 2007) have effect on TC. We also control age, gender, and job tenure of the supervisors same as Vandenberghe et al. (2019). Except for the control variables, other variables were evaluated by using the Likert 7-point scale. 1 means "completely inconsistent" and 7 means "completely in line." The larger the value, the higher the degree of agreement with the statement.

RESULTS

Mplus7.0 and SPSS23.0 are used to analyze the data.

Common Method Bias

Table 2 shows that the five factors (PSDF, NSDF, PP, THIP, and TC) are well aligned with each other in the model (x^2 = 622.71; df = 367, x^2/df = 1.70; CFI = 0.95; TLI = 0.95; RMSEA = 0.05), and this applies to a greater extent than other nested models. The results show that the variables have good discrimination validity and confirm that the study's measurements are reliable, well-structured and suited to subsequent data analysis.

We also uses the common method variance (CMV) to test the common method bias. On the basis of the five-factor model (PSDF, NSDF, PP, THIP, and TC), we added another factor which has the common origination of above five factors. The results after adding CMV shows no significant improvement for each fitting index compared with the five-factor model with higher fitting degree, ΔCFI = 0.01, Δ,TFI = 0.02, ΔRMSEA = 0.00, ΔSRMR = 0.01. Therefore, CMV shows that the research model does not have obvious deviation from the common method.

Reliability and Validity Test

We first perform confirmatory factor analysis (CFA) on the model's variables. The load of each variable measurement item is between 0.61 and 0.90. They all exceed 0.60, and most are above 0.70. The composite reliability (CR) of PSDF is 0.92; NSDF is 0.86; THIP is 0.91; TC is 0.90; and PP is 0.90. All CR is greater than 0.70. The average extraction variance (AVE) for PSDF is 0.69; NSDF is 0.66; THIP is 0.60; and TC is 0.70. With the exception of the AVE of PP (0.47), the AVE of all other variables exceeds 0.50. Though the AVE of the PP is less than 0.50, PP can still be well measured as the combined confidential degree is acceptable, and the final result is significant. It is undeniable that some data (individual items) collected in our questionnaires interfere with the value of AVE, and bring unsatisfactory effect on our test tool. We would explained more in section "Limitation." But on the whole, the internal consistency of each variable, the degree of confidence and the aggregation validity are fine and well acceptable.

Data Aggregation Test

Our research focus on the effect of SDF on creativity at team level. We aggregated individual measurements of team members into team-level variables. Our core variable, TC, is scored by the supervisors directly. Other variables, PSDF, NSDF, THIP, and PP are aggregated to team level. The Rwg (mean) and Rwg (median) of TC, PSDF, NSDF, THIP, and PP are all relatively high and exceed 0.70. **Table 3** shows that the ICC1 values of the five variables are all between 0.10 and 0.50, which indicates they have suitable inter-group differences. Four of the variables' ICC2 exceed 0.70, and one is just below (0.63), which also illustrate they have good inter-group reliability. The values of (Rwg, ICC1, and ICC2) the five variables are ideal and can be aggregated at the team level.

Variables Statistical Descriptive and Correlation Coefficient Analysis

Table 4 describe the data at team level, which listing mean, standard deviation and correlation coefficient between main variables. **Table 4** shows that the correlation coefficients of PSDF, NSDF, THIP, and TC are respectively 0.41 ($P < 0.01$), 0.59 ($P < 0.01$), 0.47 ($P < 0.01$), and 0.61 ($P < 0.01$). This indicates that PSDF is positively related to THIP and TC and that NSDF is positively correlated with THIP and TC (these correlations are stronger than

TABLE 2 | Results of confirmatory factor analysis.

Measurement model	x^2	df	x^2/df	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2/\Delta df$
BI factor model	494.34	339	1.46	0.97	0.97	0.04	0.05	3.96
Five factor model	605.30	367	1.65	0.96	0.95	0.04	0.04	265.76
Four factor model	1668.35	371	4.50	0.77	0.75	0.10	0.10	39.18
Three factor model	1785.88	374	4.78	0.75	0.73	0.11	0.11	534.77
Two factor model	2855.42	376	7.59	0.56	0.52	0.14	0.13	628.05
One factor model	3483.47	377	9.24	0.45	0.40	0.16	0.14	–

TABLE 3 | Team level variable aggregation test results.

Variables	Rwg Median	Rwg Average	ICC1	ICC2
Team Creativity	0.89	0.86	0.39	0.70
Positive Supervisor Development Feedback (PSDF)	0.92	0.86	0.41	0.71
Negative Supervisor Development Feedback (NSDF)	0.83	0.78	0.49	0.77
Team Harmony Innovation Passion (THIP)	0.96	0.93	0.47	0.76
Proactive Personality (PP)	0.97	0.89	0.33	0.63

Five factors model: include PP, PSDF, NSDF, THIP, TC.

TABLE 4 | Descriptive analysis and correlation coefficient of variables.

Variables	M	SD	1	2	3	4	5	6	7
1. Age of Supervisors	3.02	1.34							
2. Gender of Supervisors	0.33	0.47	−0.15						
3. Tenure Month of Supervisors in Teams	49.83	50.09	0.30**	0.03					
4. Positive Supervisor Development Feedback (PSDF)	5.10	0.97	0.18	−0.03	0.25*				
5. Negative Supervisor Development Feedback (NSDF)	4.60	1.17	0.02	−0.30**	0.06	0.37**			
6. Proactive Personality (PP)	5.00	0.67	0.09	−0.17	0.06	0.24*	0.49**		
7. Team Harmony Innovation Passion (THIP)	5.08	0.86	−0.02	−0.19	0.11	0.41**	0.59**	0.31**	
8. Team Creativity (TC)	4.84	0.91	0.08	−0.08	0.11	0.47**	0.61**	0.40**	0.57**

*(1) Data are described at team level; (2) The age in questionnaire is recorded as a continuous variable with 1–6 grades (1:30 years old; 2:30–35 years old, 3:36–40 years old, 4:41–45 years old, 5:46–50 years old, 6:50 years old and above), the value in the table is the average of six grades; (3) The values in the table are standardized regression coefficients *P < 0.05, **P < 0.01,***P < 0.001.*

those related to PSDF). The correlation coefficient between THIP and TC is 0.57 ($P < 0.01$), which indicates that THIP and TC are positively correlated. These results broadly support our hypotheses.

Main Effects Test

We adopt the Hierarchical Regression Analysis Method, and the test results are shown in M2 in **Table 5**. When the regression model is applied, the control variables are not found to be significant. In referring to the control variables, we add PSDF, NSDF, and PP to the regression, and find that the regression coefficient of PSDF on TC is 0.27 ($P < 0.01$), the regression coefficient of NSDF on TC is 0.49 ($P < 0.001$) and ΔR^2 is statistically significant. The results turn out that the PSDF and NSDF are both positively correlated with TC, but they have different coefficients on the TC. This shows that PSDF has a significant positive impact on TC, and NSDF also has a significant positive impact on TC. These impacts are also stronger than those observed in the case of PSDF. The results support H1a and H1b.

The result also shows that NSDF has a stronger effect on TC, which is constant to our hypothesis. By providing NSDF, individual's ideas are less creative than the standard (Zhou, 1998). After receiving negative feedback, people will make greater adjustments to their next action (Zhu et al., 2019). The purpose of negative feedback is to correct employees' bad or ineffective behavior (Zheng et al., 2015). Team members who receive negative feedback will search and review the information that not used properly (Hoever et al., 2018). In Kim and Kim's (2020) paper, negative feedback has a positive impact on creativity as it makes employees dissatisfied with the current creativity, and in turn encourages feedback recipients to carefully study the processes creativity tasks they involved. Therefore, under certain conditions, NSDF has a stronger impact on TC than PSDF.

We also found that negative feedback will bring more motivation for team as well as pressures. The negative impact on the individual's emotions and experience from negative feedback is obvious and straightforward, but the impact on creativity, especially on TC, is complex. The impact of NSDF on TC is not as simple as generally considered. Although the effect on TC in

TABLE 5 | Results of regression analysis.

Variables	Team Creativity (TC)		Team Harmony Innovation Passion (THIP)		
	M1	M2	M3	M4	M5
Constant	4.73***	0.95	5.27***	2.51***	2.21***
First Step: Control Variables					
Age of Team Supervisors	0.04	0.02	−0.10	−0.10	−0.05
Gender of Team Supervisors	−0.08	0.09	−0.20	−0.05	−0.06
Tenure Months of Supervisors in Teams	0.10	−0.006	0.14	0.05	0.06
Second Step: Main Effect					
PSDF		0.27**		0.23*	0.31**
NSDF		0.49***		0.49***	0.37***
PP		0.11		−0.01	−0.03
Third Step: Intermediary effect					
PSDF × PP					−0.24**
NSDF × PP					0.28**
ΔR^2	0.02	0.44***	0.06	0.34***	0.16***
F	0.60	12.56	1.77	9.81	10.87

*The values in the table are standardized regression coefficients *P < 0.05, **P < 0.01, ***P < 0.001.*

our research is positive, it may only be an intermediate impact at a certain stage. Frequent negative feedback could bring great psychological pressure to team members, and thus negatively affect creativity. But as team members could encourage each other when facing psychological pressure, the diversified characteristics and information process methods from team members may help team members turn pressure into motivation, and bring positive effects on TC. We believe the effect of NSDF is even stronger than PSDP.

Mediating Effects

We use *Process software* to repeatedly sample 5,000 times, in accordance with the Self-Repetitive Sampling Method (see **Table 6**). THIP mediates the relationship between PSDF and TC (Boot 95 percent CI = [0.1158,0.3085]) and the relationship between NSDF and TC (Boot 95 percent CI ([0.0974,0.6521]); THIP has a significant impact on TC (b (=0.26, Boot 95 percent CI = [0.0790, 0.4170]; PSDF has a significant positive effect on TC (b = 0.21, Boot 95 percent CI = [0.0060,0.4150]); NSDF has a significant positive impact on TC (b = 0.41, Boot 95 percent CI = [0.2240, 0.6000]); And this coefficient is stronger than the one from PSDF. THIP also has a partial mediating effect on the relationship between PSDF (NSDF) and TC. Hypothesis 2 is therefore verified.

In order to more clearly explain the relationship and influence of PSDF (NSDF) on the intermediary variables (the direct effect), THIP, and TC (the indirect effect), we draw **Figure 2**. **Figure 2** can clearly show the PSDF has less impact on THIP and TC than NSDF does.

Adjusting Effect Test

We seek to test the moderating effect of the PP on the indirect relationship of "PSDF (NSDF) → THIP→ TC." Interaction variable (PSDF (NSDF) × PP) is added on the basis of the main effect test. Refer to **Table 4**, where M4 shows that PSDF has a significant positive impact on THIP (b = 0.23, $P < 0.05$ and ΔR^2 is statistically significant); NSDF has a significant positive impact on the THIP (b = 0.49, $P < 0.001$ and ΔR^2 is statistically significant). Again refer to **Table 4**, where M5 shows the Interaction variable of PSDF and PP has a positive effect on THIP: the regression coefficient is −0.24; $P < 0.01$ and ΔR^2 is statistically significant. This indicates that PP has a significant negative adjustment effect on the relationship between PSDF and THIP. The regression coefficient of the interaction variable of NSDF and PP on THIP is 0.28, $P < 0.01$ and ΔR^2 is statistically significant. The relationship between SDF and THIP has a significant positive adjustment effect on TC. Refer to **Figure 3**, where the Simple Slope test shows that low initiative personality has $t = 4.60$ ($P < 0.001$) and high initiative personality has $t = 1.35$ ($P = 0.18$, not significant), which supports the hypothesis that PP has a partial moderating effect on the relationship between PSDF and THIP. H3a is therefore partially established. Refer to **Figure 4**, where the Simple Slope test shows that low initiative personality has $t = 2.38$ ($P < 0.05$) and high initiative personality has $t = 6.29$ ($P < 0.01$). This supports the claim that PP has a moderating effect on the relationship between NSDF and the THPFI. H3b is therefore verified.

MAIN RESEARCH CONCLUSION AND CONTRIBUTIONS

Conclusions

Both positive and negative SDF positively impact TC. NSDF has a stronger impact on TC than PSDF. When NSDF is matched and there is high PP in a team, TC will be enhanced through THIP.

TABLE 6 | Results of mediation effect analysis.

Control Variables	Team Harmony Innovation Passion (THIP)			Team Creativity (TC)		
	M6			M7		
	b	SE	Boot 95% CI	b	SE	Boot 95% CI
Control Variables						
Age of Team Supervisors	−0.07	0.63	[−0.199, 0.049]	0.04	0.07	[−0.099,0.178]
Gender of Team Supervisors	−0.10	0.22	[−0.538, 0.317]	0.22	0.16	[−0.098,0.515]
Tenure Months of Supervisors in Teams	0.000	0.002	[−0.002,0.004]	0.00	0.00	[−0.004,0.004]
Independent Variables						
PSDF	0.23	0.10	[0.051,0.462]	0.21	0.11	[0.006,0.415]
NSDF	0.49	0.12	[0.254,0.711]	0.41	0.10	[0.224, 0.600]
Mediating Variable						
THIP				0.26	0.09	[0.079, 0.417]
R^2		0.40***			0.49***	
				SE		Boot 95% CI
Intermediary effect	THIP		0.06	0.05		[0.1158,0.3085]
			0.13	0.05		[0.0974, 0.6521]

*The values in the table are standardized regression coefficients *P < 0.05, **P < 0.01, ***P < 0.001.*

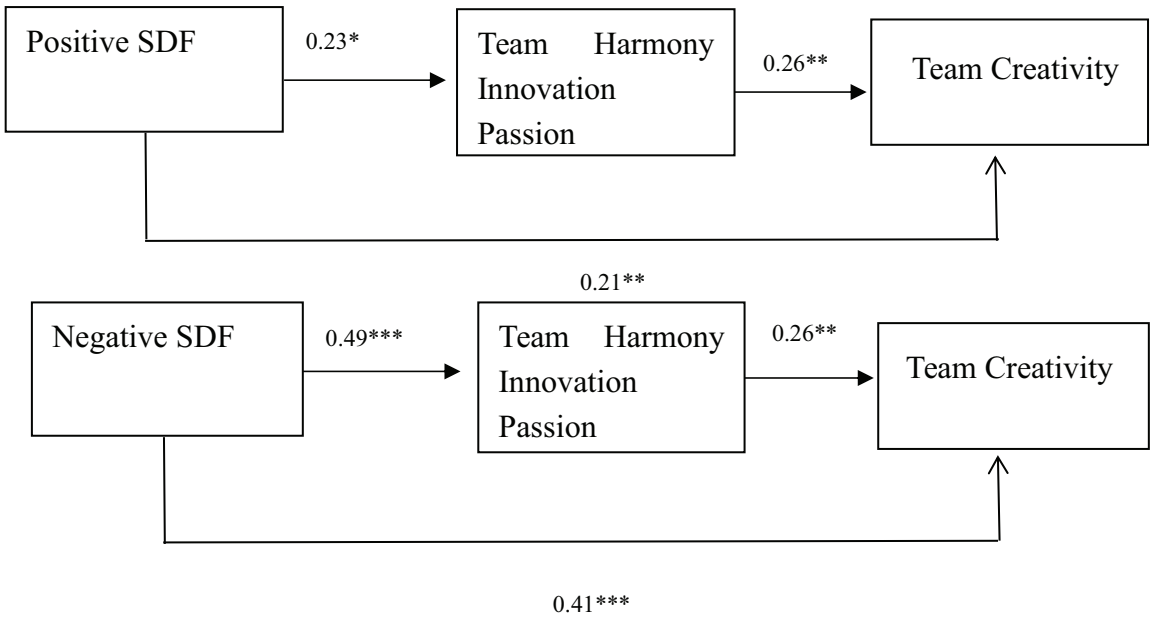

FIGURE 2 | Conditional direct and indirect effects for PSDF and NSDF. The values in the table are standardized regression coefficients.

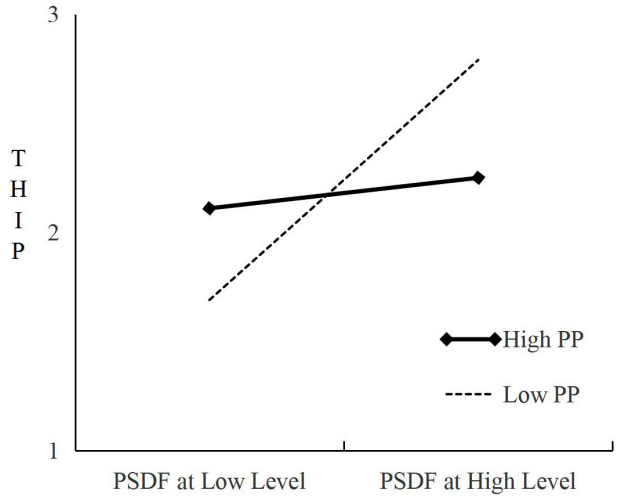

FIGURE 3 | Moderating effect of proactive personality under PSDF.

Second, THIP has a partial mediating effect on the relationship between PSDF (NSDF) and TC. In order for THIP to be generated, intervention must first occur through PSDF (NSDF). The stimulation of PSDF (NSDF) enables THIP to optimize, and TC is enhanced as a result.

Third, PP has a moderating effect on the relationship between NSDF and THPFI. A team with high PP can influence the THIP by interacting with NSDF, and it then indirectly affects TC. Teams with low PP can influence the THIP by interacting with PSDF, and then indirectly affect TC.

Theoretical Contribution

Academia has been increasingly interested in the formation and mechanism of organizational organizational behavior variables in the context of Eastern management in recent years (Chuang et al., 2015). In line with this, our paper studies the developmental feedback mechanisms PSDF and NSDF in China, and we contribute to the literature in four key aspects:

First, we adopt a development feedback perspective to explore the effects of supervisor leadership on TC. By conducting empirical research into the PSDF and NSDF variables (which originate from one source), we provide further insight into how SDF influences TC at the valence angle, and which valence has a stronger effect on TC. We thereby explain the impact of SDF on TC from the perspective of valence. This distinction and synchronization verification is critical, because in practice supervisors are likely to provide both PSDF and NSDF to subordinates simultaneously. In this way our research fills the gap left by previous studies, which lack a discussion of valence, and provides a theoretical basis on which supervisors can select better strategies to improve TC.

Second, unlike previous studies, which focus on the individual, our research extends the relationship between SDF and creativity to teams. Teams have meaning and dynamic characteristics that cannot be explained or covered by individual data. Our research presents the impact of the interaction between motivation and process on innovation at the team level. We believe it is an important test, and an extension of Amabile's creativity and innovation element model. Since the advent of Amabile's model, empirical research has focused mostly on individual-level research. However, research at the individual level ignores the interdependence and knowledge-intensive nature of TC. Our paper reveals the complex mechanism of PSDF (NSDF) on TC

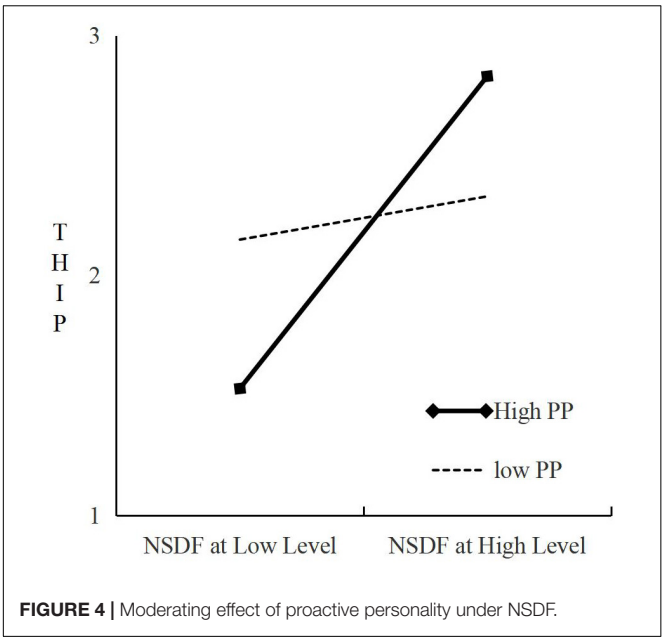

FIGURE 4 | Moderating effect of proactive personality under NSDF.

from the perspective of motivation, and finds that even NSDF at the team level can increase TC. This paper enriches the literature on the relationship between SDF and TC, expands the discussion of the SDF model itself, verifies the role of PP in the SDF model, and extends the research boundary to the influence of SDF on TC.

Third, we reveal the complex mechanism of PSDF and NSDF on TC from a motivation perspective, and specifically answer the question "Why do positive and negative SDF lead to different levels of TC respectively?" In our answer, we provide a new perspective from which to explain SDF's effectiveness. Either positive or negative SDF can enhance collective identity among team members, generate a higher THIP, increase knowledge sharing and communication between team members, and stimulate TC. The difference between PSDF and NSDF is their effectiveness on TC. We provide empirical support to further clarify the obscure relationship between SDF and TC, and enrich the literature on THIP field. Our paper provides a theoretical basis from which managers can select motivation strategies for team members when the team's creativity is failing.

Fourth, our paper draws from Feedback Intervention Theory (Kluger and DeNisi, 1996) to establish an empirical model of creativity and innovation (Amabile, 1997; Hennessey and Amabile, 1988) as its overall framework. Our paper then applies Zheng et al.'s (2015) PSDF and NSDF Measurement Table to the empirical results. Although other scholars have studied the relationship between team-centered feedback valence and creativity (Hoever et al., 2018), their research mainly adopted the random experimental method (in which the experiment is conducted in a temporary organization environment) and they did not gain sufficient data from the subsequent tasks (Hoever et al., 2018). Our study uses a non-random empirical method, in which the research object is a stable team of employees and supervisors. We tested different SDFs on the team, and the method and impact of positive and negative SDF on TC. This experiment gives managers a theoretical base that can guide their feedback practices.

Practical Contribution

We provide a new analytical mode that managers can incorporate into a valance perspective, which can then be used to improve TC. Our developmental feedback can be used to improve creativity, and we provide valuable suggestions that PSDF (NSDF) can use to stimulate TC. We also show that organizations should seek to enhance TC by strengthening supervisors' ability to provide developmental feedback.

Second, we show how THIP can be used to inspire employees. The inspiring of passion "from the heart" is a subject that has been long discussed in management practice. We provide a solution and show how supervisors can use PSDF and NSDF to stimulate THIP, and ultimately enhance TC. When teams have low levels of enthusiasm, more SDF stimuli (positive or negative) can help to generate more harmonious passion, and this will ultimately promote TC.

Third, we show managers should take proactive personality characteristics into account when considering the kind of developmental feedback they provide to the team. When teams have high PP, more NSDF can be used to stimulate THIP, as employees can generate a desire for innovation, and this can ultimately enhance TC. But when teams have low PP, we suggest that managers should instead use PSDF to stimulate harmonious innovation passion.

Research Limitations and Prospects

Due to the time and resources constrains, our study still has some improvement space. First, our data sample are small and lack vast representative in region and industry. Future research should expand the sample size and collect data from multiple industries to make sample more diversified. Second, creativity judgment is inherently subjective and self-conscious, which is difficult to assess. Although we have used two measurement methods, self-evaluation and other-evaluation, there still has bias in the measurement of TC due to subjective reasons. Thirdly, our research used questionnaire survey to collect cross-sectional data. This data may not fully reflect the longitudinal causal relationship between variables. A longitudinal and time-point research is needed. Fourth, matching supervisor and employees' data can avoid common method bias, but the only using of questionnaire survey method is insufficient. We would suggest future researchers to combine questionnaires and experimental method together to further explore the factors that can affect TC from PSDF and NSDF. Fifth, The collection of control variables is not sufficient in our survey. Future research should take more control variables into consideration. The measurement of PP (AVE) is lower than 0.50, and some individual level items on the questionnaire interfere with the value of AVE. Future research should test the tools and select measurement that are more in line with the sample. Lastly, our paper explores the influence of motivation mechanism from SDF to TC. In the future, we can try

to explore the influence of other intermediary mechanisms such as affection and team conflict.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.681910/full#supplementary-material

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REVIEW
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Cultural Competence and Cultural Sensitivity Education in University Nursing Courses. A Scoping Review

Cinzia Gradellini[1,2], Sagrario Gómez-Cantarino[3,4,5], Patricia Dominguez-Isabel[5,6], Brigida Molina-Gallego[3,4], Daniela Mecugni[7,8] and María Idoia Ugarte-Gurrutxaga[3,4]*

[1] Qualitative Research Unit, Azienda Unità Sanitaria Locale-IRCCS, Reggio Emilia, Italy, [2] Reggio Emilia Nursing Course, University of Modena and Reggio Emilia, Modena, Italy, [3] Faculty of Physiotherapy and Nursing, University of Castilla-La Mancha, Toledo, Spain, [4] Research Group Nursing, Pain and Care (ENDOCU), University of Castilla-La Mancha, Toledo, Spain, [5] Health Sciences Research Unit: Nursing (UICISA: E), The Nursing School of Coimbra (ESEnfC), Coimbra, Portugal, [6] Hospital Emergency Unit, Toledo Hospital Complex (CHT), Castilla-La Mancha Health Service (SESCAM), Toledo, Spain, [7] Reggio Emilia Nursing Course, University of Modena and Reggio Emilia, Modena, Italy, [8] Azienda Unità Sanitaria Locale–IRCCS, Reggio Emilia, Italy

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Juan Moreno-Garcia, University of Castilla-La Mancha, Ciudad Real, Spain

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Manuel Carlos Chaves, Coimbra Nursing School, Portugal

***Correspondence:**
Sagrario Gómez-Cantarino
sagrario.gomez@uclm.es

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When assessing the fragility that characterizes the health of an immigrant person, a culturally competent transformation of the nurse–patient teaching-learning process is necessary. Therefore, it is considered essential to incorporate cultural competence and intercultural communication in higher nursing education.

Objective: To determine the content and knowledge of cultural competence and intercultural communication offered in higher education in nursing courses.

Design: The Campinha-Bacote model of cultural competence was used as the primary reference.

Method: A scoping review was conducted about studies published in the period 2003 and 2020. The research was conducted between May and October 2020. More than a hundred documents (books, chapters, articles, conference proceedings) have been consulted.

Results: Undergraduate nursing courses and postgraduate education move toward promoting cultural competence and sensitivity through teaching strategies.

Conclusions: Teaching projects that combine multiple competencies are more effective, including teacher training. A predominant element is a need for continuous and transversal projects. University nursing education must adapt culturally competent curricula.

Keywords: nurses, education, cultural competence, cultural sensitivity, health

Abbreviations: EHEA, European Higher Education Area; RUCT, Registry of Universities, Centers and Titles; PCCSS, Model of Cultural Competence in the Provision of Health Services Campinha-Bacote; NCP, Nursing Care Process; PBL, Problem-Based Learning; ICT, Information and Communication Technologies; ECTS, Credit Transfer System; WHO, World Health Organization.

INTRODUCTION

The incorporation into the European Higher Education Area (EHEA; Somoza et al., 2011), has meant changes of great importance in university teaching (Sánchez-Ojeda et al., 2018). This fact has led to significant legislative, professional, and social changes. Therefore, introducing a series of transformations at a structural and operational level has been promoted, directly impacting the skills and professional profiles of university education. This change process has given an increase to a teaching paradigm in which the student becomes the center of the entire educational process: this has led to a redefinition of both roles of teachers and students (Backes et al., 2011).

It is known that first-level nursing higher education is oriented to professional activities, so they need to work a lot on the students' training (Backes et al., 2011; Gómez Cantarino et al., 2015). Successful completion of these undergraduate courses will give access to a Bachelor's or Postgraduate degree, which appears in the Registry of Universities, Centers, and Titles (RUCT). Instead, second-level education (e.g., Master's) is oriented to acquiring advanced training, as specialized or multidisciplinary topics. It also promotes initiation into research tasks (Gómez Cantarino et al., 2015).

University training in nursing follows a human, scientific, and teamwork perspective. They train students (in degree or Master's) to identify, act, and evaluate the health needs of a target population. It also affects the health promotion and education for individuals, family, and community, considering their cultural environment (Backes et al., 2011; García et al., 2011). In this sense, Meleis (2010), a nurse theorist, indicates that nursing is considered a human and holistic science, with an orientation to care practice at any time and place, which begins with acquiring skills within the classroom (Cantarino et al., 2015). Considering the requested skills, fundamental for care at any place, and for any target population, the care is considered culturally competent when congruent to the people's values and symbols influenced by the culture (Leininger, 1994).

The concept of cultural competence has its origin in the theories of intercultural nursing, specifically within the Leininger model, in the 1970s (Leininger, 1994; Leininger and McFarland, 2006). This model considers the analysis of the different cultures concerning: nursing, care practices, values and beliefs, concepts of health and disease. Its outcome guarantees effective and meaningful nursing care, in line with the cultural values and context (Ibidem).

It was only in the mid-1990s that this concept became more important. Even the American Academy of Nursing defined cultural competence, indicating that it includes a complete integration of knowledge, attitudes, and skills, facilitating intercultural communication and interactions between people (Leininger and McFarland, 2006). For this reason, United States began to incorporate cultural competence into nursing studies in the 1980s, specifically in San Francisco. In 1982, California introduced specific graduate studies in nursing (masters) to educate students on cultural competence. The literature suggests it is necessary to plan the students' training to recognize their attitudes, enabling them to instill positivity in their relationship with patients in hospital and community care (González, 2008; Gómez Cantarino et al., 2015).

The term, cultural competence, also began to be more considered in the scientific community, thanks to the emergence of new theories, which are following described. For example, Purnell (with Tilki and Taylor) presents a model of cultural competencies and listening skills useful for health care professionals. It starts from the consciousness of the professional, and it considers four phases in mutual interaction: self-awareness, cultural identity, Attachment to inheritance and family assets, ethnocentrism (Purnell and Fenkl, 2019). Spector's health traditions model is based on recognizing specific behaviors strongly related to the culture of origin. It analyzes how people manage their health concerning these. Giger and Davidhizar's (2002) model of cross-cultural nursing describe six cultural phenomenal which need to be known by the health professionals in order to guarantee effective care: the communication barriers/problems; space/setting; the social organization of the context; the dedicated time; the environment control; the biological modification (structure of the body) (Karaburak et al., 2014). Last is the Campinha-Bacote cultural competence model, which interprets cultural competence as a dynamic process, and it requests health care providers to consider this competence a priority. The main assumptions are: (1) cultural competence is a process; (2) it consists of five main elements: cultural awareness, cultural knowledge, cultural skills, cultural encounter, and cultural desire; (3) within the groups there is more variation than across them; (4) health care providers' cultural competence is strongly related to services providing culturally responsive care for ethnically diverse people (Campinha-Bacote, 2008, 2007, 2002).

In 2019, which corresponds to 3.5% of the world's population, 272 million migrants traveled worldwide. The vast majority of these people arrive in a new country with precarious health, generally due to the conditions in which they made the trip (Guild et al., 2020). Indeed, the living conditions in the new country and the stress of acculturation can cause a rapid deterioration of the health capital; good health has been verified in most of the migrant population, based on a selection of people from the country of origin who are young and in good health (Tizzi et al., 2018). It is even found that the differences observed in the health problems of migrants, compared to the local population, are constitutional, cultural, or endemic in the countries of origin (for example, cervical cancer, female genital mutilation, tuberculosis). In addition, mental health problems are observed, often associated with migration routes coupled with living conditions in the host country (Sánchez-Ojeda et al., 2018; Tizzi et al., 2018).

It is important to note that the literature indicates an improvement of cultural competence in the higher nursing education educational offer. However, some common problems still arise in the teaching plans and training: (1) the lack of consensus on what should be taught; (2) the related timing; (3) the lack of standard references; (4) a limited and inconsistent formal evaluation of educational interventions (Spector, 2018). It is a shared opinion that university nursing courses (Undergraduate/Postgraduate) need to educate and

prepare future professionals, providing them skills to face challenges and complexity generated by cultural diversity; ability to understand that care includes tolerance, respect, and critical self-reflection; ability to understand that values (related to culture but not only) are strongly involved in the therapeutic relationship.

Therefore, nursing courses are called to adopt curricula that support cultural competence to make future nurses able to promote social justice in care contexts. This concern is framed in what today is clearly defined as a standard of socio-political knowledge in nursing (Munn et al., 2018).

The objective of this scoping review is to analyze how undergraduate nursing programs and postgraduate education are promoting cultural competence and sensitivity in the learning programs.

MATERIALS AND METHODS

Study Design

A scoping review has been processed to analyze if and how nursing courses' *curricula* promote cultural competence and sensitivity. A vision of the focus of the documents is even acquired, which allows researchers an evaluation, synthesis, and criticism of the evidence inherent to the objective of the study (Siles González, 2005; Peters et al., 2015). As the primary conceptual model, we use the Process of Cultural Competence in the Delivery of Healthcare Services Model (PCCSS), proposed by Campinha-Bacote (2008, 2007, 2002). It is the most promising model to guide research since it can respond comprehensively and globally in all dimensions to the proposed objective. It is also the reference point for the analysis carried out with the designed strategy.

Through this model, culture provides the individual with a set of beliefs and values that define feelings of belonging and continuity. It also facilitates social integration and communication between members of a group (Campinha-Bacote, 2007). As previously mentioned, the PCCSS methodology is based on interpreting cultural competence as a continuous process. Students and health professionals strive to achieve skills with the different cultural groups of clients to serve (individual, family, community). Thus, cultural competence based on this model results from the integration of five concepts (1) Cultural awareness, which includes the exploration of one's own cultural and professional background. In addition to the prejudices and stereotypes that are held toward people of different cultures. Therefore, it reviews cultural awareness and sensitivity through training (2) Cultural knowledge, where beliefs and values about health are integrated. To develop cultural competence within higher education studies in nursing (3) Cultural skills include identifying needs for care and adaptation to the context. Closely related to the development of didactic strategies in nursing university studies, (4) Cultural encounter promotes the need to involve the student and the health professional in inter-cultural immersions to prevent stereotypes. Use information and communication methodologies (5) Cultural desire, based on respecting differences and reinforcing similarities. It implies the will to learn on the part of the student–teacher (Campinha-Bacote, 2003) (**Figure 1**).

Search Strategy

The scoping review process begins with an exploratory research question (Campinha-Bacote, 2003) to systematically synthesize existing knowledge (Colquhoun et al., 2014). In this research, we ask ourselves: "Are there specific didactic strategies to promote cultural sensitivity and competence in higher education in nursing?"

The model of cultural competence in the provision of health services (PCCSS) was applied. The researchers agreed on the eligibility criteria, containing information on cultural competence about nursing training and practice. The review also includes studies that contain teaching strategies and interventions. Studies on the cross-cultural theoretical/practical teaching-student experience were considered to consider the five elements proposed by the model.

The review includes books, book chapters, conference proceedings, and peer-reviewed articles. There are no restrictions regarding the country where the intervention was performed.

The exclusion criteria used are articles written in languages unknown to the researchers, articles without abstract, information that did not refer to the subject of the study.

The inclusion criteria are (1) articles from 2003 to 2020 (even if papers before this period are cited if they include theoretical models); (2) articles written in English, Spanish, Portuguese and Italian.

Several sources were consulted: (1) PubMed; (2) MedLine; (3) CINHAL; (4) Scopus; (5) Google Scholar. The terms MeSH and DeSH were used to carry out a more exhaustive and advanced investigation starting with the Boolean operator [AND], [Y], [OR]. In addition, combinations of words were used, where appropriate, to reflect the syntax and search rules common to the different databases.

The keywords used were the following: nursing, education; cultural competence; cultural sensitivity; Health; migrants, Social Determinants of Health.

After searching, eliminating, and selecting the articles, those selected were coded and identified as described in **Table 1**.

This scoping review took place between May and October 2020. This review aims to map the evidence supporting a particular research area and identify gaps in the existing evidence. This methodology does not intend to analyze the methodological quality of the included studies or find the best scientific evidence but rather to map the existing scientific evidence. Through the authors' consensus (CG; SG-C; PD-I; DM; MIU-G), the publications were reviewed. A number of 105 documents were reached that met the requirements reflected in the inclusion and exclusion criteria. Researchers screened titles, abstracts, and full articles, independently and their bibliographic references manually to add them to the review. When discrepancies arose between investigators, the consensus was attempted, and, if not possible, an external reviewer resolved the conflict.

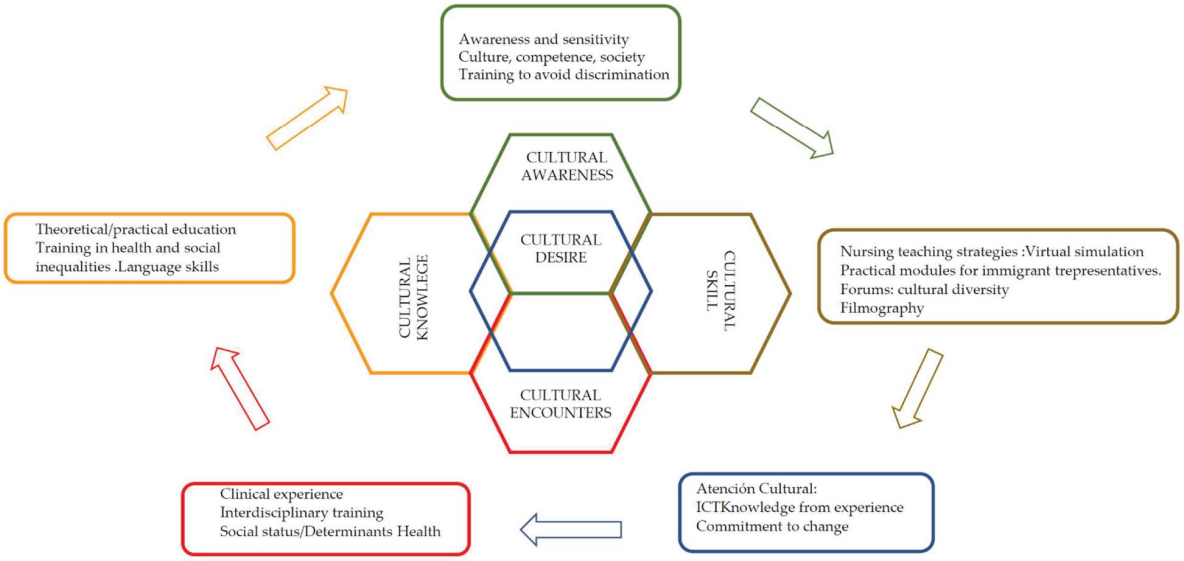

FIGURE 1 | Campinha-Bacote (2002) model of cultural competence. Source: Authors' own creation.

Analysis of Data

The content analysis of the documentation was carried out from a qualitative perspective through an objective and systematic method (Peters et al., 2015). The steps that were carried out for the analysis consisted of (1) a thematic link; (2) a preliminary classification of documents based on content and organization criteria; and (3) a selection and extraction of the relevant information, according to the scope review criteria, in order to obtain results and conclusions (Campinha-Bacote, 2003; Siles González, 2004). The selected articles were analyzed from the point of view of the five concepts studied, which make up the PCCSS (Model of cultural competence): (1) cultural awareness; (2) cultural knowledge; (3) cultural skills; (4) cultural encounter; and (5) cultural desire. These concepts represent the meaning of working with cultural diversity, which encourages the caregiver to reflect on their cultural values (Campinha-Bacote, 2007, 2003). It is essential to specify that some studies covered more than one concept, so they have been analyzed in the category considered prevalent.

In this research about cultural competence, the researchers performed an inferential interpretation to extract and summarize the data. An attempt was made to know the reality already investigated and written regarding cultural competence in higher nursing education. The first and second authors (CG and SGC) carried out the general data extraction. While the third and fourth authors (PDI and BMJ) examined, the findings found. The fifth, and sixth authors (CG, DM, and MIUG) identified the standard thematic lines, which are included within the structures that make up the PCCSS (cultural awareness, cultural knowledge, cultural skills, cultural encounter, cultural desire). When a discrepancy in the studies' inclusion appears, it has been resolved, searching for a consensus among the investigators.

The studies chosen for the analysis based on the degree of rigor were not excluded since the objective of the scoping review was to synthesize the results of the reviewed research to extrapolate a more excellent knowledge and vision of cultural competence to the scientific world (Crossetti, 2012; **Table 2**).

TABLE 1 | Search strategy in databases.

Database	Search Strategy	Limits	Filters
PubMed	Enfermería AND educación Y Competencia Cultural AND Sensibilidad Cultural AND Salud AND Migrantes OR Determinantes Sociales AND Educación Y Conciencia cultural	Title Article English/ Spanish/Italian/ Portuguese	63 items filtered
MedLine			30 items filtered
CINHAL			24 items filtered
Scopus			25 items filtered
Google Scholar			172 items filtered

RESULTS

General Findings

The search results flow through the scoping process is displayed in PRISMA. The initial search returned 314 articles, which were narrowed to 246 by eliminating duplicates. After reviewing the titles and abstracts of these studies, 51 additional studies were excluded. Of the remaining 196, 91 were eliminated for not being original studies since they did not include the subject of study (cultural competence/students), reflect cultural awareness and

TABLE 2 | Aplicación de la competencia cultural como proceso continuo a través del Modelo de J. Campinha-Bacote.

Theoretical model cultural competence	Concept treaty	Question-research	Document subject included	References
Campinha-Bacote, 2002	Cultural awareness	Are there preconceptions and prejudices on the part of health professionals toward other cultural groups?	Overview on cultural competence: ◯ Sensitivity ◯ Culture, competition, society ◯ Train and avoid discrimination	Clark et al., 2011; Lenburg, 1995; Lipson and Desantis, 2007; Meleis and Trangenstein, 1994; Meleis, 2010
				Chiarenza, 2012; Ingleby, 2012; Sealey et al., 2006; Purnell, 2005; Ibarra Mendoza and González, 2006
				Taylor et al., 2011; Maddalena, 2009; White, 2006; Atxotegui, 2000; Repo et al., 2017; Garneau, 2016; Meydanlioglu et al., 2015; Flood and Commendador, 2016; Bohman and Borglin, 2014; Jeffreys and Dogan, 2012; Bentley and Ellison, 2007; Allen, 2010
	Cultural knowledge	Is there enough knowledge about the vision that intercultural groups have of the world?	Cultural competence in cultural health training in Higher Education (Graduate/Postgraduate): ◯ Theories apply culture ◯ Virtual simulation ◯ Forums ◯ Filmography	Paul et al., 2014; Brathwaite, 2003; Foronda et al., 2016; Guzmán-Rosas, 2016; Montenery et al., 2013; Peek and Park, 2013; Noble et al., 2014; Carr and Knutson, 2015; Ahn, 2017; Lin et al., 2015; Riner, 2013; Callen and Lee, 2009; Upvall and Bost, 2007; Caffrey et al., 2005; Harkess and Kaddoura, 2016; Gradellini and Mecugni, 2015; Northam et al., 2015; Gallagher and Polanin, 2015; Truong et al., 2014; Calvillo et al., 2009; Morin, 1999; Aponte, 2012
				Gebru and Willman, 2010
				Sanner et al., 2010
				Watts et al., 2008; Cuellar et al., 2008; Gordon et al., 2016; Gradellini, 2013
	Cultural skills	Is there the ability to collect health data in a culturally sensitive way?	Other experiences: didactic strategies and adequate attention in Undergraduate/graduate: ◯ Theoretical/practical teaching: collecting cultural health data ◯ Training in social inequalities ◯ Multiprofessionalism and interculturality	Cenoz Iragui, 2004; Gradellini et al., 2012; Aponte, 2012; Sargent et al., 2005
	The cultural encounter	Do health professionals and students interact with people who belong to different cultures?	Development of cultural competence: ◯ Promotion of local, national and international care ◯ Stays in one's own country adapting to the culture	Marshall, 2017; Hart et al., 2016; Siles Gonzalez et al., 2016; Ruddock and Turner, 2007; Bønløkke et al., 2018; Amerson and Livingston, 2014
	Cultural desire	Do you really want to be culturally competent?	The role of international mobility and the application of new technologies (TiC) ◯ Promotion of competent intercultural care ◯ Knowledge through experience	Koskinen et al., 2009; Upvall and Bost, 2007; Arbour et al., 2015; Hunter and Krantz, 2010; Giddens et al., 2012

knowledge, consider educational skills, reflect on the meaning of working with cultural diversity. According To this, 105 studies were included in the scoping review (**Figure 2**).

Cultural Awareness

Social diversity is constantly changing and linked to gender, age, religion, and belonging to a geographical and cultural environment. Health care professionals carry out their activity in a complex and very diverse socio-cultural environment, a consequence, among others, of the migratory processes that are taking place (Chiarenza, 2012; Ingleby, 2012). This interrelation between populations and cultures poses new challenges, requiring new resources and professional strategies to provide an effective and quality response (Taylor et al., 2011). Improving communication and understanding between the different actors (nursing-individual, family, community) that intervene in health

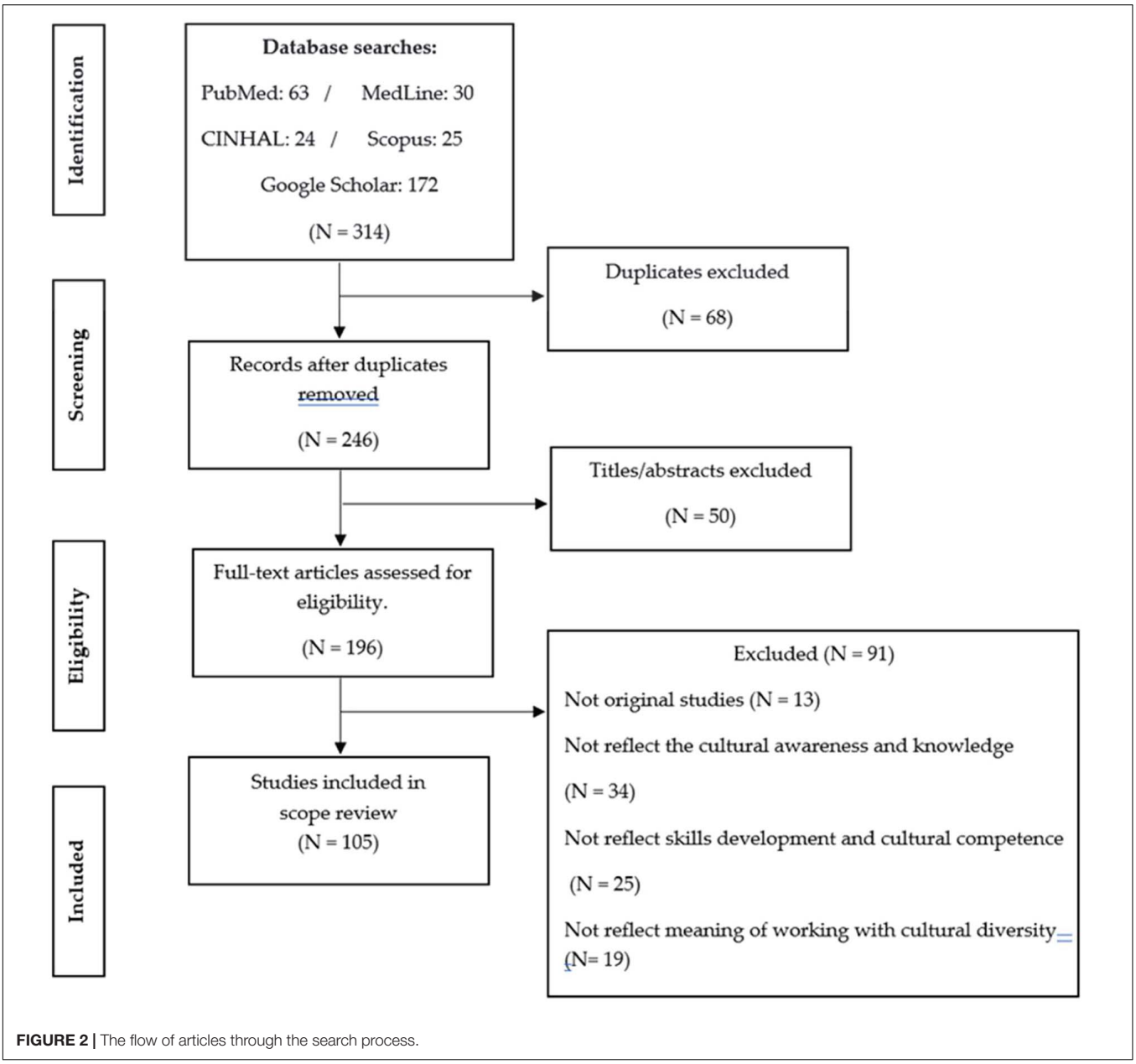

FIGURE 2 | The flow of articles through the search process.

processes has become a first-order need in the healthcare field (Maddalena, 2009). In this sense, cultural competence establishes an effective model to adapt the health services' offer to guarantee citizens quality health care, adapted to their needs. Therefore, *cultural competence* can be defined as the complex integration of knowledge, attitudes, and skills that increases communication between different cultures (cross-cultural communication) and permits appropriate/effective interactions with others (Clark et al., 2011). Now, cultural awareness results from deep exploration (self-examination) of one's own cultural and professional background, trying to manage the prejudices and stereotypes health care professionals could manifest toward people belonging to different cultures (Lenburg, 1995).

In North American contexts, to promote cultural competence, it has been developed specific teaching modules, such as the Culturally Competent Nursing Modules, proposed by the Office of Minority Health, and became a standard criterion of the Joint Commission for the accreditation of hospitals (White, 2006; Govere et al., 2016). Due to the increase of the immigrant population, with the consequent effects on the society, a similar module has been used in Spain, specifically in the city of Barcelona, in university training (Master), to promote the acquisition of cultural competence (Atxotegui, 2000). This reality has underlined the debate on intercultural processes and their influence on the Spanish health system (Sealey et al., 2006).

One of the strategies which could more than others promote cultural awareness is the experience to live the cultural difference.

A Finnish study shows a generally moderate level of cultural competence in nursing students, with statistically significant differences between those who participated in multicultural nursing courses and exchange programs and students who are part of a minority or interact with other cultures (Repo et al., 2017).

Even knowledge of languages other than the mother tongue, which presupposes exposure to cultural difference, is an element that positively influences cultural sensitivity (Meydanlioglu et al., 2015; Garneau, 2016).

Although a review of the literature does not confirm the effectiveness of teachings of Transcultural Nursing if used as the only strategy to combat racist attitudes (Allen, 2010), several articles report validity of it (Bentley and Ellison, 2007; Jeffreys and Dogan, 2012; Bohman and Borglin, 2014; Flood and Commendador, 2016). Some indications emerge presenting strategies to integrate learning about prejudice and racism into the curriculum of nursing studies (Gordon et al., 2016). For example, the use of filmography as a tool for educational reflection is suggested, and the presentation and use of the Model of Cultural Attention of Madeleine Leininger (Gebru and Willman, 2003; Lancellotti, 2008).

Reflection on the concepts of equity in the health context, starting from the social condition and the determinants of health, has been considered a vital teaching methodology (Sargent et al., 2005).

In order to promote cultural awareness, a group of students participated in a teaching-learning project. This study was developed in collaboration with health programs planned to promote community literacy for refugees. The students referred to the immersion in the immigrant community as a positive experience (Harkess and Kaddoura, 2016). Most of these studies were carried out in Latin America (Honduras, Costa Rica, México, Dominican Repúblic, and Guatemala). One of the projects was conducted online, and the classes ran for 2 and 3 weeks. Two of the courses focused on language teaching, another on language skills. A fourth course was based on providing a quantitative vision by applying various scales such as the Cultural Knowledge Scale, the Cultural Diversity Questionnaire for Nursing Educators, and the Nursing Cultural Competence Scale (Sullivan, 2009). The didactic experiences' evaluation shows students were culturally competent, and they achieved a greater awareness (Harkess and Kaddoura, 2016).

Using virtual contacts with different ethnic groups results in a good strategy for developing cultural awareness in care (Giddens et al., 2012). In general, stimulating a critical view of the concept of culture and cultural care is an important goal to develop empowerment, but it is often difficult to be achieved (Aponte, 2012).

An article suggests analyzing the students' difficulties before acquiring cultural awareness to help them manage their management (Purnell, 2005). Considering that culturally competent nursing is sensitive to cultural differences, the attention to those difficulties could be an element of care (Meleis and Trangenstein, 1994; Meleis, 2010).

Promoting awareness about stereotypes and prejudices in order to avoid value judgments about other people without really knowing them is an important issue to be taught (Meleis, 2010; Purnell and Fenkl, 2019). Likewise, students must develop forums on cultural diversity to promote sensitivity toward other cultures (Sanner et al., 2010).

The current social dynamics make nursing care a permanent challenge since the values, beliefs, and practices of individuals, family, and community must be considered, first showing respect for the difference (Ibarra Mendoza and González, 2006). This process is not simple, and it requires a high level of awareness to have cared.

Cultural Knowledge

Cultural knowledge for health care providers is fundamental to have specific skills and to provide culturally competent care. Knowledge of ethnic groups' characteristics is fundamental: prevalent diseases (considering prevalence and incidence), the biological difference (e.g., in the metabolism of drugs (Paul et al., 2014), beliefs, and values related to health. These elements increase the cultural knowledge and let focused on the client's point of view. To achieve the previously mentioned elements, the care providers must learn and use new cultural schemes (Brathwaite, 2003).

A scoping review highlights that nursing curricula introduced health-related issues and social inequalities to promote cultural awareness and competence in nursing students (Foronda et al., 2016; Guzmán-Rosas, 2016). A second review analyzes the commitment of university nursing departments to promote culturally competent care, considered imperative to promote the person's centrality in nursing care at the local, national, and global levels (Montenery et al., 2013). Several studies claim that cultural competence can be developed by combining theoretical teaching of multicultural education (Peek and Park, 2013), based on scientific evidence (Noble et al., 2014), with experiences in the field. The knowledge could be used in contact with immigrants, refugees, and even vulnerable group populations (Caffrey et al., 2005; Kardong-Edgren et al., 2005; Sealey et al., 2006; Bentley and Ellison, 2007; Kardong-Edgren, 2007; Lipson and Desantis, 2007; Upvall and Bost, 2007; Callen and Lee, 2009; dit Dariel, 2009; Allen, 2010; Axtell et al., 2010; Jeffreys and Dogan, 2012; Riner, 2013; Bohman and Borglin, 2014; Carr and Knutson, 2015; Lin et al., 2015; Meydanlioglu et al., 2015; Flood and Commendador, 2016; Garneau, 2016; Ahn, 2017).

The collaboration of health professionals with immigrant communities' spokespersons permit to define of some core elements of curricular studies, which could be subdivided into five areas: (1) self-awareness; (2) basic concepts (for example, culture and identity); (3) intercultural communication skills; (4) intercultural clinical skills; (5) promotion (Sullivan, 2009).

Two studies (a meta-analysis and a systematic review) intended to analyze the effectiveness of specific training projects to acquire cultural competence in nursing students. They declare that students training in cultural competence requires a broad explanation of procedures, practices, and potential problems, as well as a methodological rigor; the lack of agreement on a model which defines cultural competence is an obstacle to the development of the training itself (Truong et al., 2014; Gallagher and Polanin, 2015).

Let's analyze teaching strategies to promote cultural competence in higher nursing studies (bachelor/master). Some courses promote didactic case management activities (Gebru and Willman, 2010), using the Problem-Based Learning (PBL) methodology (Gradellini and Mecugni, 2015). The use of 3D simulations of healthcare settings is even considered (Roberts et al., 2014). Also, in some developing countries (Everson et al., 2015), the use of specific programs to develop intercultural communication skills is promoted (Northam et al., 2015).

A Community Participation Research project (CBPR), in which the community is involved, promotes new opportunities for knowledge and nursing-individual relationship. It shows an increase of immigrant patients' confidence in healthcare (Calvillo et al., 2009; Mathew et al., 2017).

The American Association of Nursing Colleges (AACN), as well as the European Federation of Nurses Associations (EFN), include the obligation to respect the biopsychosocial, cultural and spiritual integrity of people and to participate in the professional efforts to value life and quality of life, within their Code of Ethics. They have also made recommendations to promote elements of cultural competence (Calvillo et al., 2009). Even the United Nations Educational, Scientific and Cultural Organization (UNESCO) meeting in Paris dictated the necessary premises to include in the curriculum concerning cultural competence. In this sense, they identified five types of competencies: (1) the acquisition of knowledge about the social and cultural factors that influence care; (2) the use of evidence-based data to promote culturally competent care; (3) promoting safety and quality outcomes for people belonging to different ethnic groups; (4) the promotion of social justice, the health of vulnerable people and the elimination of health disparities; and (5) participation in the continuous development of competence, and cultural sensitivity (Morin, 1999; Calvillo et al., 2009; Sanner et al., 2010).

A combination of theoretical and practical activities is a suggested teaching strategy to promote cultural competence in undergraduate and graduate nursing students (Lipson and Desantis, 2007). Specific theoretical models related to culture and the acquisition of knowledge about the traditional medical practices used in the patient's country of origin are presented in theoretical class, as researches' results (Meleis, 2010; Purnell and Fenkl, 2019). The American Association of Colleges of Nursing (AACN) has developed an information package for educators (toolkit) that suggests culturally competent teaching strategies and care models (Morin, 1999; Calvillo et al., 2009; Sanner et al., 2010; Aponte, 2012).

The University of Pennsylvania has completed a process of change with the implementation of different activities developed through a working group made up of professors who are experts in cultural diversity. These are considered catalysts for change (Cuellar et al., 2008; Watts et al., 2008).

Cultural Skills

If we consider the cultural skills, ones related to the patient's assessment are considered fundamental. The Nursing Care Process (NCP) is a fundamental teaching in nursing studies theoretical and practical context, and the teacher must promote it. For what concerns its first stage, the nursing assessment, it is the neural center of the interview, that is why what to ask, when and how to do it, considering the specific of the professional cultural competence, should be taught with particular attention (Gallagher and Polanin, 2015). If we look at the patients' medical records, where clinical paths are reported, it emerges that the patients' perspectives and knowledge are conceived with the effectiveness of their care practices. This knowledge helps the nursing professional to plan the interventions that facilitate care, together with the individual. This approach enhances the patient's satisfaction in the care (Cenoz Iragui, 2004).

A three-year project, funded by the European Community through the Erasmus Program working on cultural competence, has been presented. It involved ten professors and twenty students from four nursing courses from Italy (Reggio Emilia), Belgium (Antwerp), Finland (Turku and Seinajoki), working in a language other than the mother tongue, for 10 days. The course's objectives were: (1) to experience being a stranger; (2) to work with students and teachers from other cultures; and (3) to reflect on what could influence intercultural care and which competencies should be acquired to care for patients in different phases life. All students participated actively in the concrete development of the program, in which experiential learning played a fundamental role. The evaluation of the project was carried out through the work of the students (content learning) and through two satisfaction questionnaires, which produced positive results (Gradellini et al., 2012).

A review of the most commonly used teaching strategies for cultural competence identifies clinical practice as the most effective element to develop awareness, knowledge, and security in students. It also advocates the development of standard cases and participation in projects that allow immersion in other cultures (Aponte, 2012).

An exciting project worked on cultural competence from a multidisciplinary perspective. Higher education students of the degree of nursing, educational sciences, and social work participated in a joint theoretical training about the process of Campinha-Bacote cultural competence. The practical didactic module was carried out using the Bennett Cultural Sensitivity Development Model. The project has been effective in developing personal awareness, acquiring knowledge about cultural differences, and ensuring culturally competent services (Campinha-Bacote, 2003). Other studies mention the Campinha-Bacote model of cultural competence as the most effective for developing specific competence in students (Campinha-Bacote, 2003; Aponte, 2012).

The Cultural Encounter

International mobility programs allow students to immerse themselves in other cultures, enhancing cultural competence and awareness (Bohman and Borglin, 2014; Hart et al., 2016; Marshall, 2017). This effectiveness has been demonstrated through elaboration focused on the students' experience, informative sessions, a briefing, and even through boarding diaries that reflect the experience (narrative approach) (Siles Gonzalez et al., 2016).

A revised study recognizes the efficacy of mobility using a phenomenological approach to Gadamerian hermeneutics, including open-mindedness, differences understanding, and

fusion of horizons. Within this hermeneutical vision, horizons are characterized by: (1) range of vision between one culture and another; (2) changes made to adapt to another culture; (3) development of cultural sensitivity; and (4) individual growth. It is still a complex process, focused both on the student's personal experience within an unknown context and a culture shock, without neglecting the decision-making that allows cultural adaptation. These are the actions to understand that sensitivity requires an openness to the multidimensional diversity of the new culture and demands an understanding of the value system as an element that influences the context of health and disease (Ruddock and Turner, 2007).

Even short periods of mobility (e.g., two weeks), accompanied by moments of guided reflection (tutor-learner), can increase: (1) cultural awareness; (2) a positive attitude toward the others; and (3) opportunity to compare differences and similarities (Bønløkke et al., 2018).

A descriptive study used reflective photography to evaluate the learning process of cultural competence. With this, the interaction of students immersed in a new cultural context during an international exchange program in Guatemala has been analyzed. The students were interviewed after reflecting on the images taken during the field activities. These portraits let to understand the experience (doing insight), in addition to generating awareness about a practice that has influenced cultural competence from a cognitive, affective, and practical point of view (Amerson and Livingston, 2014).

Cultural Desire

Campinha-Bacote describes the health care providers' cultural desire as motivation to engage in the process, creating cultural awareness, knowledge, skills, and encounter. Cultural humility also derives from this process, which refers to the will of the health professional to learn from the individual, family, and community the characteristics of their own culture (Campinha-Bacote, 2008, 2007, 2003, 2002).

Caring for individuals, families, or communities while respecting their own health culture implies formulating a culturally competent care plan. It means having the ability to consider the other's point of view and recognize the human being's subjectivity (Koskinen et al., 2009).

Regarding distance learning about cultural competence, some studies reviewed describe educational strategies that use Information and Communication Technologies (ICT). An issue that offers students from different cultures the opportunity to meet and develop the awareness, sensitivity, and respect necessary to provide culturally competent care (Upvall and Bost, 2007; Arbour et al., 2015). A semi-experimental study, applying distance training, carried out a pre-post evaluation applying the Assessing of Cultural Competence scale, and it demonstrated the effectiveness in terms of cultural diversity (Hunter and Krantz, 2010).

It should be taken into account that the use of a constructivist approach in the development of cultural competence shows that the knowledge of future nursing professionals is built from the lived experiences immersed in the culture of caring for people (Gebru and Willman, 2003; Hunter and Krantz, 2010). This approach could also be used to reduce inequalities in the health context, to promote social justice, and to promote critical reflection among nursing students after having developed practical activities (García et al., 2011; Montenery et al., 2013; Cantarino et al., 2015; Northam et al., 2015). Reflective conversations between teacher and student should be promoted to support students in giving means to what has been happened and felt to develop their own identity of care (Gradellini et al., 2012).

To analyze human responses in a context of cultural diversity, care professionals must alternate the activities programmed in the classroom with ones immersed in the care practice because such interventions implicitly carry desires, interests, motivations, expectations, and interpretations (Lipson and Desantis, 2007). Students feel comfortable and relaxing during the period in which this relationship develops is also the teacher's responsibility since they are in charge of providing the resources in the acquisition of cultural skills, cultural encounters, and cultural desires.

DISCUSSION

An immersion in the EHEA has led to structural and operational transformations of all current university education. This process has concluded in a teaching paradigm in which the student is the center of the entire educational process (Cantarino et al., 2015). It is articulated in four main axes: (1) convergence in the structure and duration of the degrees (bachelors and masters' degrees), to establish networks of European universities; (2) transferability, through the European Credit Transfer System (ECTS), adopted by all universities in the EHEA, to guarantee studies homogeneity and quality, as well as the academic and professional recognition of degrees throughout the European Union; (3) transferability of curriculum and professional qualification content and quality; and (4) mobility, to promotes competitiveness in the European labor market (Sánchez-Ojeda et al., 2018). Said axes suppose students and teachers cultural immersion at a national, European, and international level. This fact reinforces cultural diversity and even develops skills in acquiring general, transversal, and specific competencies throughout the students' training period. This cultural immersion will contribute to the full development of the students, facilitating the "learning to do" and the "learning to be," with a vision of the culture in which they are immersed (Backes et al., 2011; Gómez Cantarino et al., 2015).

These changes in higher education have generated modifications in the curricular plans of the Degree in Nursing. In them, work is being done to promote competence and cultural sensitivity through different teaching strategies (Bentley and Ellison, 2007; Jeffreys and Dogan, 2012; Bohman and Borglin, 2014; Flood and Commendador, 2016; Purnell and Fenkl, 2019). Some of these reforms are related to the development of cultural competence modules (Roberts et al., 2014; Everson et al., 2015; Gradellini and Mecugni, 2015); currently, specific postgraduate training in cultural diversity is being conducted promoted (Rozendo et al., 2017).

Thus, a specific university training is achieved and even with a specialized vision where fundamental concepts such as

culture, stereotype, prejudice, and determinants of health are worked on (Sanner et al., 2010; Clark et al., 2011). On the other hand, the most practical activities within the undergraduate and postgraduate nursing degrees propose carrying out activities within the same setting where the care will be developed. The resolution of cases in the classroom is also promoted, and even the confrontation with vulnerable populations (Caffrey et al., 2005; Kardong-Edgren et al., 2005; Sealey et al., 2006; Upvall and Bost, 2007; Callen and Lee, 2009; dit Dariel, 2009; Gradellini et al., 2012; Riner, 2013; Lin et al., 2015; Ahn, 2017). In this sense, studies have been reviewed that focus teaching effort on increasing the understanding of students, future health professionals, toward the cultural framework of the patient. Although, indeed, the translation that this fact has in clinical practice is not specified (Hsieh et al., 2016).

Even in the development of clinical care, most patients continue to be cared for by health professionals and students in training, who emphasize biological or biopsychological aspects, making minimal effort to expand toward an integral dimension that considers cultural awareness counts (Renzaho et al., 2013; Hsieh et al., 2016).

Regarding cultural knowledge, most articles present a limited number of educational activities that emphasize social justice, cultural competence, security, and cultural promotion (Renzaho et al., 2013). Precisely, it has been verified that the activities identified concerning the educational offer determine contributions aimed at reducing inequalities in health and strategies to sensitize vulnerable populations (Lane et al., 2017).

As a clinical experience, the participation of students in cultural immersion projects, together with the use of clinical cases, is determined as a successful strategy in the acquisition of cultural competence (Sanner et al., 2010). Specific skills that could be recommended to enhance cultural competence have been proven. To give an example, the two-week teaching modules (Culturally Competent Nursing Modules), proposed by the United States Office of Minority Health, have been used as a Joint Commission standard criteria for the accreditation of hospitals and primary care centers (Allen, 2010; Noble et al., 2014).

Along these lines, the Liaison Committee on Medical Education (United States) established new accredited standards in 2000. These required students and health professionals to know the perceptions and explanatory models of different cultures' people's health and disease, and how these could vary. The response of patients to various symptoms or diseases (Sealey et al., 2006). The UK General Medical Council has also included cultural competence as one of the primary skills students must develop throughout their medical training (Horvat et al., 2014; Cantarino et al., 2015).

Health professionals reinforce the knowledge of the individual's health culture and the traditional practices used by their patients, which appear essential to know all health-related practices. It has also been evaluated if these practices are oriented to promoting health, preventing the disease, or the cure. It is crucial that health professionals know and respect these practices to guarantee a confluence of traditional and conventional treatments (Siles González, 2005, 2004).

However, it is necessary to know if patients want a particular person (partner, family, friend, or relative) to be present during the care processes within cultural skills. Although it is true that the role that said person plays must be known. It has been proven that in the cases that act as translators of the native language, they can communicate errors in the transcription of health information (Kalischuk, 2014).

National, European, and international interuniversity mobility have an excellent learning impact since it encourages fieldwork in cultural contexts different from those learned (Peek and Park, 2013; Bohman and Borglin, 2014; Carr and Knutson, 2015). Although this situation indeed generates exponential learning of the new culture in future professionals, one must be cautious in believing that this situation conditions the knowledge of an entire community. Beliefs or practices held by a group cannot be generalized; within each group, there might be intra-group variation. A phenomenological study of Caucasian undergraduate nursing sciences teachers, who work on cultural differences, highlighted the need to ensure continuity in specific learning topics and promote relational exchange (Beach et al., 2005; Amerson and Livingston, 2014).

A point to consider is the personal attitude and sensitivity to specific issues of the target population of care due to personal experience (Guild et al., 2020). Following this line, it would be very positive to incorporate cross-cultural thinking into the nursing training curriculum, which induces awareness of humans (Garneau, 2016; Repo et al., 2017). The situation that leads to not reducing the human being to the lowest part of himself, on the contrary, the multiple aspects that each being brings in the person's condition will be discovered (Charles et al., 2014). However, it is true that graduate students, in general, show a higher disposition when it comes to acquiring knowledge about other cultures (Watts et al., 2008; Sanner et al., 2010; Gordon et al., 2016).

Even the acceptance and respect for cultural differences, the sensitivity to understand how these differences influence relationships with people, and the ability to offer strategies that improve cultural encounters, are essential requirements for cross-cultural care in nursing to be consolidated.

CONCLUSION

From this scoping review, the importance of defining a shared national, European and international curriculum in higher education on specific topics related to general, transversal, and specific competencies emerged clearly. Among these, the development of cultural competence stands out, and the need to define the actual effectiveness of educational strategies related to it.

Both the combination of different educational skills and the training of expert teachers should be considered critical points in the teaching of higher education in nursing. Many published experiences confirm the need to improve the acquisition of

cultural competence in nursing students as future promoters of the right to health.

The described educational's proposals underline common hindering factors for its development. The lack of knowledge about minority groups by health personnel is striking.

At the international level, the World Health Organization (WHO) recommends, since 1946, the highest level of health standards as a fundamental right of every human being. Therefore, equal treatment, access to health care, and respect for all people are a prerequisite for culturally competent care, where the person's integrity is guaranteed.

Nursing is a science that is based on care and respect for individual differences. Therefore, it is unquestionable that the progress of this care and respect for the individual, family, and community is the first requirement to achieve culturally competent care, essential to guarantee the integrity of the person.

AUTHOR CONTRIBUTIONS

CG and SG-C contributed to conception and design of the study. PD-I, B-MG, DM, and MIU-G performed the collection, organization, and analysis of data. CG and SG-C wrote the first draft of the manuscript and the sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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The WHO suggests that equal treatments, access to health care, and respect for all people are a prerequisite for culturally competent care. The acquisition of cultural competence in nursing students as future promoters of the right to health should be a must. There's a need to define a shared curriculum in higher education to teach cultural competence and sensitivity. The effectiveness evaluation of the related educational strategies is recommended. Critical points, requesting a specific attention are the combination of different educational skills and the training of expert teachers.

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A Multidimensional Study of Absorptive Capacity and Innovation Capacity and Their Impact on Business Performance

Rafael Sancho-Zamora[1], Santiago Gutiérrez-Broncano[2], Felipe Hernández-Perlines[3] and Isidro Peña-García[4]*

[1]Department of Business Administration, Faculty of Law and Social Science, University of Castilla-La Mancha, Ciudad Real, Spain, [2]Department of Business Administration, Faculty of Social Science, University of Castilla-La Mancha, Talavera de la Reina, Spain, [3]Department of Business Administration, Faculty of Law and Social Science, University of Castilla-La Mancha, Toledo, Spain, [4]Department of Business Administration, School of Computer Engineering, University of Castilla-La Mancha, Ciudad Real, Spain

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***Correspondence:**
Rafael Sancho-Zamora
rafael.sancho@uclm.es

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The aim of this paper is to understand how absorptive capacity and innovativeness influence business performance. Most previous studies have not considered the different dimensions of absorptive capacity and innovativeness. As a consequence, they have not analyzed the relationships between these dimensions, such as potential and realized absorptive capacity (RACAP) and product and process innovation. In our study, we analyzed the relationships between each of these dimensions and their effect on organizational performance. To achieve this, in addition to the theoretical foundation provided by the working hypotheses, a questionnaire was sent to 800 CEOs of Spanish companies in different sectors, obtaining a response rate of 38.25%. Structural equation modeling was applied to test the hypotheses. This study confirms the positive effect of absorptive capacity on innovation capacity, which in turn has a positive effect on business performance. Moreover, different dimensions of absorptive capacity and innovativeness play an important role in these relationships. This study contributes to a better understanding of how potential and RACAP influence the innovativeness of firms, both in their ability to innovate products and to improve business processes. In addition, it explores how these different innovations impact business performance and provide firms with knowledge on how to invest resources to increase profits. Future research should further study the inner workings of each of the dimensions analyzed to determine the importance of each dimension for business performance.

Keywords: absorptive capacity, innovation capacity, organizational performance, potential absorptive capacity, realized absorptive capacity, product innovation, process innovation

INTRODUCTION

In the knowledge economy era, innovation is a key source of competitive advantage (Daghfous, 2004; Prajogo and Ahmed, 2006). According to the knowledge-based vision, a firm's performance is based on its ability to generate, combine, recombine, and exploit knowledge (Grant, 1996). Thus understood, knowledge is essential to a firm's ability to innovate and compete, making

it a strategic resource (Wang, 2013; Ibarra-Cisneros et al., 2021). A firm's knowledge is usually produced through internal creation or external acquisition of information. Consequently, a firm's knowledge absorptive capacity (AC) is important for value creation within the firm (Xie et al., 2018).

Davenport and Prusak (1998) assert that knowledge cannot be fully transferred without the support of absorptive capacity. Similarly, Szulanski (1996) reveals that knowledge transfer in a firm will emerge as a major obstacle without the support of absorptive capacity, placing value on the importance of absorptive capacity in firms (Wuryaningrat, 2013).

Absorptive capacity has been defined as "the ability of a firm to recognize the value of new external information, assimilate it and apply it for business purposes" (Cohen and Levinthal, 1990, p. 128) and has become one of the most prevalent research areas in business management (Huang et al., 2015). Zahra and George (2002) state that absorptive capacity is a set of organizational routines required to identify and utilize knowledge, highlighting the importance of absorptive capacity in the knowledge management process (Chang et al., 2012; Sancho-Zamora et al., 2021).

Many studies support the notion of absorptive capacity directly or indirectly influencing innovation and company financial results (i.e., Fosfuri and Tribó, 2008; Chen et al., 2009; Tseng et al., 2011). Processes of absorption of external knowledge have become essential elements for innovation in companies, enabling them to better adapt to changes in the competitive environment (Camisón and Forés, 2010). For this reason, there are still abundant research opportunities in the areas of relational learning, absorptive capacity, and the achievement of competitive advantage (Chen et al., 2009).

Xie et al. (2018) argue that two important gaps limit in-depth theoretical and empirical developments in absorptive capacity management. First, several studies have considered various dimensions of absorptive capacity (e.g., Camisón and Forés, 2010), although this dimensional division of the construct and its role is ambiguous, both in theory and practice. However, few studies have focused on the relationships between the multiple dimensions of absorptive capacity and firms' innovation performance (e.g., Ahmed et al., 2020; Yaseen, 2020). Absorptive capacity is a tacit and complex construct, making it very difficult to measure. In this study, we adopt the two dimensions of Zahra and George (2002) to measure absorptive capacity, thus avoiding the use of a single index—such as R&D or R&D expenditure—to assess absorptive capacity (Liao and Wu, 2010).

Second, although several authors have suggested that each dimension of absorptive capacity plays distinct but complementary roles (Zahra and George, 2002; Najafi-Tavani et al., 2016; Flor et al., 2018), few studies have examined systematic theoretical and empirical testing of the internal mechanisms between the two dimensions of knowledge absorptive capacity.

In this paper, we mainly focus on bridging both gaps and analyzing the impact of different absorptive capacity dimensions on innovativeness. Furthermore, we differentiate between product innovation and process innovation, as suggested by some authors (Smith et al., 2005; Rush et al., 2007). We also study the effect of product innovation and process innovation on firm performance.

In order to test our hypotheses, empirical research was carried out on 315 Spanish companies, which served to validate our hypotheses and thus contribute to filling the existing gap in this field of research. Our research contributes to the existing literature by clarifying the role played by different dimensions of absorptive capacity in different types of innovation, and the effect of process and product innovation on business performance. Finally, alongside the conclusions, we present the limitations and business implications of this work. In addition, it presents different business implications, detailing the role that each of the dimensions of absorptive capacity plays in the development of innovations. The paper makes recommendations to facilitate the work of managers to focus their knowledge management if they intend to optimize innovations and achieve better economic results.

ABSORPTIVE CAPACITY AND INNOVATION

Firms are operating in a highly competitive environment and require high levels of knowledge, which has become one of their most valuable resources (Liao and Wu, 2010). In order to compete, firms cannot rely solely on their external knowledge network but also have to develop their absorptive capabilities to actively source knowledge (Matthyssens et al., 2005; Sancho-Zamora et al., 2021). This necessitates approaches and mechanisms that facilitate learning and thus enable them to disseminate and exploit the knowledge that will provide them with new organizational innovations (Daghfous, 2004). Moreover, the consolidation of this acquired knowledge is determined by the firm's absorptive capacity (Sun and Anderson, 2010).

Firms therefore need to have, and to develop, internal absorptive capacity to improve their innovation performance. This is important because this type of capacity can influence the effectiveness of innovation activities (Cockburn and Henderson, 1998).

Cohen and Levinthal (1990) were the first to define absorptive capacity as a firm's ability to evaluate new knowledge from outside, assimilate it, and apply it for commercial purposes (Wuryaningrat, 2013). It is a firm's ability to acquire and effectively use external and internal knowledge that will subsequently affect their innovation (Daghfous, 2004; Fichman, 2004).

This approach views absorptive capacity as a by-product not only of R&D activities, but also of the diversity or breadth of the organization's knowledge base, its prior learning experience, a shared language, the existence of cross-functional interfaces, and the mental models and problem-solving capacity of the organization's members (Camisón and Forés, 2010). In this way, absorptive capacity is a critical factor for companies to use external knowledge and thus stimulate internal innovation (Dutse, 2013).

Knowledge has become the most important resource for firms; having external knowledge about markets and technologies is considered essential for the generation of internal knowledge in R&D departments (Cassiman and Veugelers, 2006). Through

absorptive capacity, firms can transform external knowledge into innovation (Saebi and Foss, 2015). Initially, absorptive capacity starts with acquiring knowledge from the environment and it ends by exploiting it (Zahra and George, 2002; Jansen et al., 2006). This dynamic capacity allows firms to be in a better position to develop any kind of innovation (Andriopoulos and Lewis, 2009). Organizational learning theory suggests that a firm's innovation performance is the result of its knowledge base (Griliches, 1990; Dodgson, 1993).

Previous research, such as that conducted by Schmidt and Rammer (2006), found that firms with higher absorptive capacity were more likely to carry out product, process, organizational, or even marketing innovations. Likewise, Calero-Medina and Noyons (2008) mapped studies related to absorptive capacity and its link to various domains, finding a significant relationship between absorptive capacity and organizational innovation. More recent work, such as Chen and Chang (2012), found that the higher the degree of absorptive capacity of the firm, the higher the degree of organizational innovativeness. Jantunen (2005) in his systematized review of the literature found that most existing research in the innovation literature emphasizes the importance of the ability to utilize external knowledge. Furthermore, this interaction with new external knowledge promotes absorptive capacity (Liao and Wu, 2010).

Research by Liao et al. (2007) provided empirical evidence that innovation results from the need for knowledge sharing, triggered by its absorptive capacity. When absorptive capacity improves, it becomes much easier for someone to create a remarkable innovation based on acquired knowledge. Indarti (2010) also mentions that absorptive capacity can be seen as a process through which a particular firm creates innovative business purposes (Wuryaningrat, 2013).

Despite all the existing evidence linking absorptive capacity to innovation, this concept has continued to develop over time. The most far-reaching reconceptualization was proposed by Zahra and George (2002). These authors linked the construct to a set of organizational routines and strategic processes through which firms acquire, assimilate, transform, and apply knowledge in order to create a dynamic organizational capability (Camisón and Forés, 2010).

Dimensions of Absorptive Capacity

Zahra and George (2002) reformulated Cohen and Levinthal's (1989) original three-dimensional model and elaborated a new one with four dimensions, which are grouped into two components: potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP). Following these authors, we will consider absorptive capacity as a two-dimensional construct: While acquisition and assimilation represent the dimensions of PACAP, transformation and exploitation comprise the dimensions of RACAP (Müller et al., 2021).

Potential absorptive capacity focuses mainly on knowledge acquisition: on the one hand, the ability to value knowledge, as introduced by Cohen and Levinthal (1990) in relation to acquiring knowledge, and on the other hand, the ability to assimilate. Acquiring and using new information from the organization develops the breadth and depth of the firm's existing knowledge base (Hu, 2014). A study conducted on manufacturing firms in different sectors established that close links with suppliers have a positive effect since suppliers bring new working methods to organizations (Porter and Heppelmann, 2015). Furthermore, the acquisition of new knowledge has been shown to have a positive relationship on manufacturing efficiency (West and Bogers, 2014) and the development of new value offerings (Phene et al., 2012). On the other hand, assimilating external knowledge involves incorporating it into routines and procedures for analyzing, processing, interpreting, and understanding information obtained from outside the organization. Knowledge assimilation represents its integration within organizational structures (Gebauer et al., 2012). Furthermore, information systems have been found to increase the importance of absorptive capacity for the success of innovation strategies (Kranz et al., 2016).

Realized absorptive capacity consists of the transformation and application of knowledge (Camisón and Forés, 2010). Transformation is considered as the ability to combine old and entrenched knowledge with newly acquired knowledge. This process takes place by adding new knowledge while re-evaluating and modernizing the organization's old knowledge (Zahra and George, 2002). Considering the above, it can be deduced that by constructively combining old and new knowledge, original associations and links between different information flows emerge. This can lead to new perspectives on how to improve current activities or how to enter new markets in a differentiated way. While the former can lead to product innovation strategies, the latter can be considered market innovations or process innovations (Enkel et al., 2017). Finally, application refers to a firm's ability to apply new external knowledge commercially to achieve organizational goals (Lane and Lubatkin, 1998); it involves both market and technological knowledge (Kranz et al., 2016). Market knowledge provides firms with information on how to commercialize their knowledge, while technological knowledge provides insights on how to develop new manufacturing methods (Teece, 2010). Thus, the desired outcome of absorptive capacity is the application of new knowledge for commercial purposes (Gebauer et al., 2012).

Dimensions of Innovation Capacity

Innovation is a fundamental aspect of the research enterprise and is highly developed and present in all business processes (Chua et al., 1999; Alshanty and Emeagwali, 2019). However, the role of innovation as a key driver of business performance has changed in recent years due to globalization and increased international competition (Leal-Rodríguez and Albort-Morant, 2016; Pustovrh et al., 2017). We understand innovation as a firm's ability to exploit knowledge and thereby generate new products, services, and processes (McDowell et al., 2018). However, innovation always involves a certain amount of risk, which is why the results are not always satisfactory (Hernández-Perlines et al., 2020).

Different studies have shown that innovativeness enables firms to achieve results, such as: improving firm performance

(Jiménez-Jiménez and Sanz-Valle, 2011); increasing exports (Love and Roper, 2015); generating a competitive advantage (Coccia, 2017); and/or contributing to business growth (George et al., 2012). Overall, innovation helps firms respond to competitive challenges in globalized environments (Hausman and Johnston, 2014).

In this research, innovativeness is understood as an outcome of both potential and RACAP (Zahra and George, 2002; Winter, 2003). But it is a very complex ability in which new knowledge and ideas are continuously applied with the aim of achieving business performance through the incorporation of new offerings—product innovation—and the development of new procedures for making and distributing those offerings—process innovation (Smith et al., 2005; Rush et al., 2007), thus increasing or maintaining their effectiveness and competitiveness. Specifically, following Liao et al. (2007) and Damanpour and Gopalakrishnan (2001), we define two dimensions of innovativeness that include process innovation and product innovation. Process innovation focuses on improving the efficiency and internal workings of the firm's processes to manufacture, assemble, or deliver the product. In this way, a new process can reduce costs or generate more production capacity for the company. Product innovation, on the other hand, is where a company can bring better, differentiated, improved, or even new products to the market to meet customer needs. Product innovation focuses on the market and relies on strong capabilities, such as quality, efficiency, speed, and flexibility (Lawson and Samson, 2001), while process innovation belongs to the realm of technical innovation (Liao et al., 2007). Both types of innovation are very closely linked and constitute complex processes that usually involve all functional areas of the company (Fores and Camisón, 2011).

In view of the above, the relationship between absorptive capacity and innovation capacity is supported by the literature. Likewise, we find sufficient grounds to identify different dimensions for both absorptive capacity and business innovations. Therefore, we propose the following hypotheses:

H1: PACAP influences (+) product innovation (PROTINN).
H2: RACAP influences (+) product innovation (PROTINN).
H3: PACAP influences (+) process innovation (PROCINN).
H4: RACAP influences (+) process innovation (PROCINN).

According to Zahra and George (2002), both ACAP and RACAP play separate but complementary roles. Firms cannot apply external knowledge without first acquiring it. Similarly, some organizations can develop, acquire, and assimilate external knowledge but are sometimes unable to transform and apply this knowledge, i.e., to turn it into innovations and thus into competitive advantage. Therefore, both subsets of ACAP fulfill a necessary but not sufficient condition to generate value in the company through the innovations implemented (Camisón and Forés, 2010). Thus, we establish the following hypothesis:

H5: The PACAP influences (+) the RACAP.

INNOVATION AND PERFORMANCE

The generation and adoption of innovation enable firms to adapt to changes in the environment and to achieve their objectives. This is especially important in conditions of intense competition, where customers are better informed and demand increasingly higher-quality products and services (Jansen et al., 2006; Damanpour et al., 2009; Fernández and Peña, 2009). The development of an innovation strategy requires a combination of the firm's internal learning and absorptive capabilities (Fores and Camisón, 2011). There is a general consensus that innovation is a strong competitive advantage; numerous studies link innovation with improved business performance (Leal-Rodríguez and Albort-Morant, 2016).

Chen et al. (2009), in addition to finding a direct relationship between absorptive capacity and innovativeness, showed that improved innovativeness has a positive impact on business performance. Moreover, Camisón and Villar-López (2014) found from a sample of 144 Spanish firms that organizational innovation favors the development of technological innovation competences and that both can contribute to improved firm performance.

Exposito and Sanchis-Llopis (2018), using a large sample of Spanish SMEs, highlighted the positive impact of innovation on different performance indicators: increase in sales, cost reduction, increase in productive capacity, and cost improvement. Furthermore, they proposed analyzing the relationship between innovation and business performance from a multidimensional analytical approach, as different types of innovation have a different impact depending on the outcome indicator considered.

Based on the previous literature, and from the multidimensional approach recommended by Exposito and Sanchis-Llopis (2018), we formulate the following hypotheses:

H6: Product innovation (PROTINN) influences (+) business performance (PERF).
H7: Process innovation (PROCINN) influences (+) business performance (PERF).

METHODOLOGY

Data Collection

Data were obtained from a questionnaire mailed to 800 randomly selected small and medium-sized enterprises in the Spanish autonomous community of Castilla-La Mancha. Contacts for the questionnaire were obtained from the SABI database, and active enterprises belonging to different sectors of activity in both the industrial and service sectors were selected. A total of 315 questionnaires were obtained, of which nine were rejected as incomplete (see **Table 1**).

Table 2 shows the sectors and the activity of the participating companies.

TABLE 1 | Research technical data.

Sample size	**15,853 companies 800 randomly selected**
Unit of analysis	Company
Scope	Castilla-La Mancha (Spain)
Valid responses/Response rate	306/38.25%
Confidence level	95%
Error rate	5.55%
Informant	CEOs
Data	October–December 2019

TABLE 2 | Sector and activity of the analyzed companies.

Sectors (CNAE)	**Code**	**Activity**	**Number**	**Percentage**
62, 69, 70, 71, 73	1	Specialized consulting services	75	24.50%
41, 43	3	Construction	65	21.24%
55, 56, 46, 47, 68	2	Retail and accommodation services	96	31.37%
10, 11, 14, 18, 21, 23, 25, 26, 27, 28, 31	4	Manufacturing	70	22.87%

TABLE 3 | Measurement of variables.

Variables	**Manner of operationalization**	**Number of items**	**Authors**
Potential Absorptive Capacity (PACAP)	Second-order composite type A	7	Cohen and Levinthal (1990); Lane et al. (2006)
Realized Absorptive Capacity (RAPAC)	Second-order composite type A	7	Cohen and Levinthal (1990); Lane et al. (2006)
Product Innovation (PRODINN)	First-order composite type A	5	Prajogo and Sohal (2006)
Process Innovation (PROCINN)	First-order composite type A	4	Prajogo and Sohal (2006)
Performance (PERF)	First-order composite type A	4	Chirico et al. (2011); Kellermanns et al. (2012); Krauss et al. (2005); Naldi et al. (2007); Wiklund and Shepherd (2003)

The statistical power of the sample used in this study was 0.998 and was calculated using Cohen's (1992) retrospective test, which can be obtained with the program G * Power 3.1.9.2 (Faul et al., 2009). The value obtained allows us to affirm that the sample used in this study has adequate statistical power as it is above the threshold of 0.80 established by Cohen (1992).

Measurement of the Variables

All variables were measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Specifically, the following variables were used in this study (see **Table 3**):

a) Measurement of PACAP. PACAP was operationalized as a second-order composite type A, based on acquisition capacity (three items) and assimilation capacity (four items). The scales proposed by Cohen and Levinthal (1990) and Lane et al. (2006) were used for its measurement. This scale has been validated by Flatten et al. (2011) and Hernández-Perlines et al. (2016).
b) Measurement of RACAP. RACAP was operationalized as a second-order composite type A, based on transformation capacity (four items) and exploitation capacity (three items). The scales proposed by Cohen and Levinthal (1990) and Lane et al. (2006) were used for its measurement. This scale has been validated by Flatten et al. (2011) and Hernández-Perlines et al. (2016).
c) Measurement of product innovation. Product innovation was operationalized as a first-order composite type A, with five items from the scale proposed by Prajogo and Sohal (2006). This scale has been validated in previous studies, such as Hernández-Perlines et al. (2019).
d) Measurement of process innovation. Product innovation was operationalized as a first-order composite type A, with four items from the scale proposed by Prajogo and Sohal (2006). This scale has been validated in previous studies, such as Hernández-Perlines et al. (2019).
e) Performance measurement. To measure performance, we have used an overall measure of firm performance that assesses the perception of firm performance relative to its competitors (Olson et al., 2005). The use of perception or satisfaction measures as determinants of firm performance is increasingly common in research (Manzano-García and Ayala-Calvo, 2020). Performance was operationalized as a first-order composite type A. The four items used in this research were as: sales growth, profit growth, market share growth, and return on equity growth. All of them have been extracted from a combination of the scales proposed by Chirico et al. (2011); Kellermanns et al. (2012); Krauss et al. (2005); Naldi et al. (2007); and Wiklund and Shepherd (2003). This scale has been validated by Hernández-Perlines et al. (2021).
f) Control variables. In this research, size (number of employees) and seniority (number of years since incorporation), as proposed by Chrisman et al. (2005) and validated by Ibarra-Cisneros and Hernández-Perlines (2020), were used as control variables. All control variables were operationalized as first-order composites type A.

RESULTS

To analyze the results and test both the direct and moderating hypotheses proposed in this paper, the multivariate partial least squares (PLS) quantitative structural equation technique was employed.

The choice of this method of data analysis is justified for the following reasons:

a) It is an appropriate method of analysis when research is in the early stages of developing new theoretical constructs (Gefen et al., 2011; Ringle et al., 2015).
b) It is a method of analysis characterized by its predictive nature, which makes it possible to address the research questions posed (Hair et al., 2014; Sarstedt et al., 2014).
c) Through this method of analysis, it is possible to observe the different causal relationships between the variables analyzed (Jöreskog and Wold, 1982; Astrachan and Jaskiewicz, 2008).
d) It is a suitable method of data analysis when the sample is not very large (Reinartz et al., 2009; Henseler et al., 2015).
e) It is a method that allows the analysis of complex model relationships (Hair et al., 2019).

The software used for data analysis using SEM-PLS was SmartPLS v.3.3.3 (Ringle et al., 2015).

To analyze the results, the recommendations of Barclay et al. (1995) and Hair et al. (2017) were followed, which advise first evaluating the measurement model and then evaluating the structural model.

To follow the evaluation process of both the measurement and structural models, the variables were modeled following the method described by Sarstedt et al. (2016) in order to analyze them with PLS:

a) The PACAP was operationalized as a second-order compound type A.
b) Realized absorptive capacity was operationalized as a second-order compound type A.
c) Product innovation was operationalized as a first-order composite type A.
d) Process innovation was operationalized as a first-order composite type A.
e) Performance was operationalized as a first-order composite type A.
f) The three control variables (age, sector, and size) were operationalized as a first-order composite type A.

To evaluate the measurement model, the variables were checked for reliability and adequate levels of convergent and discriminant validity, following the recommendations of Roldán and Sánchez-Franco (2012). For this purpose, the following indicators were used (Barclay et al., 1995; Roldán and Sánchez-Franco, 2012; Hair et al., 2017):

a) Composite reliability should have values above 0.7 according to Fornell and Larcker (1981), with appropriate values being those between 0.7 and 0.9 (Hair et al., 2018). All model indicators have acceptable composite reliability values (see **Table 4**). Furthermore, the composite reliability does not present redundancy problems because no value is higher than 0.95 (Drolet and Morrison, 2001; Diamantopoulos et al., 2012).
b) Cronbach's Alpha values above 0.7 (Fornell and Larcker, 1981). In our case, Cronbach's Alpha is higher than this value for all variables (see **Table 4**).
c) The Rho a must be greater than 0.7 (Dijkstra and Henseler, 2015) and must lie between the values of composite reliability and Cronbach's Alpha (Hair et al., 2018). This condition is met for the different variables (see **Table 4**).
d) Average variance extracted (AVE) can be used to assess the convergent validity of each composite. Fornell and Larcker (1981) recommend a value higher than 0.5 for the AVE. This condition is valid for our data (see **Table 4**).
e) Heterotrait-Monotrait ratio (HTMT) allows us to measure discriminant validity. It is necessary to check that the correlation between each pair of constructs is not greater than the square root value of the AVE of each construct. For discriminant validity to hold, HTMT values must be less than 0.85 (Henseler et al., 2015). Discriminant validity is confirmed when the indicated values are met (see **Table 4**).

To complete the verification of discriminant validity, we also computed the HTMT inference from the bootstrapping option (5,000 subsamples). When the resulting interval contains values less than 1, discriminant validity exists, and our data meet this requirement (see **Table 5**).

Having confirmed the convergent and discriminant validity of the measurement model, we proceeded to check the relationships between the different variables in order to carry out a structural model analysis. The analysis of the structural model will be discussed according to the relationships proposed in the research model (see **Table 6** and **Figure 1**).

- First of all, the model suggests a positive and significant relationship between PACAP and product innovation (path coefficient = 0.297; *t*-value = 3.895). This influence is positive, as the path coefficient is positive and higher than 0.1. These results confirm the first hypothesis.
- Second, the model suggests a positive and significant relationship between RACAP and product innovation (path coefficient = 0.556; *t*-value = 5.571). These results confirm the second hypothesis.
- Third, the model suggests a positive and significant relationship between PACAP and process innovation (path coefficient = 0.318; *t*-value = 3.787). These results confirm the third hypothesis.
- Fourth, the model suggests a positive and significant relationship between RACAP and process innovation thesized. (path coefficient = 0.332; *t*-value = 2.188). These results confirm the fourth hypothesis.
- Fifth, the model suggests a positive and significant relationship between the PACAP and the RACAP (path coefficient = 0.864; *t*-value = 42.485). These results confirm the fifth hypothesis.
- Sixth, the model suggests a positive and significant relationship between product innovation and performance (path coefficient = 0.464; *t*-value = 5.384). These results confirm the sixth hypothesis.
- Seventh, finally, the model suggests a positive and significant relationship between process innovation and performance (path coefficient = 0.350; *t*-value = 6.744). These results confirm the seventh hypothesis.

TABLE 4 | Correlation matrix, composite reliability, convergent and discriminant validity, Heterotrait-Monotrait ratio (HTMT), and descriptive statistics.

Construct	AVE	Composite reliability	PACAP	RACAP	PROTINN	PROCINN	PERF
1. PACAP	0.893	0.943	0.944*				
2. RACAP	0.900	0.947	0.764	0.948*			
3. Product innovation (PROTINN)	0.618	0.889	0.677	0.726	0.786*		
4. Process innovation (PROCINN)	0.652	0.881	0.605	0.607	0.767	0.807*	
5. Performance (PERF)	0.722	0.912	0.273	0.177	0.206	168	0.846*
Heterotrait-Monotrait rate (HTMT)							
1. PACAP							
2. RACAP			0.584				
3. Product innovation (PROTINN)			0.760	0.812			
4. Process innovation (PROCINN)			0.694	0.703	0.653		
5. Performance (PERF)			0.0.264	0.192	0.171	0.187	
Cronbach's Alpha			0.880	0.888	0.846	0.821	0.875
Rho A			0.888	0.890	0.871	0.856	0.900
Mean			4.09	4.35	4.02	4.38	3.96
SD			1.12	1.31	1.19	0.98	0.99

**The values of the diagonal were obtained from the square root of the AVE of each compound.*
The mean and standard deviation values of each of the second-order composites were calculated from the mean values of the different first-order composites of which they are composed.

TABLE 5 | HTMT inference.

	Original sample (O)	Sample mean (*M*)	5.0%	95.0%	Sample mean (*M*)	Bias	5.0%	95.0%
PACAP- > RACAP	0.864	0.863	0.827	0.893	0.863	0.001	0.824	0.891
PACAP- > PROTINN	0.197	0.203	0.031	0.372	0.203	0.007	0.020	0.359
RACAP- > PROTINN	0.556	0.551	0.383	0.710	0.551	−0.005	0.389	0.714
PACAP- > PROCINN	0.197	0.203	0.031	0.372	0.203	0.006	0.02	0.359
PACAP- > PROCINN	0.318	0.321	0.079	0.553	0.321	0.003	0.068	0.545
PROTINN- > PERF	0.064	0.072	−0.194	0.350	0.072	0.008	−0.202	0.342
PROCINN- > PERF	0.150	0.152	−0.215	0.451	0.152	0.002	−0.281	0.411

TABLE 6 | Structural model.

Relations	*ß*	*t*-value	Hypothesis
PACAP > PROTINN	0.297	3.895	*H1: Supported*
RACAP > PROTINN	0.556	5.571	*H2: Supported*
PACAP > PROCINN	0.318	3.787	*H3: Supported*
RACAP > PROCINN	0.332	2.188	*H4: Supported*
PACAP > RACAP	0.894	42.485	*H5: Supported*
PROTINN > PERF	0.464	5.384	*H6: Supported*
PROCINN > PERF	0.350	6.744	*H7: Supported*

It is also important to check the percentage explanation of the variance of the dependent variables. In this sense, the model proposed is capable of explaining 74.6% of the variance of RACAP from the PACAP (see **Table 7** and **Figure 1**). The variance of product innovation is explained by the PACAP and RACAP, accounting for 53.7% of the variance (see **Table 7** and **Figure 1**). The variance of process innovation is explained by PACAP and RACAP to the extent of 39.5% (see **Table 7** and **Figure 1**). Finally, performance is explained by product innovation and process innovation, so that both types of innovation explain 26.2% of the variance of performance (see **Table 7** and **Figure 1**). If we look at the different paths and the path coefficients, we can define the most appropriate route to improve performance based on absorptive capacity and innovation. As shown in **Figure 1**, the PACAP is an antecedent of the RACAP ($B = 0.894$). RACAP is an antecedent of product innovation ($B = 0.556$) and product innovation is an antecedent of performance (0.464). Therefore, the best way to achieve performance is through PACAP, RACAP, and product innovation.

None of the control variables have an influence that can be considered relevant (path coefficients are less than 0.2), and they are not significant (their value is less than the recommended value, $p < 0.001$; see **Table 8**).

To complete the analysis of the structural model, the goodness of fit of the model was calculated through the standardized root mean square residual (SRMR) proposed by Hu and Bentler (1998) and Henseler et al. (2015). The SRMR value is 0.069 (lower than the value of 0.08 recommended by Henseler et al., 2015) as adequate.

DISCUSSION

Drawing on the most recent literature on dynamic capabilities, this study conducted an empirical analysis to demonstrate the impact of different dimensions of absorptive capacity on different types of innovation (H1–H4), product innovation, and process

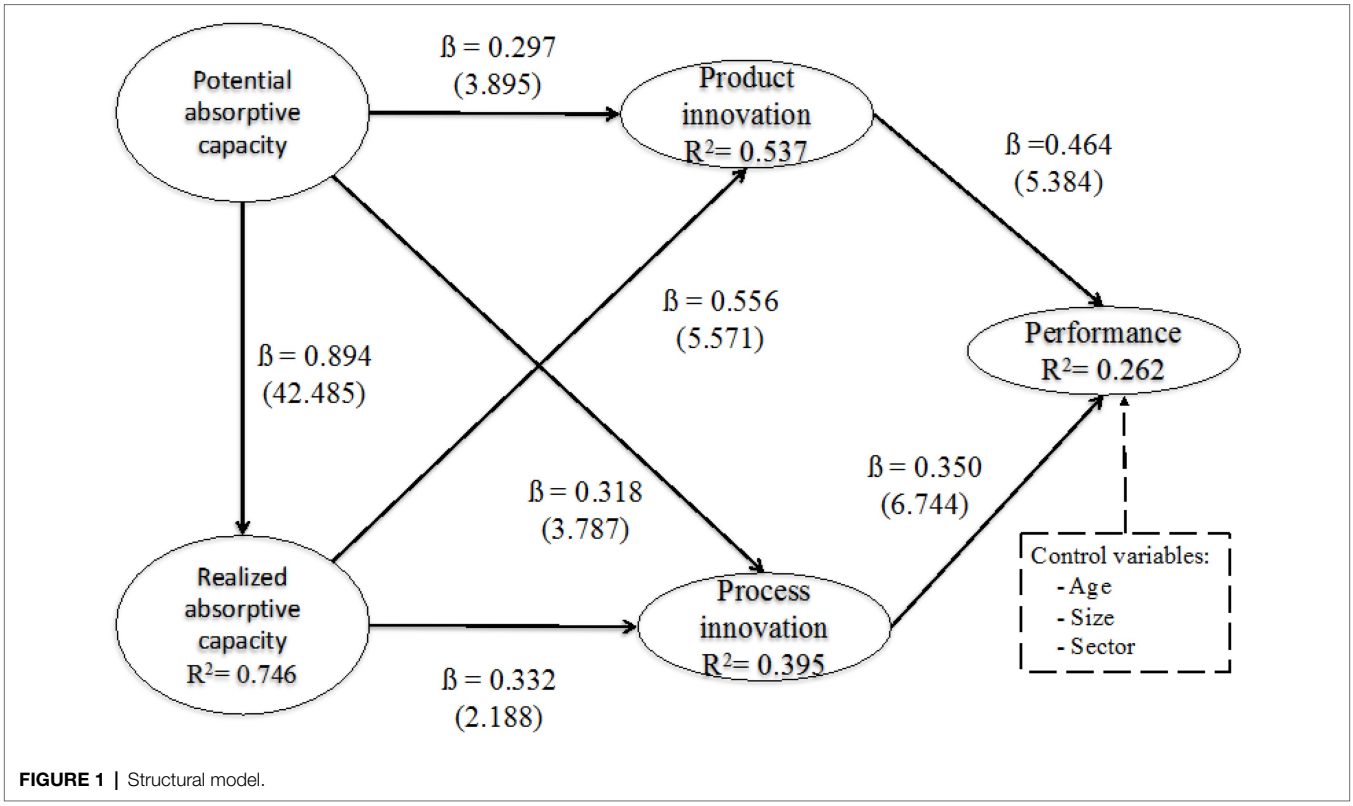

FIGURE 1 | Structural model.

TABLE 7 | Explanation of variance.

Variable	R^2
RACAP	74.6
Product Innovation	53.7
Process Innovation	39.5
Performance	26.2

TABLE 8 | Control variables.

Variable	*ß*	*t*-valor
Age	−0.097	0.982
Sector	−0.089	0.679
Size	0.071	0.551

innovation, as suggested by some authors (Smith et al., 2005; Rush et al., 2007). Only a few studies have focused on the relationships between the multiple dimensions of absorptive capacity, innovativeness, and business performance.

Second, we tested the positive impact of the different types of innovation proposed on business performance (H6 and H7). The results obtained are consistent with previous theoretical and empirical literature relating ACAP (Limaj et al., 2016) and innovation to business performance (Fernández and Peña, 2009).

Furthermore, a positive and significant relationship was found between PACAP and RACAP (H5). This research addresses a gap in the literature regarding the direct and positive relationship between PACAP, RACAP, and firms' innovation, in line with Yaseen's (2020) proposal. Potential and RACAP represent different but complementary roles, because knowledge cannot be transformed and exploited if it has not been previously acquired and assimilated. This suggests that acquiring absorptive capacity is a sequential process that allows outside knowledge to be absorbed, recognizing its value, and proceeding to understand and combine it with internal knowledge in order to subsequently generate new knowledge. These results are in line with the proposal of Zahra and George (2002), since PACP allows competitive advantage in innovation to be achieved but will be superior when firms develop their capacity to transform and exploit external knowledge (RACAP).

For companies committed to the acquisition and assimilation of external knowledge, and the development and refinement of routines that facilitate combining existing and newly acquired knowledge, better product and process innovation results are achieved, which has an impact on business performance. In this way, we can affirm that companies with greater absorptive capacity make much better use of all the information captured from external sources and improve their results. In rapidly changing environments, this is essential for the improvement of their processes and products to improve their competitive position. The theoretical literature on ACAP postulates that greater investment in knowledge creation increases absorptive capacity, which ultimately helps firms to achieve higher innovative and financial performance.

This paper contributes to the literature on absorptive capacity and innovation management and provides several insights for practitioners, highlighting the importance of transforming and

exploiting acquired knowledge to improve innovation capacity and overall business performance. Competitiveness requires an organizational culture that fosters knowledge acquisition and learning. Thus, companies must focus on retaining and recruiting employees with prior knowledge related to experience to take advantage of the knowledge generated. From our point of view, skilled personnel are at the core of absorptive capacity since they are the ones who can value, assimilate, transform, and exploit knowledge and produce innovation. Since knowledge resides in the people that make up a company, organizational absorptive capacity is more than the sum of individual capacities; therefore, companies must create communication structures and internal information flows to favor the innovation process. As a way of accessing external knowledge, companies should build cooperation networks with other companies that favor innovation and encourage the geographical and organizational mobility of qualified personnel.

The results of this study should be viewed and interpreted with some caution due to several limitations. One of the limitations of the study relates to the use of cross-sectional data, which does not enable exact causal relationships to be established. Second, respondents provided us with information on absorptive and innovation capacity and business performance. In this situation, there is a tendency for respondents to more positively rate those variables over which they have a more direct influence, and in some cases, they may not have exact knowledge about certain performance indicators. In this paper, we have seen how PACAP influences RACAP, thus supporting Zahra and George's (2002) proposal that the two dimensions are considered distinct but complementary. However, these dimensions can also act separately, as established through a systematic theory, and therefore, we recommend a stronger analysis of the inner workings between the different dimensions of absorptive capacity. Future lines of research should be aimed at overcoming the aforementioned limitations and broadening the scope of the study as a consequence of the findings obtained in this research, in terms of other possible contingencies that condition the relationships set out in the paper.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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High-Performance Work System, Strategic Flexibility, and Organizational Performance—The Moderating Role of Social Networks

Yizhi Wang[1], Yi Cao[2], Nan Xi[3] and Huitian Chen[4]*

[1] The Institute of Public Administration and Human Resources, Development Research Center of the State Council, Beijing, China, [2] School of Psychological and Cognitive Sciences, Peking University, Beijing, China, [3] School of Labor Economics, Capital University of Economics and Business, Beijing, China, [4] Middlebury College, Middlebury, VT, United States

Based on the dynamic capability theory, this research investigated the effect of a high-performance work system on organizational performance, the mediating role of strategic flexibility, and the moderating role of an enterprise's social network in this relationship. A total of 214 middle and senior managers from 58 Chinese enterprises were invited to participate in this research. The results showed that the high-performance work system is positively correlated with organizational performance and such correlation is partially mediated by strategic flexibility. Results found that the social network of an enterprise negatively moderated the relationship between a high-performance work system and strategic flexibility. However, the social network did not moderate the mediating role of strategic flexibility in high-performance work systems (HPWS) and organizational performance.

Keywords: dynamic capability theory, high-performance work system, organizational performance, strategic flexibility, social network

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***Correspondence:**
Yi Cao
cycaoyi@pku.edu.cn

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INTRODUCTION

Enterprises are facing increasing uncertainties of the environment and market as a result of dynamic competition in recent years. At the same time, strategic flexibility has become a major approach in allowing enterprises to maintain competitive advantages in varied situations (Cao et al., 2018). Although many researchers have demonstrated the positive relationship between strategic flexibility and organizational competitive advantages or organizational performance (Han and Gao, 2017; Lin et al., 2017), the antecedent variables of strategic flexibility, especially its relationship with High-performance Work Systems (HPWS) is rarely explored. Accordingly, whether HPWS can improve organizational performance through strategic flexibility remains controversial. HPWS refers to a series of different but interrelated human resource practices implemented by enterprises, which aim to improve individual and organizational performance by improving employees' abilities, attitudes, and motivations (Takeuchi et al., 2009; Miao et al., 2013).

Previously, a large body of research had found that HPWS are positively related to organizational performance, including decreasing employee turnover rate (Arthur, 1994; Guthrie, 2001), increasing employee satisfaction (Wright and Snell, 1991), labor productivity, and business

performance (Huselid, 1995). However, some research in recent years has also challenged these conclusions because of environmental uncertainty. For example, Shin and Konrad (2017) found that there is a reverse causal relationship between HPWS and organizational performance. Researchers in the field of institutional theory pointed out that with the people-oriented concept deeply rooted in the mind of employees, the labor union may hinder the positive relationship between HPWS and organizational performance (Jackson et al., 2014). Accordingly, Wright et al. (2005) and Guest et al. (2013) also suggested that the positive relationship between HPWS and organizational performance will disappear after controlling the influence of past performance. We proposed that the contradictory conclusions mentioned above may be caused by: (1) the fact that previous research has not fully considered the impact of the dynamic environment when exploring the mechanism of HPWS on organizational performance (Batt, 2002; Jiang et al., 2013; Miao et al., 2013); and (2) the impact of boundary conditions between HPWS and outcome variables has not been fully considered.

Based on dynamic capability theory (Teece et al., 2015), strategic flexibility can help enterprises prepare to adapt to changes in the environment (Sanchez, 1995, 1997). Xing et al. (2015) have suggested that enterprises can implement HPWS in an uncertain environment to allocate human resources rationally, which could further improve strategic adjustment and contribute to organizational performance. Recently, strategic flexibility has been increasingly used to explain the relationship between the top management team and performance in the dynamic environment (Wang, 2015; Li et al., 2016). On the contrary, the perspective of strategic human resource management rarely considered strategic flexibility as an organizational capability. The dynamic capability theory indicates that strategic flexibility, an organizational capability in a dynamic environment (Han and Gao, 2017), involves the ability to adapt to environmental changes or actively change the environment (Nadkarni and Herrmann, 2010). This ability is the core competitive advantage of an enterprise. Accordingly, HPWS are considered to be the key approaches to improving the organizational capabilities of enterprises. In a dynamic environment, HPWS can enable enterprises to respond to changes in the external environment by improving strategic flexibility and further improving organizational performance. Unfortunately, there has been research on the relationship between different HPWS, strategic flexibility, and organizational performance.

The implementation effect of HPWS is not universal (Liang and Cui, 2012) and can be affected by other factors in society (Miao et al., 2013), especially in the "Guanxi"(a word for describing general relationship) society in China. The idea that "Guanxi is productivity" or that "Guanxi is a resource" can be applied to not only individuals but also enterprises. Thus, the present research put the social network into the model from the perspective of sociology. The social network of an enterprise refers to a set of stable resources and interaction norms formed by relationships and interactions between enterprises. The broader the social networks of the enterprise, the higher resource richness, and network embeddedness. Such richness and embeddedness can bring better strategic adjustment ability and be able to find higher potential market opportunities (Casciaro et al., 2015). However, such resources and advantages do not stem from management capabilities but depend more on their inherent position in social networks (Ren and Rui, 2014). Conversely, for enterprises with a limited social network, their resources and network embeddedness will also be low. In other words, for such enterprises, their ability to find potential market opportunities and make strategic adjustments needs to rely on its own management capabilities (human resource management system). Therefore, enterprises with rich social network resources will rely less on their HPWS to obtain strategic flexibility. In conclusion, the capability of social networks and the capability of human resource management may conflict with each other in improving strategic flexibility. Thus, social networks may moderate the relationship between HPWS and strategic flexibility.

In summary, this research examined the role of strategic flexibility between HPWS, organizational performance, and the moderating role of social networks in this model from the perspective of sociology, the result of this research may give a theoretical reference for the management of enterprises.

THEORETICAL BACKGROUND AND HYPOTHESES

High-Performance Work System

The research on HPWS is based on the idea that a human resource management system is positively related to the improvement of organizational performance. Although the specific practices that should be included in HPWS are still controversial, such an expectation is supported by other researchers (Miao et al., 2013; Jackson et al., 2014). Huselid et al. (1997) pointed out that HPWS refers to "designing and implementing a series of internally coordinated human resource policies and practices to ensure the improvement of human capital (employees' knowledge, skills, and abilities) to ultimately achieve the business goals." Miao et al. (2016) also claimed that the practices of HPWS should be complementary and synergistic. Additionally, compared with single human resource practices, the bundle of human resource practices is more effective.

The differences between China and other countries in terms of social and economic development mean there are differences in the choice of HPWS. Countries in Europe and the US, have generally adapted commitment-oriented HPWS. However, an inconsistent transition from industrialization to scientific management has meant that Chinese enterprises place more emphasis on the combination of "commitment-oriented" and "control-oriented" HPWS (Miao et al., 2013). It should also be noted that, with the overall improvement of the quality of Chinese employees, the proportion of control-oriented human resource practices in HPWS has gradually decreased. Accordingly, in this research HPWS is based on commitment-oriented human resource practices, supplemented by control-oriented human resource practices. The commitment-oriented human resource practices are composed of recruitment, training, employee participation, internal market,

information sharing, and salary management. The control-oriented human resource practices are composed of assessment and discipline management.

High-Performance Work System and Organizational Performance

The relationship between HPWS and organizational performance has always been an important topic in research on strategic human resource management. Theories supporting the relationship between the two tend to focus on resource-based views (Barney, 1991), behavioral perspectives (Jackson et al., 2010), human capital theory (Becker, 1964), AMO theory (Appelbaum, 2000), social exchange theory (Blau, 1964), and institutional theory (Meyer and Rowan, 1977), with the resource-based theory the most used. The resource-based view claims that the resources that help enterprises maintain competitive advantages are the most heterogeneous ones, especially those valuable and scarce (Jackson et al., 2014; Saridakis et al., 2017), such as dedicated human resources. The enterprises that invest in those resources through the implementation of HPWS will improve the knowledge, skills, and abilities of employees. Such improvement can ultimately improve organizational performance (Ployhart and Moliterno, 2011). Moreover, in the dynamic environment, dynamic capability theory can be a good supplement to the resource-based view (Lin and Zhao, 2013). It contributes to a better explanation of the relationship between HPWS and organizational performance. Dynamic capability theory emphasized that enterprises need to have the ability to integrate, construct, and reconfigure internal and external resources quickly to adapt to a rapidly changing environment (Teece et al., 2015). This theory assumed enterprises with higher dynamic capabilities have more competitive advantages under the dynamic environment. We propose that HPWS can improve the effectiveness of enterprises in a dynamic environment. For example, team building, and flexible authorization have the function of reconfiguring and constructing internal and external resources. Policies such as encouraging information sharing are more conducive to the effective development and implementation of new opportunities by enterprises (Cao et al., 2018). The disciplines of the enterprise need to be followed strictly when facing key events so that business opportunities will not be missed. At the same time, incentives such as salary management can improve employees' motivation and enable them to adapt to environmental changes more proactively. Therefore, HPWS can help enterprises to create, expand, and adjust their human resources strategically, which ultimately affects organizational performance.

Hypothesis 1: HPWS is positively related to organizational performance

High-Performance Work System and Strategic Flexibility

Research on strategic flexibility stems from technological progress, intensified global market competition, the rise of learning organizations, and the emergence of new business models. Accordingly, to cope with environmental uncertainty, technological development, and market changes, enterprises need to improve their strategic flexibility. The concept of strategic flexibility was proposed by Sanchez (1995, 1997) and divided into resource flexibility and coordination flexibility. Previous research had pointed out that in a dynamic competitive environment, the resources of enterprises can easily become rigid and unable to adapt to the environment. Such changes may lead to the ultimate loss of inherent value especially for intellectual capital that is updating fast (Ketkar and Sett, 2009). The available value will be reduced greatly if not updated. Accordingly, enterprises need to continuously increase the flexibility of this type of resource for responding to changes (Barney, 1991). In addition, enterprises also need to have the ability to allocate resources reasonably and flexibly, especially for problems like poor process communication and opaque information sharing in the management process. Besides, coordination flexibility is also critical for enterprises to maintain competitive advantages. Based on the research of Evans (1991) and Sanchez (1995, 1997), present research defines strategic flexibility as "in response to the dramatic changes in the dynamic environment, enterprises use flexible and effective management to identify markets, adjust strategies, allocate resources, and obtain competition advantages." Strategic flexibility can enable enterprises to obtain competitive advantages in the dynamic competitive environment, which motivates us to explore how enterprises obtain strategic flexibility (Martín et al., 2008). From the perspective of human resource management, scholars in the field of strategic human resource management have suggested that HPWS are an effective way of improving strategic flexibility (Sparrow, 1998).

Previously, researchers have explored the impact of HPWS on strategic flexibility from the perspective of management practices based on dynamic capability theory (Wright and Snell, 1998; Evans and Davis, 2005). For example, the practices of extensive training, internal market, and recruitment in HPWS can improve the learning atmosphere of employees and enable the enterprise to train employees to learn skills needed in the future (Martín et al., 2008). Thus, the enterprises' ability to discover market opportunities will also be improved (Pavlou and El Sawy, 2011). Human resource practices such as rotation exchanges and career development can help employees expand their horizons, improve self-awareness, and determine what knowledge and abilities need to be improved and rebuilt, help them to respond to changes in the complex environment (Parker and Axtell, 2001). These practices can essentially increase the stock of employees' intellectual capital, hence improving resource flexibility. In addition, the core of flexible authorization is to reintegrate the internal processes and architecture of the enterprise. Such reintegration can remove the information communication barriers brought by the previous bureaucracy, and "allow employees who can hear the gunfire to make decisions." By doing so, the enterprise can make better decisions and quickly respond to changes in the external environment (Cao et al., 2018). Moreover, the internal information sharing mechanism implemented by the enterprise can promote the large-scale flow of information and resources within the enterprise, which can help the enterprise to identify external markets and opportunities continuously and

quickly (Evans and Davis, 2005; Pavlou and El Sawy, 2006). These practices enhance coordination flexibility.

Hypothesis 2: HPWS is positively related to strategic flexibility

Strategic Flexibility and Organizational Performance

Enterprises with higher strategic flexibility are more capable of responding to changes and challenges brought by uncertain environments in the dynamic competition (Cao et al., 2018) and improving organizational performance. Specifically, enterprise with resource flexibility can rely on its rich intellectual capital to make more strategic choices. As the old saying goes "Knowledge is power," which means the richer the employee's intellectual capital is, the more likely it can help the enterprise in the shortest time to realize the transformation of market strategy at the minimum cost, thereby reducing its market risks, enhancing its environmental adaptability, all of which will improve organizational performance. Furthermore, talents with multiple abilities and skills are more likely to deal with unknown challenges and seize fleeting strategic opportunities in a complex environment, thereby increasing the probability of an enterprise being a successful enterprise. From another perspective, enterprises with coordination flexibility are more likely to reintegrate and allocate resources in a dynamic competition in a timely manner to maximize the effectiveness of resources. Coordination flexibility not only saves the enterprise's existing operating costs, but also improves the frequency of the enterprise's new products, timely response to market competition, and improves organizational performance.

In addition, some research also pointed out that strategic flexibility has a significantly positive impact on organizational performance. For example, Li et al. (2016) took 350 Chinese enterprises as an example and found that strategic flexibility has a positive impact on organizational performance. Lin and Zhao (2013) suggested that strategic flexibility is a key element for enterprises to gain a competitive advantage in the twenty first century. In summary, strategic flexibility can help enterprises in quickly identifying and adapting to the ever-changing external environment, and bring more strategic opportunities, which can improve organizational performance.

Hypothesis 3: Strategic flexibility is positively related to organizational performance

High-Performance Work System, Strategic Flexibility, and Organizational Performance

Previous research on the mediating mechanism between HPWS and organizational performance is often based on static resource-based views, using employee attitudes or behaviors as a mediating mechanism (Lin and Zhao, 2013). However, dynamic capability theory indicates that the resource-based view is a static theory, and it is difficult to explain the source of enterprises' competitive advantage in eras of rapid change (Barney, 2001; Cao et al., 2018); however, dynamic capability theory can supplement this deficiency. Thus, the present research is based on dynamic capability theory to clarify the mechanism that how HPWS influence organizational performance through strategic flexibility.

Strategic flexibility is characterized by dynamic capabilities, specifically the ability to integrate and restructure resources to adapt to environmental changes (Batt, 2002). Research on strategic flexibility is based on dynamic capability theory, which suggests that the dynamic ability of an enterprise responding to the changing environment is the basis for maintaining its competitive advantage while existing resources and capabilities can only bring temporary competitive advantages to the enterprise (Sanchez, 1997). Strategic flexibility is essentially a dynamic capability of maintaining enterprise competitive advantages (Amit and Schoemaker, 1993) and implementing new strategic opportunities (March, 1991), which is based on continuously improving resource flexibility and resource use efficiency. Even though early research was based on the resource-based view, studies were already aware of the importance of dynamic capabilities (Wright et al., 2001). Moreover, they also indicate out that strategic human resource management can increase the enterprises' intellectual capital stock to increase strategic flexibility, and thereby enhance the competitive advantage. Subsequent research was further based on the dynamic capability theory, using strategic flexibility as a mediating mechanism and found that strategic human resource management can reconfigure internal and external resources and capabilities to generate new knowledge and capabilities by discovering and seeking internal and external opportunities, thereby creating the competitive advantage (Becker and Huselid, 2006; Beltrán-Martín et al., 2008; Lin and Zhao, 2013).

From the perspective of HPWS, the present research suggests that by using a series of human resource practices, enterprises can continuously improve the knowledge and skills of employees, and increase the stock and flow of corporate intellectual capital. By doing so, the obstacles of communication and coordination can also be eliminated to a certain extent, and the flow of corporate knowledge and information will increase. Ultimately, the enterprises' ability to respond to changes in the external environment will be enhanced and affect organizational performance.

Hypothesis 4: Strategic flexibility mediates the relationship between HPWS and organizational performance

The Moderating Role of Social Networks

The importance of the social context and social networks had been gradually recognized by scholars (Granovetter, 1985; Nahapiet and Ghoshal, 2000). The term social network in this research refers to the organizational-level social network (Ahuja, 2000). It is a collection of stable resources and interaction norms formed by the relationships and interactions between different enterprises for obtaining and maintaining competitive advantages.

Even though HPWS can affect strategic flexibility, the effect can nevertheless vary in different social situations (Granovetter, 1985; Arenius and Clercq, 2005). Social network theory indicates that the social network presents a pyramid-like structure: the

closer the position to the top of the tower is, the fewer the number of occupants will be, but the richer the resources they can master. Accordingly, the more important the position in the network is, occupants in this position can have a wider view of the entire network and easier access to the most valuable resources (Lin, 1999). The huge network itself brings enterprises the opportunity and ability to quickly identify the market opportunities and make strategic adjustments. In addition, if the network strength of the enterprise is high, there will be a high exchange of resources between enterprises, which often brings high proprietary capital to the enterprise. Thus, a strong relationship between each other (Granovetter, 1973) will be established and the trust between enterprises can be enhanced (Teece, 2009), which makes it easy to form a consistent shared mental model, values, and strategic goals (Evans and Davis, 2005). Thus, those enterprises can realize the flow of resources at a lower cost. When the market changes, enterprises can share risks, information and exchange resource quickly (Gargiulo and Benassi, 2000), flexibly adjust strategies, and jointly respond to market changes. Based on these benefits that social network brings to strategic flexibility, we can infer that if an enterprise has a high-level social network, and the positive effect of HPWS on strategic flexibility would decrease. Moreover, when the centrality of the enterprise in the social network is more important, it would occupy more structural holes in the social network, which can allow the enterprise to easily obtain valuable, non-redundant, and high-quality information for increasing strategic flexibility. In this context, no matter how effective the implementation of HPWS is, enterprises can obtain strategic flexibility not only on HPWS but also the rich resources and advantageous positions brought about by social networks.

Enterprises with a low-level social network may have sparse and loose embedded business ecological network structure, weaker connection strength with customers, suppliers, and scientific research institutions. The structural hole occupied by enterprises can also be limited. Although objectively it is not conducive for enterprises to obtain more comprehensive information, enterprises in this context are often forced to weaken or even eliminate their dependence on social networks (Arenius and Clercq, 2005; Ren and Rui, 2014). Instead, they focus on their management to invest and develop human resources and then use human resources more as a means of seizing market opportunities and making strategic adjustments to improve strategic flexibility. Gargiulo and Benassi (2000) suggest that excellent management relies less on external networks, but more on its management capabilities. In this context, when social networks are low-level, enterprises need to rely on HPWS to obtain strategic flexibility.

Hypothesis 5: Social network moderates the positive relationship between HPWS and strategic flexibility in such a way that the relationship is stronger when the social network is low than when it is high.

Present research can be extended to a model of the mediated moderation effect. Specifically, strategic flexibility mediates the impact of HPWS on organizational performance; however, this mediating effect depends on the abundance of enterprises' social networks. Generally speaking, for enterprises with richer social networks, the impact of HPWS on strategic flexibility is weaker, thus the strategic flexibility would less transmit the effect of HPWS on organizational performance. In contrast, for enterprises with fewer social networks, the impact of HPWS on strategic flexibility is stronger, thus the strategic flexibility would more transmit the effect of HPWS on organizational performance.

Hypothesis 6: Social network moderates the mediation effect of strategic flexibility between HPWS and organizational performance in such a way that the mediation effect is stronger when the social network is low than when it is high.

The research framework is illustrated in **Figure 1**.

MATERIALS AND METHODS

Participants

Data collection lasted for 5 months and the participants mainly came from students in an MBA class. They were from various industries and most of them were human resources directors or senior managers of their enterprise. According to the design of research, all related enterprises were over 100 employees because the larger the scale of the enterprise, the more likely it is to implement HPWS. We invited 327 participants to participate in the questionnaire survey. In total, 214 completed the survey and the effective recovery rate was 65.4%. After simple data processing, we found that 83 participants' enterprises belong to the second industry and that 131 participants' enterprises belong to the third industry. From the ownership perspective, 92 of the participants' enterprises belonged to state-owned examples, and 122 of the participants' enterprises belonged to non-state-owned examples.

Measures

High-Performance Work Systems

We revised the scale based on Miao et al. (2014) to measure HPWS. This scale is composed of 8 dimensions and 33 items, example items are "Compared to skills, company pay more attention to the basic qualities of employees learning ability when recruiting [. . .]. The training content provided by the company is systematic, such as corporate culture, management/professional skills." In this research, the Cronbach's α coefficient of the scale was 0.955.

Strategic Flexibility

We revised the scale of strategic flexibility based on the scale of Sanchez (1995, 1997) and Wang (2015). This scale has 2 dimensions: resource flexibility and coordination flexibility, including 9 items, such as "the same resource often has multiple uses" and "enterprises can discover future opportunities and react faster than existing and potential competitors." In this research, the Cronbach's α coefficient of the scale was 0.907.

Social Network

We revised the scale of social networks based on the scale of Xie et al. (2014). This scale includes 3 dimensions (network scale,

network intensity, and network center) and 12 items, example items are "the frequency of cooperation and communication between customers" and "our enterprise is the information distribution center of other enterprises in the corporate network." In this research, the Cronbach's α coefficient of the scale was 0.956.

Organizational Performance

We used the Chinese version of the scale developed by Xie et al. (2006) for measuring organizational performance. This scale has 2 dimensions: short-term performance and long-term performance, and 12 items, example items are "compared with major competitors, the enterprise's satisfaction with sales growth rate," "compared with major competitors, the enterprise's satisfaction with new product development performance." In this research, the Cronbach's α coefficient of the scale was 0.946.

RESULTS

Confirmatory Factor Analysis and Common Method Deviation Test

We used AMOS21.0 to conduct the confirmatory factor analysis. The results showed (see **Table 1**) that comparing with single-factor, two-factor, or three-factor model, the four-factor model fitted the best, which reflected that the variables involved in this research have good discriminative validity.

To avoid the possible impact of common method deviation, we used Harman's single factor method to test the homological bias and used SPSS22.0 to conduct the principal component analysis on variables. The result showed that the first factor explains 39.713% of the total variation, which is lower than the standard 40%, so we believe that the common method deviation of the data is within an acceptable range. In addition, all the variables were centered and we found that its tolerance is between 0.55 and 0.99, and VIF (variance inflation factor) is between 1.01 and 1.83, which is lower than the critical value of 10. Therefore, there is no serious multi-collinearity problem in this model.

Preliminary Analysis

Table 2 provides preliminary analysis results of main variables, including the mean (M), standard deviation (SD), average extraction variance (AVE). The results showed that HPWS is positively correlated with organizational performance ($r = 0.600$, $P < 0.01$), and is positively correlated with strategic flexibility ($r = 0.719$, $P < 0.01$), and strategic flexibility is positively correlated with organizational performance ($r = 0.701$, $P < 0.01$), so the hypothesis 1–3 has been initially verified. The AVE is greater than 0.5 and the square root is greater than the absolute value of the correlation coefficient of each variable, which indicates that the model has good discriminant validity.

TABLE 1 | Confirmatory factor analysis results ($N = 214$).

Model	c2	*df*	c2/*df*	TLI	CFI	RMR	RMSEA
Single-factor	1042.161	90	11.58	0.552	0.616	0.213	0.223
Two-factor	877.833	89	9.863	0.625	0.682	0.200	0.204
Three-factor	479.051	87	5.506	0.809	0.842	0.255	0.145
Four-factor	204.241	84	2.431	0.939	0.952	0.064	0.082

Single-factor model: Four variables are combined into one factor; two-factor model: Strategic flexibility (SF), social network (SN), and organizational performance (OP) are combined into one factor; three-factor model: SF and SN are combined into one factor.

TABLE 2 | Mean value, standard deviation, correlation coefficient, square root of AVE.

Variable	*M*	*SD*	1	2	3	4	α
HPWS	5.13	0.87	0.590				0.955
SF	4.86	1.02	0.719**	0.646			0.907
SN	4.42	1.21	0.260**	0.287**	0.677		0.956
OP	4.52	0.98	0.600**	0.701**	0.280**	0.638	0.946

*N = 214, **means $p < 0.01$. The correlation coefficient is in the lower triangle of the matrix, and the square root of AVE is on the diagonal.*

TABLE 3 | Test of the mediating role of strategic flexibility.

	Organizational performance				Strategic flexibility	
	M1	M2	M3	M4	M5	M6
Scale	0.091	0.040	0.073	0.059	0.026	−0.036
Industry	−0.014	0.055	−0.014	0.011	0.000	0.082
Ownership	−0.095	−0.157**	−0.121	−0.137**	0.038	−0.036
Location	0.265***	0.249***	0.128*	0.154**	0.196**	0.177***
HPWS		0.608***		0.221***		0.723***
Strategic flexibility			0.698***	0.535***		
R^2	0.023	0.387	0.495	0.516	0.026	0.543
$\triangle R^2$	0.023	0.364**	0.472***	0.129***	0.003**	0.517***
F-value	2.277	27.81	42.815	38.800	2.435	51.548

*All are standardized coefficients; N = 214, M is model, **means $p < 0.01$, ***means $p < 0.001$.*

Hypothesis Testing

We used the SPSS22.0 to conduct the hypothesis testing (mediation and moderation). The independent variable in this research is HPWS, and the dependent variable is organizational performance. Firstly, based on past research experience, we used the enterprise scale, enterprise industry, enterprise ownership, and enterprise location as the control variables (Li and Zhang, 2007). Then, Model 2 showed that HPWS had a significant positive effect on organizational performance ($\beta = 0.608$, $p < 0.001$), supporting Hypothesis 1. Model 6 showed that HPWS has a significant positive effect on strategic flexibility ($\beta = 0.723$, $p < 0.001$), supporting Hypothesis 2. Model 4 incorporated strategic flexibility into the model and found that HPWS is significantly related to organizational performance ($\beta = 0.221$, $p < 0.001$), and strategic flexibility in model M3 is significantly related to organizational performance ($\beta = 0.698$, $p < 0.001$), and $0.221 < 0.608$, so strategic flexibility mediated the relationship between HPWS and organization performance, supporting the Hypothesis 3 and Hypothesis 4 (see **Table 3**).

The next step is to test the moderating role of social networks (see **Table 4**). Based on model M6, the social network was incorporated into model M7, and the result showed that HPWS ($\beta = 0.667$, $p < 0.001$) and social network ($\beta = 0.165$, $p < 0.001$) had a significant positive effect on strategic flexibility. In model M8, the interaction term between HPWS and social network is significant ($\beta = -0.122$, $p < 0.01$), and $\triangle R^2 = 0.010$ ($p < 0.001$). Thus, hypothesis 5 is supported. As shown in **Figure 2**, the relationship between HPWS and strategic flexibility is stronger when the social network level is low than when it is high.

Finally, we tested the mediated moderation model based on the method of Muller et al. (2005). The procedures were: (1) regression of dependent variables on independent variables, moderating variables, and interaction terms, the coefficient of the interaction term is significant; (2) regression of the mediating variable to the independent variable, the moderating variable, and the interaction term, the coefficient of the interaction term is significant; and (3) regression of the dependent variable to the independent variable, the moderating variable, the interaction term, and the mediating variable, the mediating variable is significant; if the coefficient of the interaction term in standard (3) is not significant or the significance is reduced, the moderating variable completely or partially moderate the mediating mechanism.

Unfortunately, Model 10 incorporated the interaction term into the model and found that the interaction term was not significant (see **Table 4**). Therefore, there was no need to do the following test, and hypothesis 6 was rejected.

TABLE 4 | Moderating test.

	Strategic flexibility		Organization performance	
	M7	**M8**	**M9**	**M10**
Scale	−0.057	−0.052	0.021	0.022
Industry	0.079	0.092	0.053	0.056
Ownership	0.005	0.014	−0.120	−0.118
Location	0.179***	0.163	0.251***	0.246***
HPWS	0.667***	0.660	0.567***	0.562***
Social network	0.165***	0.212	0.146**	0.160**
HPWS*SN		−0.122**		−0.035
R^2	0.564	0.574	0.419	0.400
$\triangle R^2$	0.564	0.010***	0.419	0.019**
F-value	46.883	41.982	24.860	21.294

*All are standardized coefficients; N = 214, M is model, **means $p < 0.01$, ***means $p < 0.001$.*

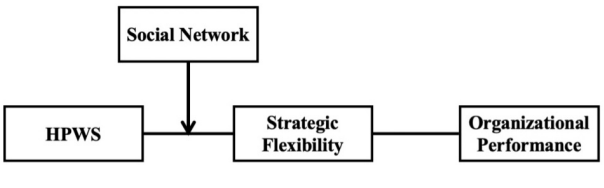

FIGURE 1 | Research model.

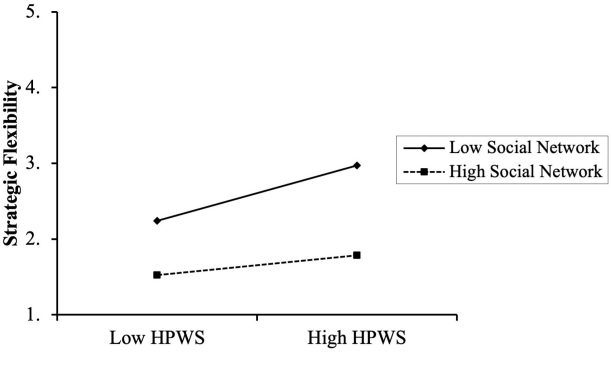

FIGURE 2 | The moderating effect of social networks on the relationship between HPWS and strategic flexibility.

DISCUSSION

Theoretical Implication

This research confirmed that in a dynamic competitive environment, HPWS influence organizational performance through strategic flexibility. This conclusion is consistent with the results of Becker and Huselid (2006); Beltrán-Martín et al. (2008), and Lin and Zhao (2013). It provides a theoretical basis and empirical evidence for further revealing the "black box" between HPWS and organizational performance. Moreover, strategic flexibility only partially mediated the relationship between HPWS and organizational performance, indicating that future research should continue to explore the mechanism of HPWS from other perspectives.

Secondly, this research also tested the moderating role of social networks. Most previous research on this subject paid more attention to the internal situation factors within the enterprise and only a few took the social network into account from the perspective of sociology when exploring the boundary condition of HPWS. Our research combined the social network theory into exploring the impact of relationships formed by enterprises on strategic flexibility. The results showed that social networks negatively moderated the relationship between HPWS and strategic flexibility, which means the richer social network resources an enterprise has, the smaller the impact of HPWS on strategic flexibility will be. In other words, HPWS and the social network is mutual substitution in the process of acquiring strategic flexibility. These conclusions further expand the framework of social network theory.

In addition, this research also investigated whether there is a mediated moderation effect in this model. We found that social networks did not moderate the mediation effect of strategic flexibility and there may be two reasons: firstly, social networks are indispensable for enterprises to survive in business competition, thus social networks are beneficial to the impact of HPWS on organizational performance to a certain extent; secondly, when the enterprise' social network is excessively rich, the enterprise has too many resources and opportunities, which may cause information confusion for the

enterprise. Specifically, enterprises may spend too much time choosing resources and potential opportunities and miss market opportunities. Therefore, we predict that the relationship of HPWS, social network, and organizational performance is not a simple linear relationship, but is likely a quadratic non-linear relationship.

Practical Implication

This research has at least three practical implications. First, the results showed that the HPWS can improve organizational performance in a dynamic competitive environment. Thus, we recommend that the CEO (Chief Executive Officer) of enterprises construct HPWS. Moreover, it should be noticed that HPWS with "commitment-oriented" and "control-oriented" is more effective for Chinese enterprises. Besides, the CEO should also note that with the overall improvement of the employees' quality, the composition of HPWS shall gradually transit to practices of "commitment-oriented," supplemented by practices of "control-oriented." Secondly, results showed that HPWS influenced organizational performance partly through strategic flexibility. Hence, when enterprises try to improve organizational performance in a dynamic competition environment, the CEO can focus on strategic flexibility and implement HPWS that can promote strategic flexibility. For example, through the implementation of some practices, such as extensive training, employees can master more dimensional knowledge and skills, which can help enterprises in improving their strategic flexibility significantly. Finally, the results showed that HPWS has boundary conditions in promoting strategic flexibility. We found that social networks can negatively moderate the relationship between HPWS and strategic flexibility, which means that the role of HPWS and social networks may conflict with each other in the process of obtaining strategic flexibility. Therefore, the CEO needs to balance the relationship between HPWS and social networks as much as possible.

Limitation and Future Direction

There are some limitations in this research: firstly, the number of samples is insufficient as we obtained only 214 valid samples. In addition, participants in our survey are people that have close relationships with the author and collaborators. Therefore, the sample was not collected strictly according to the method of a "random sample," meaning some coefficients may have biased estimates. We suggest that it is necessary to continue to expand the sample size in future research and conduct a "random sample" survey if conditions permit. Secondly, it is difficult to use cross-section data to reveal the causal relationship between variables. Although we tested the common method deviation, we still cannot rule out the possibility of reverse causality. Further research should use longitudinal data to test the hypothesis. Thirdly, we have not made an objective measurement of the social network but only made a subjective evaluation. Future research could explore a new method of overcoming the shortcomings of this subjective evaluation. Finally, we suggest that future research should incorporate a broader sociological perspective into management research.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

YC and YW: conceptualization, methodology, and writing-original draft preparation. YC, NX, and YW: data curation, software, writing-reviewing, and editing. YW and HC: visualization, investigation, supervision, and validation. All authors contributed to the article and approved the submitted version.

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Determinants of Green Innovation to Achieve Sustainable Business Performance: Evidence From SMEs

*Yasser Baeshen[1], Yasir Ali Soomro[1]*and Muhammad Yaseen Bhutto[2]*

[1] *Department of Marketing, Faculty of Economics and Administration, King Abdulaziz University, Jeddah, Saudi Arabia,*
[2] *Department of Marketing, Business School, Shandong Jianzhu University, Jinan, China*

Environmental degradation and global warming are major challenges to humankind in the twenty-first century. Thus, businesses are now adopting and incorporating more sustainable manufacturing methods to produce environmental products and services. It is inevitable for organizations to adopt green practices and achieve sustainable performance. This extant research addresses how to obtain sustainable development (SD) through green innovation (GRIN). The main purpose of this study is to develop a comprehensive model by integrating natural resource-based view (NRBV) and triple bottom line (TBL) framework. Three antecedents namely green absorptive capacity (GAC), sustainable human capital (SHC), and organization support (OS) were selected, and their influence was checked on GRIN of the SMEs from manufacturing sector. This study included all three factors of TBL: environmental, economic, and social sustainability in terms of GRINs possible consequences. Data were randomly collected from 304 firms in the kingdom of Saudi Arabia through questionnaire. Convergent and discriminant validity analyses were conducted to assure validity and reliability, and structural equation modeling (SEM) was utilized to assess the relationships between variables using smartPLS 3.0 software. Further, firms were categorized into two groups based on company size—small and medium—to explore group differences. Hence, firm size was included as a moderator in the proposed model and multi-group analysis (MGA) was performed. The results indicate that GAC, SHC, and OS have positive influence on GRIN within SMEs. Further, results reveal GRIN had strong significant impact on all three variables of sustainable performance. The study concludes with MGA results that provided evidence of significant group differences, with a stronger relationship between GAC and GRIN in medium-sized firms compared to small-sized firms. Similarly, the relationship between GRIN and environmental performance was stronger in medium-sized firms than small-sized firms. This study is unique and provides practical and theoretical implications. This paper offers an integrative model for sustainability which may be of interest to scholars, marketers, and policymakers.

Keywords: green absorptive capacity, green innovation, sustainable human capital, organization support, economic performance, environmental performance, social performance, firm size

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****Correspondence:***
Yasir Ali Soomro
yasir.soomro@hotmail.com

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INTRODUCTION

Environmental degradation is causing major challenges to humankind, their economic success, and nature (Leonidou et al., 2017). Due to the growing concern of environmental issues, governments and businesses are concentrating on more sustainable manufacturing methods and integrating sustainable processes into core business operations (Das and Rangarajan, 2020; Muangmee et al., 2021; Qu et al., 2021; Huang et al., 2019). Environmental challenges have also highlighted the importance of small- and medium-sized enterprises (SMEs). SMEs also play a significant role in creating jobs, manufacturing value added products, and driving innovations to local economies (OECD, 2017). Hence, SMEs are generally perceived as the backbone of the economy. On the other hand, SMEs often account for more than 60–70% of industrial pollution because these companies are numerous and less focused on environmental protection (Hillary, 2004). According to researchers' recommendations and policymakers, one of the most effective techniques for SMEs to reduce pollution while maintaining competitiveness is "GRIN" (Jun et al., 2019).

In comparison with large enterprises, SMEs are extremely resistant to technological change and more adaptive to market changes, while their organizational structure enables them to make quicker decisions (Pilar et al., 2018). SMEs have lately begun to embrace green innovation (GRIN) initiatives in response to stakeholder pressures (Jun et al., 2019). However, the adoption of GRIN in SMEs is still unknown (Aboelmaged and Hashem, 2019). Innovation studies, particularly those focusing on SMEs, have attempted to explain and examine how to foster an atmosphere conducive to innovation and identify the key factors of organizational innovation. Still, the innovation process, the capabilities and resources inside a firm that foster GRIN, as well as the relationship between the two, remain complex. While several organizational capabilities and factors exist, numerous studies have missed important capabilities in their research. A holistic and integrated approach is thus required to transform SMEs in emerging markets (Aboelmaged and Hashem, 2019).

Kingdom of Saudi Arabia (KSA) is the world's largest oil producer (Balat, 2006). Despite fast industrial and economic progress, KSA has encountered major environmental difficulties, including air pollution, energy waste, and water pollution (Raggad, 2018). According to the Ministry of Labor and Social Development, Saudi Arabian SMEs generate around 22% of the Kingdom's GDP. Approximately 34% of Saudi employees work in (SMEs; Jadwa Investment, 2019). The kingdom has adopted the Vision 2030 strategic plan to transform the economy and stimulate innovation in the country; as a result, SMEs are aided in their efforts to develop eco-friendly manufacturing processes. To fill the gap in the literature on emerging markets' promising challenges of sustainable economic development and environmental conservation, with a particular emphasis on Saudi Arabia. This study makes three significant contributions: first, the internal and external organizational factors analyze GRIN adoption. A research model is built to demonstrate how green absorptive capacity (GAC), sustainable human capital (SHC), and organizational support (OS) affect GRIN in SMEs in Saudi Arabia.

Secondly, how GRIN affects the firm to obtain sustainable performance. The majority of past research has focused on performance as a single dimension (Xie et al., 2019) or has taken two dimensions of organization performance (i.e., Economic and Satisfaction; Yáñez-Araque et al., 2017; Hernández-Perlines et al., 2019). The authors of this study have used the Triple bottom line (TBL) model to view performance as a multidimensional term (i.e., social, economic, and environmental performance; Shahzad et al., 2020). Thus, the following three SP dimensions were investigated in this study: environmental, economic, and social sustainability. Thirdly, this study used firm size as a moderating variable to investigate the group difference between medium-sized and small-sized SMEs.

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

The intersection of the natural resource-based view (NRBV) and TBL framework provides the theoretical foundation for this study. It is argued that the effectiveness of GRIN adoption is influenced by organizational capabilities derived from the firm's NRBV (Aboelmaged and Hashem, 2019). According to the NRBV (Hart, 1995), the competitiveness of a company can be maintained through the use of strategic VIRO (value, difficult to copy, unique, and organized) resources (Lin and Wu, 2014). According to the NRBV, a firm's environmental abilities, stewardship of products and services, and overall sustainability all add to its competitiveness (Hart, 1995). A firm's response to global environmental changes can foster a sustainable capability. It reflects the firm's environmental capabilities and resources (Teece, 2009) and can provide proactive solutions to sustainability issues. NRBV helps meet stakeholders' environmental concerns while also providing other advantages, such as energy conservation, environmental recycling, material reduction, pollution prevention, etc. (Chen et al., 2014; Wang, 2019). Following Minbashrazgah and Shabani (2019) research, they considered three interrelated internal practices: SHC, sustainable orientation, plus sustainable collaboration can positively drive GRIN.

Additionally, researchers also reveal that absorptive capacity (AC) which is a firm's capability does influence GRIN (Arfi et al., 2018). AC reflects the firm's ability to recognize and use external knowledge. AC is increasingly seen as critical to innovation and competitive performance (Danquah, 2018). March and Simon (1958) found that rather than developing new information and experiences, most innovative firms identify and absorb them from other organizations. After that, Cohen and Levinthal (1990) refined the concept further, arguing that firms' AC reflects their ability to recognize, integrate, and implement valuable external knowledge.

The environmentalist and naturalists endorsed the organizations for incorporating advanced knowledge and green ideas into their manufacturing processes to benefit increased business sustainability (Qu et al., 2021). Similarly, sustainable development (SD) has been addressed in current environmental management literature. Though, this is a hot topic, academics and experts are not yet in agreement on the concept and definitions (Hahn et al., 2015). The World Commission on Environment and Development (WCED, 1987) defined SD as "development that meets the needs of the present without compromising the ability of future generations to meet their needs." Economic, environmental, and social challenges are all included in this definition of WCED. These three pillars of sustainable business performance (SBP), together referred to as the "triple bottom line", affect present and future generations (Elkington, 1998). TBL is a CSR framework with three dimensions: economic, social, and environmental. These three dimensions must achieve sustainable goals. Each of the three dimensions of sustainable performance (environmental, economic, and social) is rather prominent in this framework; consequently, it may be considered an integrative theory of sustainability (Asadi et al., 2020).

Studies found that SBP plays a vital role in meeting SD goals using various strategies together such as corporate social responsibility (CSR), GRIN, and AC (Abbas, 2020; Shahzad et al., 2020). However, the influence of organizational factors such as GAC, SHC, and OS combine has not been investigated to achieve sustainable performance in SMEs through GRIN. Moreover, prior empirical studies on absorptive capacity, internal capabilities, and GRIN are precisely uncommon, especially in developing nations and SMEs (Albort-Morant et al., 2018; Aboelmaged and Hashem, 2019). Furthermore, few studies can be found to integrate NRBV and TBL frameworks in SMEs in developing contexts. To fill these gaps is vital for advising SMEs on innovation policies. Thus, this study aims to bridge the gap by adopting NRBV and TBL framework in the context of SMEs.

Green Innovation

GRIN is a term that refers to technological advancements that are used to manage the environment, prevent pollution, reduce waste, and conserve energy (Chen, 2008; Zhang et al., 2019). GRINs help businesses function better by reducing waste and costs for a sustainable environment (Kleindorfer et al., 2005). Additionally, GRIN increases market positions, builds brands, spurs innovation, and attracts potential customers (Chandy and Tellis, 2000). GRIN is intrinsically linked to corporate environmental management and environmental goal attainment. As a result, it is often considered that GRIN results in increased performance (Zailani et al., 2015). Few recent studies have revealed that GRIN is a key factor that directly affects sustainable business performance (Abbas and Sağsan, 2019; Shahzad et al., 2020). Numerous prior studies have demonstrated the effect of GRIN on performance (Gluch et al., 2009; Arfi et al., 2018). Numerous organizational variables are examined concerning GRIN adoption, including human resource quality, top manager leadership skills, OS, and organizational culture (García-Machado and Martínez-Ávila, 2019; Jun et al., 2019). This study focuses on GAC, OS, and SHC, as these elements consistently have a greater impact on GRIN adoption (Zailani et al., 2015; Aboelmaged and Hashem, 2019).

Green Absorptive Capacity and Green Innovation

Organizations require dynamic capabilities, such as absorptive capacity, to keep up with the rapidly changing environment (Cohen and Levinthal, 1990; Martinez-Sanchez and Lahoz-Leo, 2018). The literature on innovation identifies a firm's absorptive capacity as the main factor driving innovation (Ali and Park, 2016; Ali et al., 2020). Earlier research has established that adopting innovative practices in manufacturing or service contexts requires a firm's capacity to acquire, transmit, and apply internal and external knowledge (Tseng and Hung, 2011). For example, Tseng and Hung (2011) found that knowledge transfer and absorptive capacity positively affected organizational innovation and performance in Taiwan's knowledge-intensive business sectors. Albort-Morant et al. (2018) suggested that a firm's AC enhances its ability to generate innovative methods that have a positive environmental impact, like green products, services, or processes. They confirmed that firms are aware of external knowledge detailing how their businesses environmental issues, such as pollution, waste, and other results, negatively affect the world, and integrate it with their existing knowledge to assist in adopting GRIN methods. These methods may include developing new environment-friendly products and procedures for waste reduction, recycling, pollution control, and more.

On the other hand, GAC is a very new and untested concept (Chen et al., 2014). Chen et al. (2015) defined "green absorptive capacity" as a high capacity for identifying, assimilation, and utilization of external knowledge. The GAC of a firm can help developing a sustainable competitive advantage through the use of external and internal green knowledge (Qu et al., 2021). As a result, we may say that an organization wanting to increase its GRIN performance should put an emphasis on the firm's GAC. Green absorptive capacity enables a business to identify, acquire, integrate, and utilize environmental knowledge in order to foster GRIN (Chen et al., 2014). GAC enables enterprises to effectively manage environmental knowledge, enhancing firms' GRIN capabilities (Chen et al., 2015; Roberts, 2015). Further, Chen et al. (2015) used structural equation modeling (SEM) to study the relationship between absorptive capacity and green services in the context of the electronic industry in Taiwan. They concluded that absorptive ability had a positive effect on service-oriented GRIN. Organizations require the green absorptive capability to generate creative and innovative ideas from environmental knowledge to develop a sustainable competitive advantage through GRIN (Chen et al., 2015). Additionally, GAC aids in disseminating environmental knowledge across various departments (Roberts, 2015), thereby strengthening firms' interaction mechanisms, research and

development, and management processes (Vicente-Oliva et al., 2015), thus further enhancing GRIN. Recently, Qu et al. (2021) revealed and endorsed that GAC is a key factor contributing to GRIN. Thus, SMEs must integrate external and internal knowledge to embrace new environmentally friendly methods to achieve GRIN. Based on the discussion above, our study proposes the following hypothesis:

Hypothesis 1: GAC positively influences GRIN within SMEs.

Sustainable Human Capital and Green Innovation

The availability of skilled human capital and managers' dedication to environmentally friendly activities are also considered as major factors motivating businesses to create environmentally friendly practices (Wu et al., 2012). According to Huang and Kung (2011), sustainable human resources can display important abilities such as an environmentally friendly direction, attitude, skills, knowledge, competence, and knowledge through employee activities. GRIN can be fostered by key intangible and tangible assets, as well as the knowledge of environmental friendly management and staff (Aboelmaged and Hashem, 2019). The HR function can encourage SHC by means of green practices in recruitment, training, and by awarding green initiatives (Renwick et al., 2016). As per Consoli et al. (2016), many green jobs require more training, education, work expertise, cognitive abilities, and interpersonal skills than non-green jobs. In addition, many workers in the United States have expressed an interest in working for green employers (Gully et al., 2013). SHC can help organizations reduce uncertainty, accept risk, and overcome employee opposition to innovation and green practices (Chen and Chang, 2013). The availability of skilled human resources in-house and managers' adherence to green practices are regarded as the primary factors pushing businesses to pursue GRIN (Lee, 2008; Wu et al., 2012). Additionally, Lin and Ho (2011) stated that rewarding employees for eco-friendly conduct could encourage workers to adopt green practices. Support from top management is critical for achieving sustainable goals, particularly support for employees' green behavior, making organizational resources easily accessible to employees, improving the quality of recruitment, learning capabilities of the organization, and accumulating environmental knowledge (Lin and Ho, 2011). Previous studies have revealed that SHC have a significant positive impact on the adoption of GRIN (Cowden et al., 2015; Singh et al., 2020). Still, there is a need to probe more on SHC within the context of sustainability (Yong et al., 2019). As a result, the authors anticipate that SHC will positively affect GRIN.

Hypothesis 2: SHC positively influences GRIN within SMEs.

Organizational Support and Green Innovation

The term "organizational support" refers to the degree to which an organization facilitates its employees in using a certain technology or system (Naujokaitiene et al., 2015). Fostering innovation and assuring the availability of innovative funding and technical resources significantly affect innovation adoption (Clohessy and Acton, 2019). OS is critical for the development of environmental management because it ensures that the resources necessary to implement green practices are readily available and that workforce is motivated to do so. Above all, top management has a significant role in providing OS. Most green practices require coordination and collaboration between various departments of an organization during implementation. To ensure their success, green projects are typically supported and encouraged by higher management. The key task of top management is to ensure resource availability and distribute them proficiently so that the firm can adopt green practices to gain a competitive environmental advantage (González-Benito and González-Benito, 2006). Hence, we anticipate that OS will have a positive impact on SMEs GRIN and offer the following hypothesis:

Hypothesis 3: OS positively influences GRIN within SMEs.

Green Innovation and Sustainable Business Performance

The TBL model highlighted the importance of the economy, society, and environment as the dimensions of firm performance (Elkington, 1998; Asadi et al., 2020). This study has included all three dimensions from the perspective of SMEs, as these are critical for sustainable innovation and business performance (Asadi et al., 2020). In line with this, scholars have pointed out the importance of financial performance, social welfare, and environmental quality in the general public's well-being (Mahrinasari and Bangsawan, 2020; Shahzad et al., 2020). Ali et al. (2016) discover a favorable relationship between a firm's innovativeness and overall sustainable performance. Further, Rajapathirana and Yui (2018) found a positive correlation between the innovativeness of SMEs and their overall performance (Ali et al., 2020). However, scholars argue that organizations are more focused on the economic element than social and environmental (Asadi et al., 2020). For the successful operations of the business, all components have a crucial role in the success of business performance (Fernando et al., 2019).

Environmental performance (ENP) can be described as the environmental impact of a firm's green activities (Henriques and Sadorsky, 1996; Chen, 2008). GRIN practices can reduce environmental threats (e.g., air emissions, regularity of landfill disposal) to enhance a firm's environmental performance (Kammerer, 2009), and its reputation in the industry (Dangelico, 2013). Environmental performance is assessed by firms that minimize waste generation and carbon dioxide emissions, and the use of harmful chemicals (Asadi et al., 2020; Muangmee et al., 2021). Previous research has shown that the introduction of green technologies will increase the chances of improving environmental performance (Singh et al., 2016; Xue et al., 2019). As a result, the following hypothesis was proposed:

Hypothesis 4a: GRIN positively affects the ENP of SMEs.

GRIN does benefit businesses that outperform their competitors. Companies are generally engaged in GRIN activities to support a diverse range of transactions that suit the demands and needs of potential buyers. This can result in increased sales volume, which enhances a company's financial situation (Chen, 2008; Caracuel and Ortiz-de-Mandojana, 2013; Zhang et al., 2020). Many studies show that more innovative organizations tend to do better financially. For example, Marques and Ferreira (2009) found that innovativeness gives firms a competitive advantage, improving their financial performance. Economic success is also a result of GRIN. Numerous businesses are beginning to create next-generation clean technologies to help their economic development in the future. Shell has been investing in solar, wind, and other renewable energy sources to believe that they can quickly substitute non-renewable energy (Hart and Milstein, 2003). According to Xie et al. (2019), GRIN mitigates negative environmental impacts and enhances economic performance (ECP) through reduced waste and costs. Furthermore, cost savings in production are essential for GRIN and a sustainable environment (Hojnik and Ruzzier, 2016), and Li et al. (2017) revealed the positive influence of GRIN on ECP. As a result, the following hypothesis was presented in this study.

Hypothesis 4b: GRIN positively affects the ECP of SMEs.

Apart from solving environmental problems, GRINs are critical for employee retention, improving communication, and increasing the brand's acceptability. Development of human capital through training may assist in persuading employees and shifting their behavior and attitude toward more environmentally friendly practices (Huang et al., 2016). It turns out that being environmentally aware and having good environmental practices both positively affect corporate profits and employee well-being. Additionally, it provides several other benefits, including increased social responsibility, recruitment, and retention of qualified individuals (Mehta and Chugan, 2015; Muangmee et al., 2021). Indeed, as Wagner (2013) indicates, the performance of organizations that invest in social accountability, pay proper attention to satisfied customers through innovation and hire appropriately qualified employee's increases. Previous research indicates that businesses' green performance increases their social performance (SOCP; Asadi et al., 2020; Shahzad et al., 2020). Based on prior research, the following hypothesis is developed:

Hypothesis 4c: GRIN positively affects the SOCP of SMEs.

Firm Size as Moderator

There is much literature on the factors of innovation and, in particular, on the impact of firm size on innovation (Acs and Audretsch, 1991). The firm's size has been consistently identified as a significant organizational element influencing environmentally friendly behavior (Etzion, 2007) and performance (Hernández-Perlines and Xu, 2018). Generally, big corporations implement environmentally friendly practices more quickly than small firms, given their considerable resources and essential infrastructure (Lin and Ho, 2010). Previous literature reveals that small firms are significantly less inventive than big companies (Roper and Hewitt-Dundas, 1998; Raymond and St-Pierre, 2010). For example, Du et al. (2007) discovered that when internal resource factors were considered in firms with 10 or more employees, size had a favorable effect on the likelihood of innovation, but at a declining rate. Sdiri and Ayadi (2011) observed a similar impact when examining the effects of the same determinants on the decision to innovate using simultaneous and sequential models applied to a dataset of 108 Tunisian service firms. This is because, while large companies may benefit from economies of scale in terms of technology and learning, such benefits may be overshadowed by organizational differences in size (Zenger, 1994). Likewise, according to Vossen (1998), "the relative strength of large firms is largely determined by their financial resources and technology, while the relative strength of small firms is primarily determined by their entrepreneurial dynamism, flexibility, efficiency, proximity to the market, and motivation." Within the framework of SMEs, this study used SMEs as moderators to see if there are significant differences and implications for the adoption of GRIN.

The Conceptual Model

The research model of the study in **Figure 1** shows the impact of GAC, SHC, and OS on GRIN. Further, it depicts the effect of GRIN on SBP and its all dimensions (environmental, economic and social) following the TBL. Moreover, the moderating role of firm size is also examined.

METHODOLOGY

Data Collection Procedure and Participants

A primary research design with a quantitative approach was performed to empirically interpret the proposed conceptual hypothesis developed and presented in the framework. The data for this study were gathered in two phases: first, semi-structured interviews with five managers were conducted. These managers worked in SME manufacturing companies in the Jeddah industrial area in Saudi Arabia to identify the most important drivers of GRIN and sustainable performance. A research questionnaire was developed by adopting construct items used in earlier literature on GRIN and SBP. In this study, the data were gathered using a random sampling technique. Because each unit has the equal chance, random sampling is considered the most appropriate sampling approach (Secker et al., 1995). The items of constructs were adopted and modified to suit the current research. Green absorptive capacity had five items developed by Chen et al. (2014). For the organization

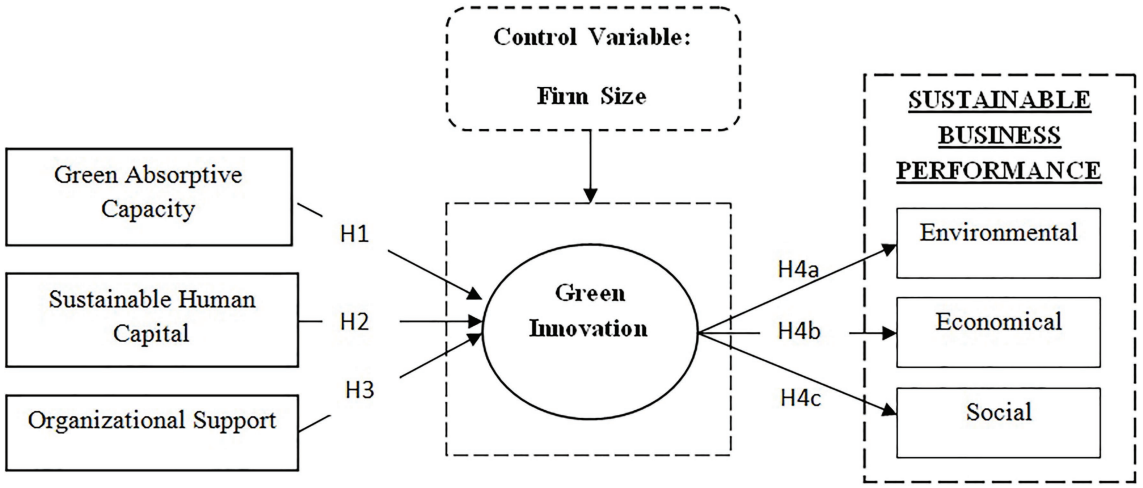

FIGURE 1 | Research model.

TABLE 1 | Demographic analysis.

Demographics		Frequency	Percent
Gender	Female	184	60.5
	Male	120	39.5
Industry/Sector	Construction	64	21.1
	Energy	40	13.2
	IT	47	15.5
	Logistics	41	13.5
	Manufacturing	56	18.4
	Services	56	18.4
Job level	Entrepreneur	101	33.2
	Middle management	77	25.3
	Senior management	126	41.4
Firm size	Medium (50–249 employees)	189	62.2
	Small (6–49 employees)	115	37.8

factor, two sub-constructs were included: SHC (Chang and Chen, 2012; Aboelmaged and Hashem, 2019) and OS (Jun et al., 2019). GRIN had four items modified from previous studies (Kusi-Sarpong et al., 2015; Aboelmaged and Hashem, 2019). Lastly, sustainable business performance had three constructs: environmental performance having three items (Bansal, 2005; Wang, 2019), economic performance having three items (Bansal, 2005), and social performance had four items (Bansal, 2005). All items were slightly modified to suit our study on SMEs. The finalized questionnaire was spread to SMEs belonging to six industry sectors: Construction, Energy, Logistics, Manufacturing, IT, and Services. A total of 304 valid responses were received, and all the responses were included for data analysis, among 304 respondents from the industry, comprised of entrepreneurs (33.1%), senior management (41.4%), and middle management (25.3%). Female respondents dominated (60.5%) in the sample compared to male respondents (39.5%). In Saudi Arabia, SMEs are defined as businesses that employ 249 or fewer employees and have less than SR200m ($53.3 m) in annual revenue. As per Saudi Nitaqat data and the General authority for statistics (GaStat), authors categorize firms into two sizes: small firms having 6–49 employees and medium firms with 50–249 employees. Out of 304 responses, 189 were from medium-sized firms, and the remaining 115 were from small firms. The demographic analysis of the data collected from managers of Firms can be seen in **Table 1**.

RESULTS

The gathered data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM; Hair et al., 2013, 2014); the PLS-SEM analysis gave the measurement model analysis which includes validity measurements given below in **Table 2**.

Measurement Model

Table 2 shows that the measurement model had good convergent validity. Evaluating convergent validity through examining (AVE) of each latent construct. The average variance extracted value greater than 0.5 indicates that the validity of the variable and construct is high. According to Sarstedt (2017), items loading must lie between 0.05 and 0.07; it was observed that out of 25 items, one item that is related to social performance (our organization recognized and acted on the need to fund local community initiatives) was deleted because it is outer loadings was below 0.07. Hence, in the whole model, only 24 items were retained as loadings greater than 0.07 (see **Table 2**), indicating that the measurement model was reliable and meaningful.

Discriminating validity was observed by comparing the indicators with other reflective indicators in the cross-loading. The authors followed the Fornell and Larcker rule of thumb (Fornell and Larcker, 1981). Regarding discriminant validity, to achieve the discriminate validity, the square root of the AVE should be higher than the correlation among latent variables

TABLE 2 | Factor loadings, composite reliability, and average variance extracted.

Constructs	Codes	Loadings[a]	Cα	rho_A	CR	AVE[b]
Green absorptive capacity			0.959	0.959	0.959	0.825
	GAC1	0.897				
	GAC2	0.937				
	GAC3	0.893				
	GAC4	0.902				
	GAC5	0.910				
Sustainable human capital			0.934	0.935	0.934	0.781
	SHC1	0.896				
	SHC2	0.908				
	SHC3	0.897				
	SHC4	0.833				
Organization support			0.917	0.918	0.917	0.786
	OS1	0.866				
	OS2	0.876				
	OS3	0.917				
Green innovation			0.931	0.932	0.932	0.773
	GIA1	0.874				
	GIA2	0.902				
	GIA3	0.866				
	GIA4	0.874				
Economic performance			0.907	0.907	0.907	0.766
	ECP1	0.878				
	ECP2	0.880				
	ECP3	0.867				
Social performance			0.723	0.897	0.801	0.559
	SOCP1	0.876				
	SOCP2	0.869				
	SOCP3	0.843				
	SOCP4	(0.072 deleted)				
Environmental performance			0.890	0.898	0.890	0.732
	ENP1	0.772				
	ENP2	0.941				
	ENP3	0.845				

Cα, Cronbach's Alpha; CR, composite reliability; rho_A, Dijkstra-Henseler's rho; AVE, average variance extracted.

[a]*All loadings are significant at $p < 0.001$.*

[b]*Percentage of variance of item explained by the construct.*

(Henseler et al., 2018). In **Table 3**, the correlation among the construct was compared to the square root of the AVE (values in boldface). The outcome generated with the help of SmartPLS3 and Excel shows that the square root of AVE was all greater than the correlations among the constructs, revealing adequate discriminant validity.

Structural Model

The bootstrapping technique was used in this study to determine the relevance and importance of each hypothesis. The findings are presented in **Table 4** of statistically significant hypotheses acquired using the bootstrapping technique (304 responses, 5,000 samples with no sign change option). To confirm the relevance of hypotheses, t-statistic was utilized with two-tailed test (Hair et al., 2017). The results of the hypotheses testing show that all of the proposed hypotheses are supported (**Table 4**). According to the statistical results of PLS-SEM, GACE has a positive and significant impact on GRIN (H1; $\beta = 0.319$; $p < 0.05$), SHC also has positive and significant impact on GRIN (H2; $\beta = 0.680$; $p < 0.01$) and similarly OS (H3; $\beta = 0.595$; $p < 0.001$), thus supporting H1, H2, and H3. Finally, GRIN has a positive and significant impact on ENP (H4a; $\beta = 0.933$; $p < 0.001$), ECP (H4b; $\beta = 0.958$; $p < 0.001$) and SOCP (H4c; $\beta = 0.956$; $p < 0.001$); thus H4a, H4b and H4c are accepted. Detailed results are also displayed in **Figure 2**. Additionally, the standardized root means square residual (SRMR) value is 0.044, less than the threshold limit of 0.08, indicating an excellent model fit. The SRMR index was used to verify the overall goodness-of-fit score for structural model validation in this study (Hair et al., 2017).

Multi-Group Analysis (Firm Size)

An MGA was used to examine the impact of the variables between the different groups. There are four techniques to analyze these groups, according to Sarstedt et al. (2013): parametric, permutation, confidence-based, and Henseler's multi-group approach. Henseler (2012) provided an even more developed adaptation for the latter, the PLS-MGA technique (Multi-Group Analysis), which indicates significant differences between groups when they are less than 0.05 or greater than 0.95. The authors employed a percentile bootstrapping method to examine the differences between the two groups of firms in this study. As previously stated, the authors received 304 replies in this survey, with 189 responses coming from medium-sized businesses and the remaining 115 from small businesses.

TABLE 3 | Co-relation matrix.

	ECP	ENP	GAC	GRIN	OS	SOCP	SHC
Economic performance	**0.875**						
Environmental performance	0.846	**0.855**					
Green absorptive capacity	0.820	0.814	**0.908**				
Green innovation	0.957	0.933	0.855	**0.879**			
Organization support	0.874	0.890	0.883	0.858	**0.887**		
Social performance	0.992	0.965	0.816	0.955	0.822	**0.748**	
Sustainable human capital	0.831	0.801	0.953	0.888	0.860	0.654	**0.884**

Entries shown in boldface represent the square root of the AVE (average variance extracted). GAC, green absorptive capacity; SHC, sustainable human capital; OS, organizational support; GRIN, green innovation; ENP, environmental performance; ECP, economic performance; and SOCP, social performance.

TABLE 4 | Hypothetical relationships.

Hypothesis	Structural path	Standardized path coefficient	*t*-value	Significant difference ($p < 0.05$)?	Findings
H1	GAC → GRIN	0.319	1.372	**0.042***	Supported
H2	SHC → GRIN	0.680	3.379	**0.001****	Supported
H3	OS → GRIN	0.595	5.706	**0.000*****	Supported
H4a	GRIN → ENP	0.933	47.105	**0.000*****	Supported
H4b	GRIN → ECP	0.958	35.785	**0.000*****	Supported
H4c	GRIN → SOCP	0.956	34.367	**0.000*****	Supported

*GAC, green absorptive capacity; SHC, sustainable human capital; OS, organizational support; GRIN, green innovation; ENP, environmental performance; and ECP, economic performance. *p < 0.05, **p < 0.01, ***p < 0.001.*

As a result, the authors checked the moderating role of firm size in the model. When the value of p was greater than 95 percent or less than 5 percent, the results demonstrated a significant intergroup difference with a 5 percent margin of error. A percentile of less than 5% implies that the bootstrap result for group A (Medium Size firm) is better than that of group B (Small Size Firm). A percentile exceeding 95% shows that the yield of group B is higher than that of group A (**Table 5**).

The PLS-MGA value of p results shows that there are significant differences between medium and small SMEs. Our study found a significant difference in H1 ($p = 0.249 < 0.05$), which means that the relationship between GAC and GRIN is stronger in medium-sized firms than in small-size firms. In addition, our study also found a significant difference in H4 (a) ($p = 0.047 < 0.05$), which shows that the relationship between GRIN and environmental performance is stronger in medium-size SMEs in the comparison of small-size SMEs.

DISCUSSION AND CONCLUSION

This study explores the antecedents and consequences of GRIN in order to gain a better knowledge of the important success factors. Using the conceptual framework presented in **Figure 1**, this research hypothesizes to examine how GAC, SHC, and OS work together to improve GRIN and to explain the role of GRIN in achieving SBP in manufacturing industries that are trying to remain competitive in the face of changing innovative processes, government legal environmental pressures, and stakeholders demand. The cross-sectional survey results collected from 304 SMEs in Saudi Arabia validate and support all of the hypothesized relationships reported in **Table 4**.

Our study found that GAC has a significant relationship with GRINs; the results are similar to previous studies that mentioned that GAC enables firms to effectively manage environmental knowledge to improve the ability of firms to adopt GRINs (Chen et al., 2015; Qu et al., 2021). The study results suggest that Saudi manufacturing SMEs manage their core competencies and knowledge resources effectively and efficiently, thereby increasing GRIN and organizational performance. Sustainable human capital has a significant positive impact on GRIN consistent with prior studies (Weng and Lin, 2011; Zailani et al., 2014). The availability of skilled human resources in-house and managers' adherence to green practices are the primary factors pushing businesses to pursue GRIN (Lee, 2008; Wu et al., 2012). The study results suggest that managers' commitment to greening SMEs has been demonstrated in the context of Saudi SMEs, which means that this can be achieved when top management of SMEs are fully motivated to pursue GRIN goals. Sustainable human resource has a significant relationship with GRIN; the findings support previous research that determined that SHC positively influences the adoption of GRIN (Cowden et al., 2015; Ortega-Lapiedra et al., 2019; Singh et al., 2020). The results of this research show that the green behavior of employees has a positive effect on GRIN in manufacturing SMEs. In the case of Saudi Arabia, the skills, innovation, abilities, capacity, and responsibility of workers with respect to environmental security promote GRIN in Saudi manufacturing SMEs.

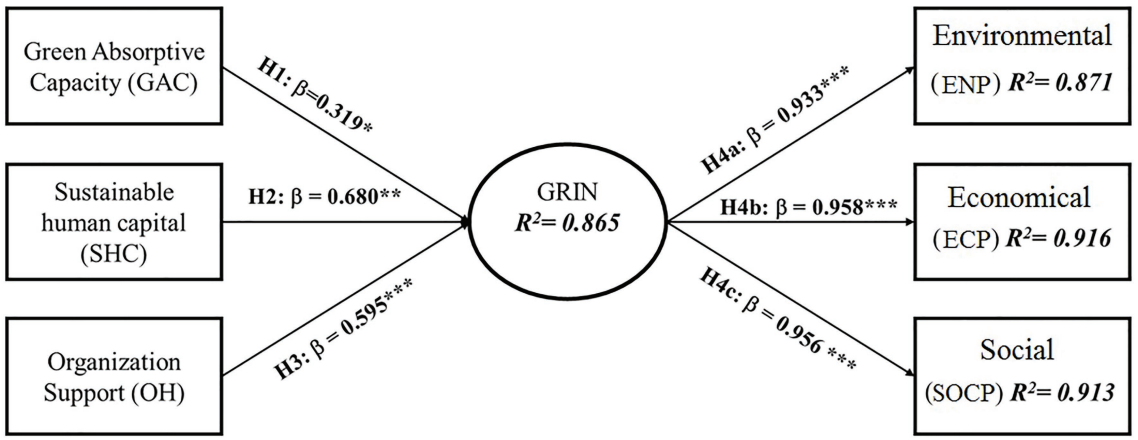

FIGURE 2 | Structural model results with beta values, *** denotes $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

TABLE 5 | Multi group analysis (firm size).

Relationships	Path (M)	Path (S)	Diff.	PLS MGA (*p*)
H1 GAC → GRIN	0.087	−0.162	0.249	0.045
H2 SHC → GRIN	0.120	0.064	0.056	0.661
H3 OS → GRIN	0.136	0.246	−0.110	0.636
H4(a) GRIN → ENP	−0.171	0.084	−0.255	0.159
H4(b) GRIN → ECP	0.247	0.296	−0.048	0.785
H4(c) GRIN → SOCP	0.940	0.892	0.047	0.013

GRIN, green innovation; ENP, environmental performance; SOCP, social performance; ECP, economical performance. Bold font: PLS-MGA value of p below 5% and above 95% indicates significant values. Diff., path coefficient differences.

This study found that the adoption of GRINs significantly affects Saudi SMEs' environmental, economic, and social performance. The results show that the adoption of GRIN can lead to a win-win situation so that SMEs can simultaneously increase their environmental, economic, and social performance. The relationship between GRIN and environmental performance was found significant; the findings of this study support past studies (Weng et al., 2015; García-Machado and Martínez-Ávila, 2019; Singh et al., 2020). The findings of this study suggest that GRIN adoption and better productivity enhance the environmental performance of Saudi manufacturing SMEs. In addition, this study recognizes that GRIN is a critical organizational resource used by SMEs to improve their environmental performance and gain goodwill among industry and stakeholders. The relationship between GRIN and economic performance was found to be significant; this finding supports past studies (Caracuel and Ortiz-de-Mandojana, 2013; Zailani et al., 2015; de Azevedo Rezende et al., 2019). The findings show that Saudi SMEs have realized that GRIN is a critical factor in financial performance. The results suggest that adopting GRINs will reduce pollution, waste, energy, and materials, and process improvements will improve the economic performance of Saudi manufacturing SMEs. The results also support the positive impact on social performance by GRIN, which also supports the stance of previous research conducted by Zailani et al. (2015), such that socially responsible firms are more active and committed to meeting environment-friendly consumer demands to reduce environmental damage (Albort-Morant et al., 2018). The results suggest that the adoption of GRIN will improve the goodwill of Saudi manufacturing SMEs among stakeholders, including employees, customers, and the general public, which will ultimately improve their social performance.

The moderating effect of firm size revealed the significant difference in the relationship between GAC and GRIN. Our study found that compared with small SMEs, medium-sized SMEs have a more substantial impact of GAC on GRIN; medium size SMEs have a better ability to accumulate and utilize knowledge regarding green practices due to their sufficient resources and strong infrastructure. A similar study revealed that large companies adopt GRIN more quickly than small ones (Andries and Stephan, 2019). Further, regarding the environmental performance, this study found a significant difference between medium and small size SMEs; according to the findings of this study, Saudi medium-sized SMEs believe that adopting green technology helps them accomplish environmental performance, which helps advance the firm's environmental image and CSR.

THEORETICAL IMPLICATIONS

This study makes several theoretically contributions. This research offers an unprecedented empirical approach to sustainable business performance in the SMEs industry of KSA by integrating previously separate strands of Innovation theory, Dynamic Capabilities theory, and organizational factors into the Triple-bottom line framework. The results of the study provide the following contributions. First, this study proposed a conceptual model based on NRBV that provides various new correlations to address the lack of prior literature in GRIN. This study proposed model by analyzing several essential subcomponents, such as GAC, SHC, OS on GRIN adoption, and sustainable

performance. Such a combination of constructs in a single model is missing in the existing GRIN studies, particularly in manufacturing SMEs. Secondly, Absorptive capacity is a necessary capability for responding to environmental changes in the modern-day. This study establishes that GAC has a significant impact on GRIN and the SBP, both directly and indirectly. Since Cohen and Levinthal (1990) introduced the concept of absorptive capacity, many studies on absorptive capacity have developed within the topic of innovation theory (Ali and Park, 2016; Ali et al., 2020). Although previous research has established the positive effects of absorptive capacity on innovation performance, the role of GAC on GRIN needs more investigation (Chen et al., 2014; Qu et al., 2021). Additionally, just a few academics have applied absorptive capacity to the field of environmental management and GRIN research. Hence, to overcome the gaps in the current literature, this research examined GAC and GRIN in the manufacturing industry within the framework of SMEs. Furthermore, this study also explains how GAC affects GRIN and tries to find a new way to promote GRIN in organizations alongside SHC and OS.

Thirdly, our research found that GRIN is a significant determinant of SBP and all of its dimensions that contribute to protecting the environment and SD; however, GRIN has a strong significant effect on the economic and social dimensions of SBP. As a result, this study adds to the NRBV in a developing economy context by demonstrating that GRIN continues to be an important factor in determining sustainable performance. Furthermore, this empirical study is the first to examine the moderating effect of firm size on GAC, SHC, OS, GRIN, and SBP. According to the results of this study, firm size could also be regarded as a moderator to investigate GRIN and sustainable business performance.

PRACTICAL IMPLICATIONS

This study has numerous practical implications for the managers and policymakers that sustained the competitive advantage of SMEs. First, from the perspective of GAC, this study found that it has a significant impact on the GRIN of the manufacturing SMEs in Saudi Arabia. Firms should increase their efforts to cultivate GAC. They need to develop their absorptive capacity to a strategic and tactical level, develop an internal knowledge management system, and conduct formal and informal training and knowledge sharing activities within departments. Organizations must foster an environment conducive to learning and collaboration throughout the organization in order to encourage and enhance employees' knowledge acquisition, assimilation, and application capabilities, as well as their creative ability to develop environmentally friendly products, services, and processes, enhance their attentiveness to and awareness of external knowledge and acquire new information and technical resources from external sources. Additionally, competent government authorities should actively promote and guide organizations to connect with and collaborate with academics and scientific research centers. Simultaneously, they should publicize the newest industrial policies and trends, foster collaboration and innovation, and develop knowledge management systems to help local SMEs and entrepreneurial firms improve their overall GRIN performance. Further, senior management, employees, suppliers and customers are well aware of environmental and sustainability issues. The research also helps practitioners and is useful to managers to understand environmental, social and economic performance. In addition, the use of this model in manufacturing in developing countries is expected to improve the ability of organizations to pursue cleaner production and use green human capital as a strategy for achieving sustainable results.

LIMITATIONS AND FUTURE DIRECTIONS

This study has limitations, despite providing unique and valuable insights for scholars and practitioners. The sample was obtained from a one country, therefore limiting the findings' generalizability to other countries. Future research may include longitudinal surveys from other nations at various phases of development (e.g., developed vs. developing) and from other cultures (e.g., Western vs. Eastern). Additionally, organizational culture may be influenced by national culture, which varies substantially from country to country (Yang et al., 2017). Researchers can compare mean responses and the strength of relationships using such multi-country analysis, contributing to a more holistic understanding of GRIN and its consequences. Additionally, this study covered only manufacturing SMEs, implying that additional research on services and non-manufacturing SMEs is necessary to understand this hot issue better.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material; further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

YB, YS, and MB contributed to the conceptualization, formal analysis, investigation, methodology, writing of the original draft, and writing review and editing. All authors contributed to the article and approved the submitted version.

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Mapping Innovation Research in Organizations: A Bibliometric Analysis

*Renzhong Peng[1], Jingshuang Chen[1] and Weiping Wu[2]**

[1] School of Foreign Languages, Huazhong University of Science and Technology, Wuhan, China, [2] School of Foreign Languages, Wuhan University of Technology, Wuhan, China

This essay conducts a bibliometric study on innovation research in organizations within the three levels (i.e., individual, work team, and organizational) by using CiteSpace software to analyze 6,354 academic articles from the year 2000 to 2020 in four aspects: temporal distribution of published papers, scientific community (countries/regions/cited authors), intellectual structure (cited journals/cited references), and research hotspots. The research findings show that the total number and the growth rate of publications at the organizational level are far higher than the other two levels (individual and work team). The top three countries with the number of publications are United States, China, and United Kingdom. The top five highly cited authors are identified and listed from individual, work team, and organizational levels. *Academy of Management Journal* and *Academy of Management Review* are the top two highly cited journals at all three levels (i.e., individual, work team, and organizational levels). The most highly cited articles at the three levels are about topics of linking empowering leadership and employee creativity, team-level predictors of innovation at work, and organizational ambidexterity. The top three research hotspots are identified and listed from individual, work team, and organizational levels. These findings provide snapshots and comparisons of innovation research in management within the three levels (i.e., individual, work team, and organizational levels), which might be beneficial for researchers and scholars to understand and explore innovative behavior in organizations from a multilevel perspective.

Keywords: innovation, creativity, organizations, bibliometric analysis, CiteSpace

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****Correspondence:***
Weiping Wu
wuweiping@whut.edu.cn

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INTRODUCTION

Serving as a critical source of competitive advantage in organizations, innovation research has been deeply explored among researchers in management (Anderson et al., 2014). Research on innovation in organizations originates from the late 1960s, in which scholars conducted innovation research from an organizational perspective, especially in the healthcare industry, focusing on innovation diffusion (Walker, 1969) and centralization in organizations (Zaltman et al., 1973). From the early 1980s to the late 1990s, many studies expanded topics from the organizational level, such as innovation processes (Kimberly, 1981; Woodman et al., 1993; Amabile, 1997) and innovation determinants (complexity of structure, size, slack resources, and culture) (Rogers et al., 1983; Damanpour, 1991; West and Anderson, 1992), to the individual and work team levels

involving personality characteristics (Barron and Harrington, 1981), motivation (Amabile, 1983), cognitive abilities (Kirton, 1999), team structure (West and Anderson, 1996), team climate (West and Anderson, 1996), and team processes (West, 1990). As innovation at the individual and work team levels has generally been studied in terms of the factors that determine creativity (Gupta et al., 2007), there is considerable overlap between research on innovation and creativity in organizations. Thus, the differences between creativity and innovation at these two levels are ignored in this study. Since the twenty-first century, innovation research has been undertaken from a multilevel perspective involving topics such as task and goal interdependence (Van der Vegt and Janssen, 2003), job characteristics (Baer et al., 2003), transformational leadership (Shin et al., 2012), social network (Shalley and Perry-Smith, 2008), and reflexivity climate (Jung et al., 2003).

Following a large number of articles on innovation in organizations at different levels, this article reviewed and synthesized these findings performed over the last decades through the use of a bibliometric approach. As the application of mathematics and statistical methods to the study of scientific publications (Leydesdorff, 1995), a bibliometric analysis is more objective and efficient than traditional qualitative analysis methods. There have been some previous bibliometric studies of innovation research, which mainly focused on reviewing some sub-topics of innovation, such as frugal innovation (Dangelo and Magnusson, 2021), open innovation (Randhawa et al., 2016), inclusive innovation (Mortazavi et al., 2021), and new product development (Marzi et al., 2021), or reviewing a specific journal related to innovation research, such as *Journal of Product Innovation Management* (Durisin et al., 2010; Antons et al., 2016; Sarin et al., 2018). To provide a comprehensive and systematic overview of innovation research in organizations, this study adopted CiteSpace, a widely used bibliometric mapping software to analyze the distribution of research publications, the scientific community (countries/regions/cited authors), intellectual structure (cited journals/cited references), and research hotspots. This study has involved a total of 6,354 articles (including the analysis of the related bibliographies, which correspond to approximately 234,000 references) published between 2000 and 2020.

As for the classification of innovation levels, despite the verified literature across management field of study, their meanings are basically the same, such as individual innovation and employee innovation, work team innovation, and work group innovation. Therefore, this study categorizes the three levels of innovation as the individual, work team, and organizational levels. The identified knowledge framework for innovation research at the three levels is beneficial for scholars to understand and explore the frontier of innovation research.

MATERIALS AND METHODS

Research Questions

In the past two decades, innovation research in the field of management has emerged in an enormous amount, requiring scientific and systematic literature analysis. In doing so, the scientific community (countries/regions/cited authors), knowledge structure (cited journals/cited references), and research hotspots have been the main indicators for doing bibliometric analysis in the literature review (Pan et al., 2018). Accordingly, we investigated the following research questions:

RQ1. What is the distribution of research publications of innovation research at different levels (individual, work team, and organizational levels)?

RQ2. What is the scientific community of innovation research at different levels (individual, work team, and organizational levels)?

RQ3. What is the intellectual structure of innovation research at different levels (individual, work team, and organizational levels)?

RQ4. What are the research hotspots of innovation research at different levels (individual, work team, and organizational levels)?

Data Collection

This article chose the subjects from articles in the Web of Science-Social Science Citation Index (SSCI) database. First, we preliminary searched the keywords "innovation, innovative, innovativeness, creative, and creativity" at different levels (individual, team, and organizational levels). The qualified keywords at the three levels were input as "employee, individual, work team, work group, and organizational." For example, the search formula for innovation articles at the work team level was [TS = (*innovation* OR *innovative* OR *innovativeness* OR *creative* OR *creativity*) AND (*work team* OR *work group*)]. Second, during the data refining process, the time span was set from 2000 to 2020, the document type was set as "article," the research area was set as "management," and the language was set as "English." Third, some articles not directly related to innovation or not mainly focused on innovation were removed through manual filtering. Meanwhile, the classification level was further determined through screening the abstracts of articles. Finally, we obtained a total of 6,354 articles, including 923 articles at the individual level, 1,205 articles at the work team level, and 4,226 articles at the organizational level.

Statistical Analysis

The retrieved data were organized and analyzed by a set of different bibliometric analysis tools. First, the research publications on different levels of innovation research were displayed in a time-distributed manner by using the line chart. Second, the data from each level of innovation research were imported into CiteSpace software version 5.6.R2 for mapping countries (regions), cited authors, cited journals, cited references, and research hotspots so as to detect and visualize the research trends. In the knowledge map, the size of the node indicates the number of publications, and the number of concentric circles in the node indicates publication time. Moreover, the number of connections between one node and other nodes

in the network is measured by centrality, which reflects the importance of that node (Chen, 2006). Finally, the research results were discussed.

RESULTS AND DISCUSSION

Distribution of Research Publications

Figure 1 shows the diachronic changes in the volume of innovation research publications at different levels (individual, work team, and organizational levels) during 2000–2020. Although the number of published papers on innovation research at all three levels shows an overall increasing trend, the total number and the growth rate of publications at the organizational level are far higher than the other two levels (N_i = 923, N_t = 1,205, N_o = 4,226; R_i = 5.86%; R_t = 4.76%; R_o = 15.57%).[1] As the pressure for organizational change has increased with progressing globalization and competition in the twenty-first century, the growing attention has been attached to organizational innovation (Poole and Van de Ven, 2004). After 6 years of steady development, the number of organizational innovation publications increased sharply from 2006 to 2011 (the number of publications increases from 95 to 297), which may result from a wave of mergers and acquisitions (M&As) around 2006 (Bhaskaran, 2006; Calipha et al., 2010). Through a slight decline in the number of organizational innovation articles from 2011 to 2013 (the number of publications increases from 297 to 256), the volume of articles rose constantly from 2013 to 2020 (the number of publications increases from 256 to 379), which reflects the fierce competition among enterprises from the change of the business environment and the tough challenge from new internet technology use and connection.

Scientific Community

Publication Countries (Regions)

Figure 2 shows the knowledge maps of publication countries (regions) of innovation research at different levels (individual, work team, and organizational levels), and **Table 1** lists the top 10 publication countries (regions). As shown in **Figure 2** and **Table 1**, the top three high publication countries at all the three levels of innovation research are United States, China, and United Kingdom.

From **Figure 2** and **Table 1**, United States was the highest-ranked country in the number of publications at the three levels, due to its four outstanding research institutions: University of Maryland, Harvard University, Michigan State University, and University of Pennsylvania. Specifically, the main contributors at the University of Maryland are Anil Gupta and Kathryn Bartol, both from the Center for Leadership, Innovation, and Change (CLIC), who are concerned with topics such as transformational leadership, individual skill development, team knowledge, and multiple-level innovation. At Harvard University, Teresa Amabile, Amy Edmondson, and Michael Tushman make prominent achievements in the work team and organizational innovation, whose research interests are team innovation process, psychological safety, strategic innovation, and open innovation. In addition, scholars such as Frederick Morgeson and Adam Grant from Michigan State University

[1] N_i, N_t, and N_o represent the total number of publications at different levels (individual, work team, and organizational levels). R_i, R_t, and R_o represent the mean growth rate of publications at different levels (individual, work team, and organizational levels).

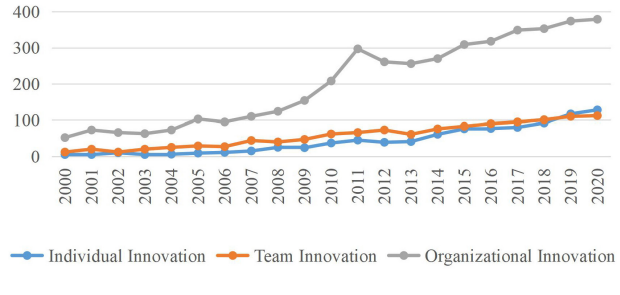
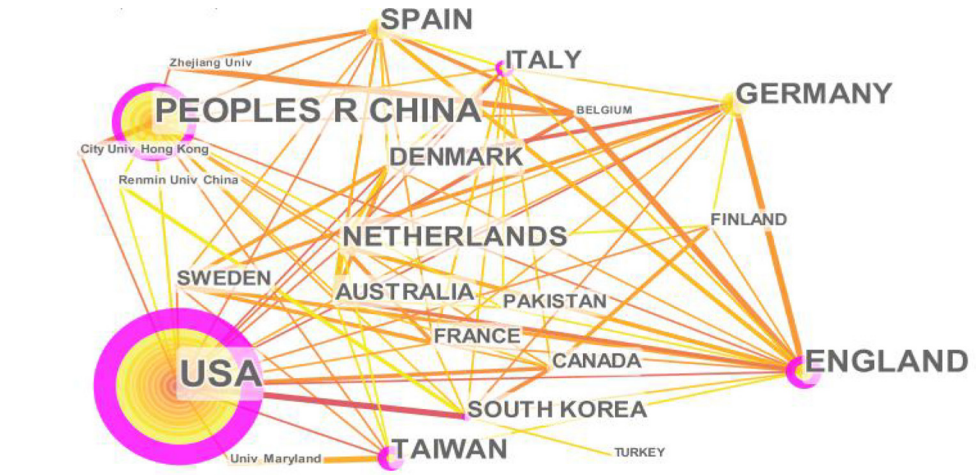


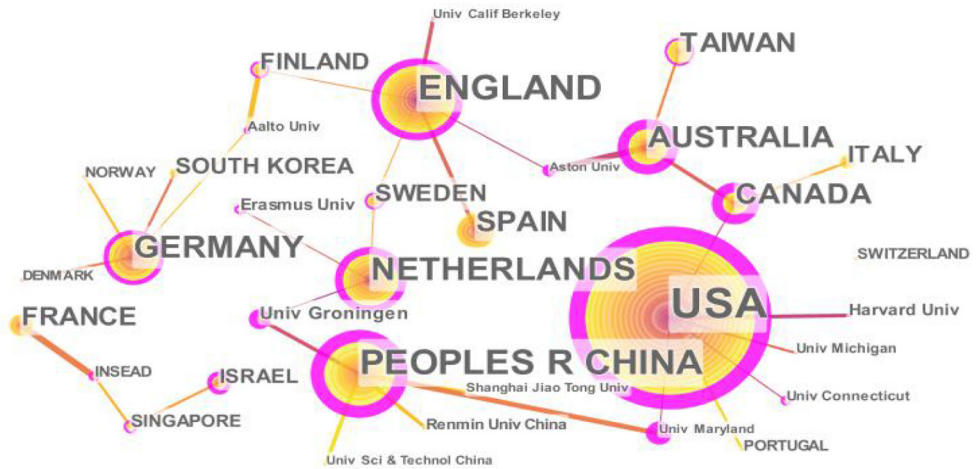
FIGURE 1 | Annual publication volume of innovation research at different levels (2000–2020).

TABLE 1 | Top 10 publication countries (regions) of innovation research at different levels.

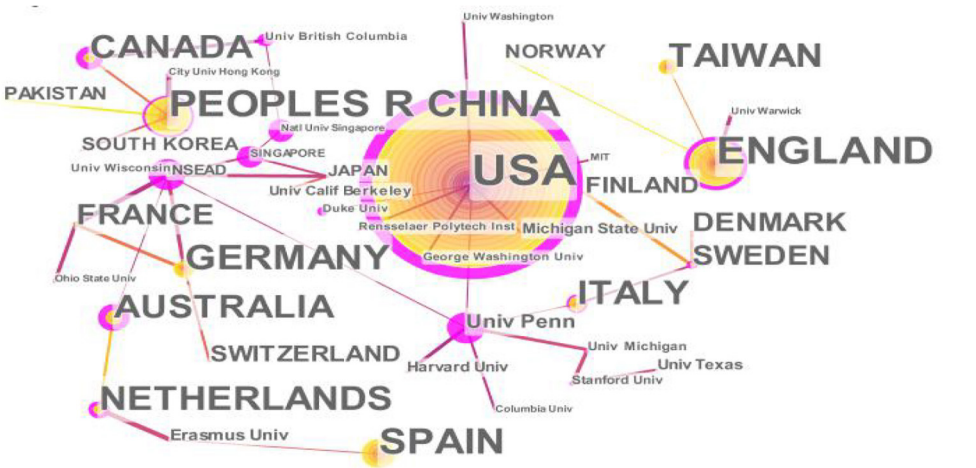
Level	Rank	Research countries (regions)	Number of publications	Centrality
Individual	1	United States	255	0.88
	2	China	151	0.24
	3	United Kingdom	92	0.36
	4	Spain	78	0.04
	5	Germany	72	0.02
	6	Taiwan	60	0.24
	7	Netherlands	59	0.08
	8	Italy	45	0.17
	9	Denmark	37	0.01
	10	Australia	32	0.04
Work team	1	United States	482	1.17
	2	China	152	0.92
	3	United Kingdom	149	0.46
	4	Netherlands	91	0.46
	5	Germany	89	0.25
	6	Australia	72	0.61
	7	Canada	51	0.66
	8	Spain	50	0.02
	9	Taiwan	42	0.12
	10	France	39	0.06
Organizational	1	United States	1,372	0.88
	2	United Kingdom	543	0.25
	3	China	406	0.19
	4	Spain	350	0.00
	5	Germany	261	0.06
	6	Italy	243	0.18
	7	Netherlands	230	0.34
	8	Taiwan	228	0.00
	9	Australia	195	0.40
	10	Canada	174	0.47



Individual



Work team



Organizational

FIGURE 2 | Knowledge maps of countries (regions) of innovation research at different levels.

and the University of Pennsylvania mainly focus on leader–member exchange and intrinsic and prosocial motivations at the organizational level.

China ranks second at the individual and work team level and third at the organizational level, mainly contributed by three universities, namely, City University of Hong Kong, Renmin University of China, and Shanghai Jiao Tong University. Among these institutions, researchers such as Aurelia Mok, Kwok Leung, and Kwaku Atuahene-Gima from the City University of Hong Kong are interested in individual and organizational innovation, with their contributions in bicultural individuals' creative styles, interpersonal harmony, and product innovation strategy. At Renmin University of China and Shanghai Jiao Tong University, researchers such as Jun Liu, Xiao-Hua Wang, and Ali Ahmad Bodla are dedicated to the work team level involving topics such as leadership style, social networks, and team diversity.

United Kingdom ranks third at the individual and work team level and second at the organizational level, primarily due to the contributions of three prominent institutions, namely, the University of Warwick, Aston University, and the University of Cambridge. At the University of Warwick, Jacky Swan from Innovation, Knowledge and Organizational Networks Research Unit (IKON) and Stephen Roper from the Department of Entrepreneurship & Innovation are the main contributors, with a focus on knowledge management, organizational learning, and networks of practice. At Aston University, Claudia Sacramento with her research team of the Entrepreneurship & Innovation has conducted various research on the determinants of effective team innovation, including bureaucratic practices and challenge stressors. At the University of Cambridge, Letizia Mortara from the Institute for Manufacturing and Shahzad Ansari from Cambridge Judge Business School have done some meaningful and influential research on open innovation and radical innovation in organizations.

Cited Authors

The knowledge maps of the highly cited authors of innovation research at different levels (individual, work team, and organizational levels) are shown in **Figure 3**, and **Table 2** lists the top 10 highly cited authors.

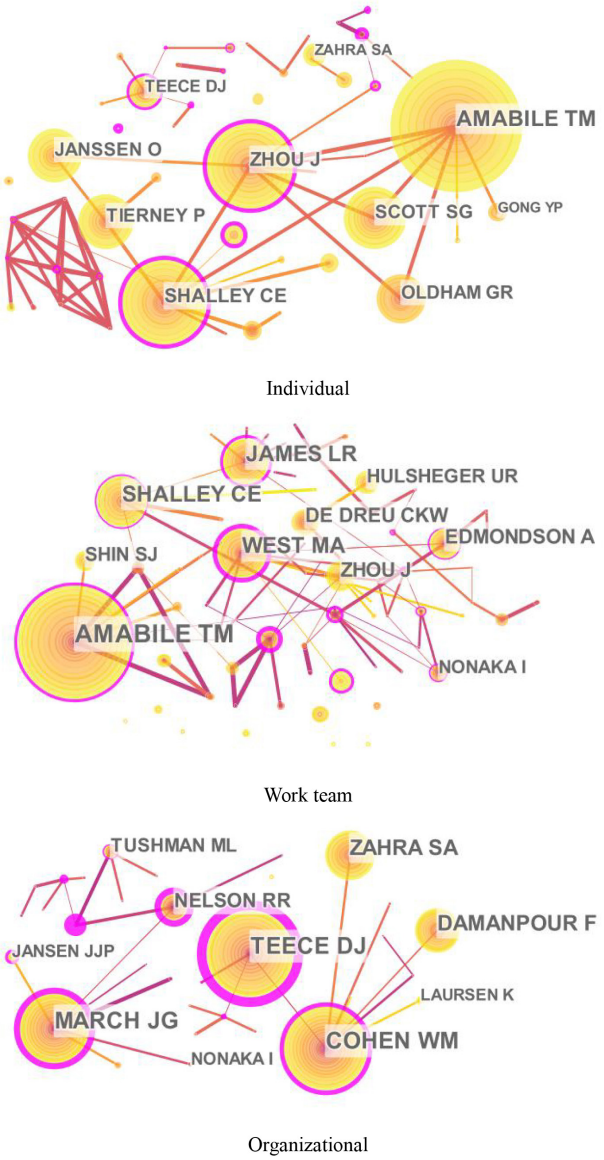


FIGURE 3 | Knowledge maps of the cited authors of innovation research at different levels.

At the individual level, Teresa Amabile, Jing Zhou, Christina Shalley, Susanne Scott, and Onne Janssen are the top five highly cited scholars (see **Figure 3** and **Table 2**). Teresa Amabile, from Harvard Business School, is the most highly cited author of individual innovation with the centrality of 0.10. By integrating individual creativity with the organizational work environment, she proposed the componential theory of organizational creativity and innovation and explored methods to evaluate creativity, motivation, and working environment through empirical research (e.g., Amabile, 1997). Her recent research investigated how everyday work life influenced individual creative performance, including factors such as identification with work, the meaning of work, life structure, key relationships, and participation in creative activities (Amabile, 2017). The second highly cited author is Jing Zhou from Rice University. Her major contributions are on developing the dual adjustment model of emotions for creativity in a supportive environment (George and Zhou, 2007). She is also dedicated to studying the interaction of personal and situational factors to facilitate or inhibit creativity, including job dissatisfaction, openness to experience, and conscientiousness. The third highly cited author is Christina Shalley from the Georgia Institute of Technology. Her main contribution is exploring the characteristics of work that affect innovative behavior, such as time deadlines and goals, work environment, and job complexity. Moreover, she proposed the centrality-creativity spiral model and emphasized the importance of both static and dynamic social networks to individual creativity (Perry-Smith and Shalley, 2003). Both the fourth highly cited author, Susanne Scott, and the fifth highly

cited author, Onne Janssen, investigated determinants and path model of innovative behavior in the workplace, including factors such as leadership, individual problem-solving style, and job demands (Scott and Bruce, 1994; Janssen, 2000).

At the work team level, Teresa Amabile, Michael West, Lawrence James, Christina Shalley, and Amy Edmondson are the top five highly cited scholars (see **Figure 3** and **Table 2**). Teresa Amabile ranks the first place with centrality (0.29) in the work team innovation. Her research interest has gradually expanded to the work team level since the twenty-first century, focusing on collaboration and helping in creative teams. Furthermore, she introduced four new constructs into the componential model of creativity and innovation in organizations: a sense of progress in creative idea development; the meaningfulness of the work to those carrying it out, affect, and synergistic extrinsic motivation (Amabile and Pratt, 2016). Both the second highly cited author, Michael West, and the fifth highly cited author, Amy Edmondson, focused on the innovation process of work team. The former made multiple contributions to the measurement of team climate, the Team Climate Inventory (TCI) (Anderson and West, 1998), and the team reflection theory, which shows how team reflection, planning, and action predict both team effectiveness and innovation in teams (West, 2000). The latter is mainly dedicated to explaining the definition and mechanism of psychological safety in innovation teams (Edmondson and Mogelof, 2006). Lawrence James ranks third with the number of citations. He made great contributions to the estimation methods in groups and laid the foundation for the measurement and explanation of team climate (James and Jones, 1974). The fourth highly cited author is Christina Shalley, who mainly contributes to detecting the relationship between the social network and team innovation: diverse personal ties outside of the team facilitate team creativity, especially outside ties with nationality-heterogeneous individuals and weak outside ties (Shalley and Perry-Smith, 2008).

TABLE 2 | Top 10 highly cited authors of innovation research at different levels.

Level	Rank	Number of citation	Centrality	Cited author
Individual	1	248	0.10	Teresa Amabile
	2	159	0.44	Jing Zhou
	3	157	0.53	Christina Shalley
	4	114	0.00	Susanne Scott
	5	105	0.01	Onne Janssen
	6	104	0.04	Pamela Tierney
	7	95	0.03	Greg Oldham
	8	62	0.35	David Teece
	9	45	0.00	Shaker Zahra
	10	39	0.00	Yaping Gong
Work team	1	375	0.29	Teresa Amabile
	2	182	0.45	Michael West
	3	174	0.26	Lawrence James
	4	167	0.15	Christina Shalley
	5	112	0.10	Amy Edmondson
	6	105	0.06	Jing Zhou
	7	95	0.03	Carsten De Dreu
	8	79	0.00	Ute Hülsheger
	9	76	0.00	Shung Jae Shin
	10	73	0.17	Ikujiro Nonaka
Organizational	1	1,065	1.14	David Teece
	2	1,011	0.58	Wesley Cohen
	3	885	0.65	James March
	4	604	0.00	Shaker Zahra
	5	598	0.00	Fariborz Damanpour
	6	363	0.72	Richard Nelson
	7	245	0.18	Michael Tushman
	8	129	0.00	Ikujiro Nonaka
	9	122	0.26	Justin Jansen
	10	93	0.00	Keld Laursen

At the organizational level, David Teece, Wesley Cohen, James March, Shaker Zahra, and Fariborz Damanpour are the top five highly cited scholars (see **Figure 3** and **Table 2**). David Teece, the top-ranked scholar from the Haas School of Business, University of California, made great contributions to the definition and application of organizational dynamic capabilities, which is an important scholar of innovation performance (Teece, 2007). Moreover, other works done by David Teece deal with issues of facilitating innovation from business models and strategies and profiting from innovation. The second highly cited author is Wesley Cohen from the Fuqua School of Business, Duke. His main contribution is that he proposes the concept of "absorptive capacity" and explores its impact on related innovation activities, including basic research, the adoption and diffusion of innovations, and decisions to participate in cooperative R&D ventures (Cohen and Levinthal, 1990). His other efforts in exploring determinants of innovative activity and performance are also significant, including firm learning, market structure, and firm size. The third highly cited author is James March, who is a theoretical pioneer in the field of organizational innovation research. His major contributions are on organizational learning and decision-making, especially the delicate trade-off between exploration and exploitation (March, 1991). Shaker Zahra ranks fourth, whose research centered on international entrepreneurship, dynamic capabilities, and innovation strategy in organizations (Zahra and George, 2002). The fifth highly cited author is Fariborz Damanpour, who mainly contributes to exploring antecedents, processes, and outcomes of innovation in organizations, such as the relationship between organizational size and innovation (Damanpour, 1992), the characteristics of innovation adoption (Damanpour and Schneider, 2009), and the impact of different types of innovation on organizational performance (Damanpour et al., 1989).

Intellectual Structure

Cited Journals

The knowledge maps of the highly cited journals of innovation research at different levels (individual, work team, and organizational levels) are shown in **Figure 4**, and **Table 3** lists the top 10 highly cited journals. These active journals in **Figure 4** and **Table 3** indicate that innovation research involves a wide range of disciplines such as psychology, organizational behavior, organization science, and strategic management.

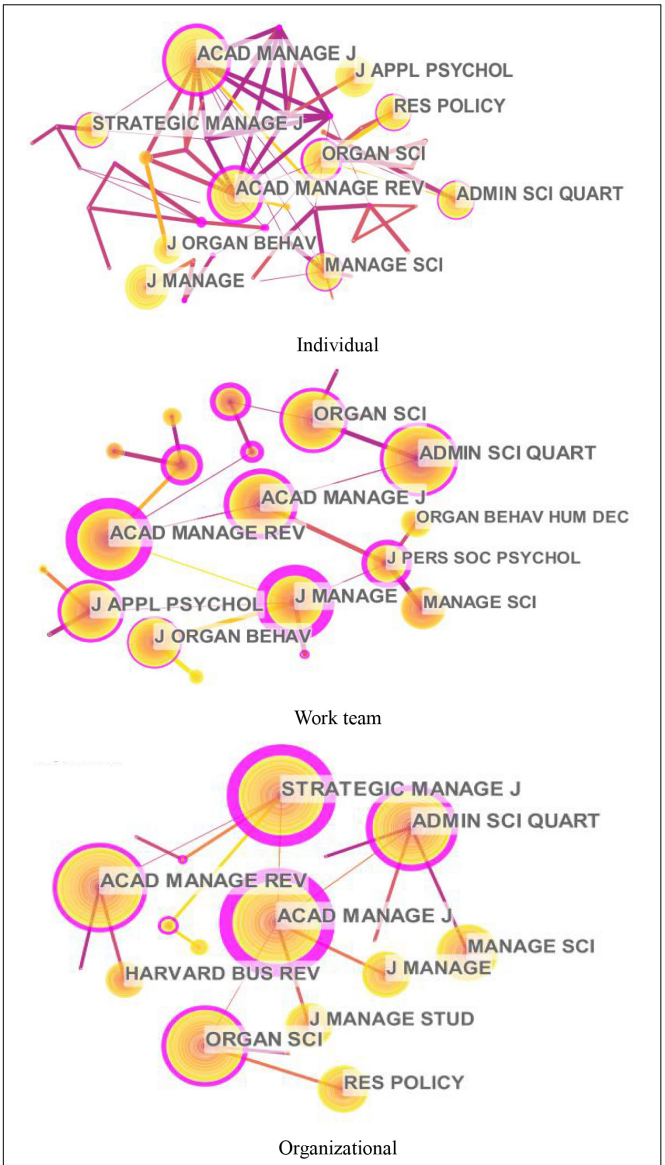


FIGURE 4 | Knowledge maps of the cited journals of innovation research at different levels.

TABLE 3 | Top 10 highly cited journals of innovation research at different levels.

Level	Rank	Number of citation	Centrality	Cited journal
Individual	1	617	0.49	*Academy of Management Journal*
	2	538	0.53	*Academy of Management Review*
	3	456	0.00	*Journal of Management*
	4	422	0.14	*Administrative Science Quarterly*
	5	422	0.38	*Organization Science*
	6	394	0.00	*Journal of Applied Psychology*
	7	390	0.16	*Research Policy*
	8	389	0.14	*Strategic Management Journal*
	9	378	0.15	*Management Science*
	10	284	0.00	*Journal of Organizational Behavior*
Work team	1	890	0.49	*Academy of Management Journal*
	2	834	1.05	*Academy of Management Review*
	3	763	0.40	*Administrative Science Quarterly*
	4	705	0.38	*Organization Science*
	5	691	0.29	*Journal of Applied Psychology*
	6	688	1.06	*Journal of Management*
	7	506	0.15	*Journal of Organizational Behavior*
	8	390	0.00	*Management Science*
	9	335	0.42	*Journal of Personality and Social Psychology*
	10	275	0.00	*Organizational Behavior and Human Decision Processes*
Organizational	1	3,053	1.46	*Academy of Management Journal*
	2	3,043	0.46	*Academy of Management Review*
	3	2,975	1.26	*Strategic Management Journal*
	4	2,806	0.46	*Organization Science*
	5	2,788	0.66	*Administrative Science Quarterly*
	6	2,282	0.00	*Management Science*
	7	2,052	0.00	*Research Policy*
	8	2,043	0.00	*Journal of Management*
	9	1,821	0.00	*Journal of Management Studies*
	10	1,693	0.00	*Harvard Business Review*

At the individual level, the top five highly cited journals are *Academy of Management Journal*, *Academy of Management Review*, *Journal of Management*, *Administrative Science Quarterly*, and *Organization Science* (see **Figure 4** and **Table 3**). Among these journals, the top two highly cited journals, *Academy of Management Journal* (*AMJ*) and *Academy of Management Review* (*AMR*), cover a wide range of innovative topics from the macro-level to micro-level. However, *AMJ* attaches more importance to empirical research, while *AMR* mainly focuses on theoretical research. The third and fourth highly cited journals are *Journal of Management (JOM)* and *Administrative Science Quarterly* (*ASQ*), both of which are published by SAGE and cover all the three levels of innovative research. *JOM* involves various disciplines such as organizational behavior, entrepreneurship, and human resource management, while *ASQ* is committed to organizational studies. *Organization Science* (*OS*) ranks fifth with a centrality of 0.38, covering innovative topics such as fairness expectations, dynamic capabilities, and decision-making in individual innovative performance.

At the work team level, the top five highly cited journals are *Academy of Management Journal*, *Academy of Management Review*, *Administrative Science Quarterly*, *Organization Science*, and *Journal of Applied Psychology* (see **Figure 4** and **Table 3**). The first two highly cited journals for work team innovation, *Academy*

of Management Journal (*AMJ*) and *Academy of Management Review* (*AMR*), are the same as the top two cited journals at the individual level, which are comprehensive management journals covering topics such as team creative efficacy, team learning behavior, and the process of group creativity. The third and fourth highly cited journals are *Administrative Science Quarterly* (*ASQ*) (0.40 centrality) and *Organization Science* (*OS*) (0.38 centrality). As the top journals in the fields of management and organization theory, *ASQ* and *OS* both receive interdisciplinary research from organizational behavior, psychology, and sociology, involving team innovation topics such as structural dynamism, national diversity, and psychological safety. As a vital journal of the American Psychological Association, *Journal of Applied Psychology* (*JAP*) ranks fifth, investigating work team innovation from the perspective of team development, processes, and effectiveness.

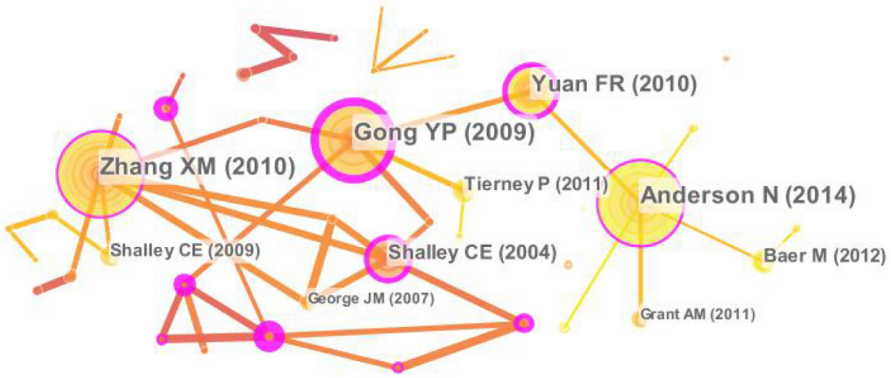
At the organizational level, the top five highly cited journals are *Academy of Management Journal*, *Academy of Management Review*, *Strategic Management Journal*, *Organization Science*, and *Administrative Science Quarterly* (see **Figure 4** and **Table 3**). The first two highly cited journals for organizational innovation, *Academy of Management Journal* (*AMJ*) and *Academy of Management Review* (*AMR*), are the same as the top two cited journals at the individual and work team level, covering topics such as organization structure, organizational policy, and human capital acquisition. The third highly cited journal is *Strategic Management Journal* (*SMJ*) with the centrality of 1.26. Specialized in strategic management, *SMJ* explores organizational innovation from the perspective of entrepreneurship, strategic resource allocation, and strategic decision processes. The other two journals are *Organization Science* (*OS*) and *Administrative Science Quarterly* (*ASQ*). In addition to the focus on work team innovation mentioned above, many innovation articles in *OS* and *ASQ* concern the organizational level involving topics such as organizational ambidexterity and collaborative innovation.

Cited References

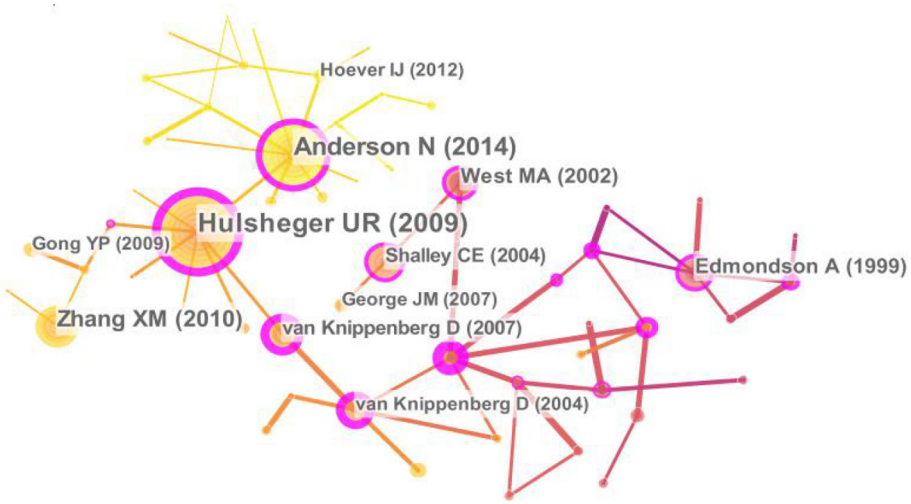
The knowledge maps of the highly cited references of innovation research at different levels (individual, work team, and organizational levels) are shown in **Figure 5**, and **Table 4** lists the top 10 highly cited references. These highly cited documents provide insights into theoretical knowledge, empirical evidence, and research pattern in innovation research at different levels.

Among the top five highly cited articles at the individual level (see **Figure 5** and **Table 4**), the second highly cited article, *Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework* (Anderson et al., 2014), and the fifth highly cited one, *The effects of personal and contextual characteristics on creativity*: *Where should we go from here* (Shalley et al., 2004), belong to literature review studies with traditional qualitative methods. The former provides insights into understanding how the range and variety of innovation research contribute to the various levels of analysis in organizations for scholars through a levels-of-analysis framework. The latter constructs a comprehensive model of employee creativity conducive to understanding the overall value and process of creative behaviors. The other three highly cited articles empirically test employee creativity with quantitative methods (e.g., questionnaires) and qualitative methods (e.g., focus group interview). Specifically, the first top highly cited one, *Linking empowering leadership and employee creativity: The influence of psychological empowerment, intrinsic motivation, and creative process engagement* (Zhang and Bartol, 2010), emphasizes the mediating role of empowering leadership on creativity via psychological empowerment, intrinsic motivation, which lays the foundation for further research and theory progress in investigating how empowering leadership can enhance innovative performance in organizations. The third top highly cited one, *Employee learning orientation, transformational leadership, and employee creativity: The mediating role of employee creative self-efficacy* (Gong et al., 2009), stresses the significant positive relationship among employee learning orientation, transformational leadership, and employee creativity. Their research findings not only provide evidence for researchers to confirm the practical value of studies on the antecedents of employee creativity but also offer constructive suggestions for managers to promote innovative performance by developing a learning orientation at the workplace. The fourth top highly cited one, *Innovative behavior in the workplace: The role of performance and image outcome expectations* (Yuan and Woodman, 2010), underlines the direct impact of outcome expectations of job performance and internal image of the organization on individual innovation behaviors. Their studies give substantial explanations for why employees are reluctant to innovate from the perspective of risks and benefits and offer solutions for managers to enhance employees' willingness to innovate from two aspects of the relevant job requirements and the positive social recognition.

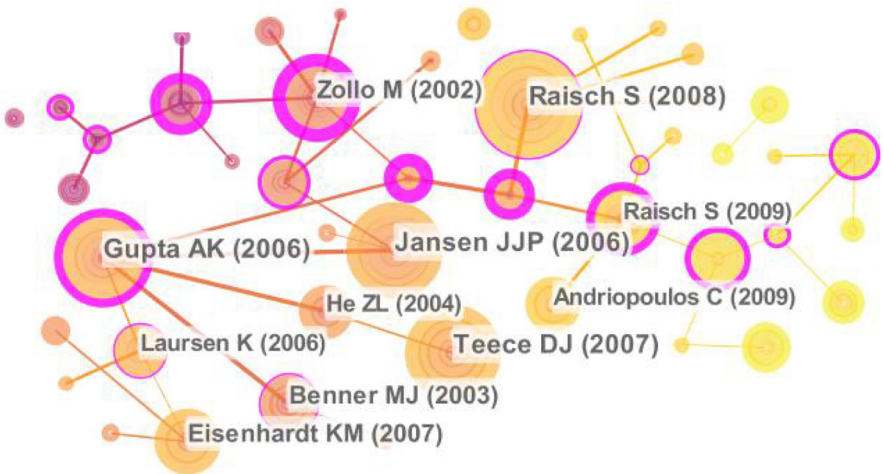
At the work team level (see **Figure 5** and **Table 4**), the first top highly cited article, *Team-level predictors of innovation at work: a comprehensive meta-analysis spanning three decades of research* (Hülsheger et al., 2009), makes the first meta-analysis study to comprehensively analyze the antecedents of innovation at the team level, which is conducive to promoting the theory construction and detecting future research directions of innovation research in work teams. The second top highly cited one, *Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework* (Anderson et al., 2014), provides multiple theoretical perspectives for researchers to further investigate work team innovation in organizations. The third top highly cited one, *Linking empowering leadership and employee creativity: The influence of psychological empowerment, intrinsic motivation, and creative process engagement* (Zhang and Bartol, 2010), provides guidance for cross-level innovation research by exploring the influence mechanism of team-level variables of empowering leadership on employee creativity. The fourth highly cited one, *Psychological safety and learning behavior in work teams* (Edmondson, 1999), indicates that the construction of team psychological safety is beneficial to understanding the collective learning process, proposes supplementary explanations for theories of team effectiveness, and lays an important theoretical foundation for examining the role of psychological safety in the innovation process. The fifth top highly cited one, *Sparkling fountains or*



Individual



Work team



Organizational

FIGURE 5 | Knowledge maps of the cited references of innovation research at different levels.

TABLE 4 | Top 10 highly cited references of innovation research at different levels.

Level	Rank	Number of citation	Cited references	Authors and years
Individual	1	54	Linking empowering leadership and employee creativity: The influence of psychological empowerment, intrinsic motivation, and creative process engagement	Zhang and Bartol, 2010
	2	54	Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework	Anderson et al., 2014
	3	48	Employee learning orientation, transformational leadership, and employee creativity: The mediating role of employee creative self-efficacy	Gong et al., 2009
	4	34	Innovative behavior in the workplace: The role of performance and image outcome expectations	Yuan and Woodman, 2010
	5	25	The effects of personal and contextual characteristics on creativity: Where should we go from here?	Shalley et al., 2004
	6	17	Creative self-efficacy development and creative performance over time	Tierney and Farmer, 2011
	7	17	Putting creativity to work: The implementation of creative ideas in organizations	Baer, 2012
	8	14	Interactive effects of growth need strength, work context, and job complexity on self-reported creative performance	Shalley et al., 2009
	9	12	The necessity of others is the mother of invention: Intrinsic and prosocial motivations, perspective taking, and creativity	Grant and Berry, 2011
	10	11	Dual tuning in a supportive context: Joint contributions of positive mood, negative mood, and supervisory behaviors to employee creativity	George and Zhou, 2007
Work team	1	86	Team-level predictors of innovation at work: a comprehensive meta-analysis spanning three decades of research	Hülsheger et al., 2009
	2	71	Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework	Anderson et al., 2014
	3	45	Linking empowering leadership and employee creativity: The influence of psychological empowerment, intrinsic motivation, and creative process engagement	Zhang and Bartol, 2010
	4	31	Psychological safety and learning behavior in work teams	Edmondson, 1999
	5	28	Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups	West, 2002
	6	26	Work group diversity	Van Knippenberg and Schippers, 2007
	7	25	The effects of personal and contextual characteristics on creativity: Where should we go from here?	Shalley et al., 2004
	8	20	Work group diversity and group performance: an integrative model and research agenda	Van Knippenberg et al., 2004
	9	19	9 Creativity in organizations	George, 2007
	10	17	Fostering team creativity: perspective taking as key to unlocking diversity's potential	Hoever et al., 2012
Organizational	1	88	Organizational ambidexterity: Antecedents, outcomes, and moderators	Raisch and Birkinshaw, 2008
	2	81	Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance	Teece, 2007
	3	80	Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators	Jansen et al., 2006
	4	69	The interplay between exploration and exploitation	Gupta et al., 2006
	5	53	Deliberate learning and the evolution of dynamic capabilities	Zollo and Winter, 2002
	6	50	Exploitation, exploration, and process management: The productivity dilemma revisited	Benner and Tushman, 2003
	7	47	Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis	He and Wong, 2004
	8	47	Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation	Andriopoulos and Lewis, 2009
	9	46	Organizational ambidexterity: Balancing exploitation and exploration for sustained performance	Raisch et al., 2009
	10	43	Open for innovation: the role of openness in explaining innovation performance among United Kingdom manufacturing firms	Laursen and Salter, 2006

stagnant ponds: An integrative model of creativity and innovation implementation in work groups (West, 2002), establishes a basic model containing the dynamic and interactive process of work group innovation and provides constructive suggestions for supervisors to lead teams to innovate from the perspective of task characteristics, different support during the innovation process, and development of skills. Among them, some contribute a lot for the theoretical discussion on innovation research at the

work team level and others enlighten scholars and researchers to further explore some influence mechanism of team-level variables and the construction of team psychological safety.

At the organizational level (see **Figure 5** and **Table 4**), the first top highly cited article, *Organizational ambidexterity: Antecedents, outcomes, and moderators* (Raisch and Birkinshaw, 2008), provides a multidisciplinary knowledge base of organizational ambidexterity by identifying its antecedents, moderators, and outcomes, which could accelerate cross-fertilization across various disciplines and lay a theoretical foundation for studying the impact of organizational ambidexterity on organizational innovation. The second top highly cited one, *Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance* (Teece, 2007), identifies the most critical capabilities of management, entrepreneurial managerial capitalism, for enterprise sustainable development by integrating the strategy and innovation literature. The third top highly cited one, *Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators* (Jansen et al., 2006), empirically tests exploratory and exploitative innovation with quantitative methods (e.g., questionnaires). Jansen et al. (2006) offered empirical evidence for researchers and managers to understand the complicated process of coordinating the development of exploratory and exploitative innovation in ambidextrous organizations. The fourth top highly cited one, *The interplay between exploration and exploitation* (Gupta et al., 2006), puts forward the central issues of exploration and exploitation, including definitions and connotations, orthogonality vs. continuity, ambidexterity vs. punctuated equilibrium, and duality vs. specialization, which is beneficial to better understanding how complex organizational systems can gain competitive advantages and further studying on exploratory innovation and exploitative innovation. The fifth top highly cited one, *Deliberate learning and the evolution of dynamic capabilities* (Zollo and Winter, 2002), stresses the role of deliberate learning (including experience accumulation, knowledge articulation, and knowledge codification processes) in the mechanisms of dynamic capabilities development in organizations, which advances the understanding the functions of dynamic capabilities on long-run enterprise success and provides theoretical foundations and empirical inquiry for studying the impact of dynamic capabilities on innovations.

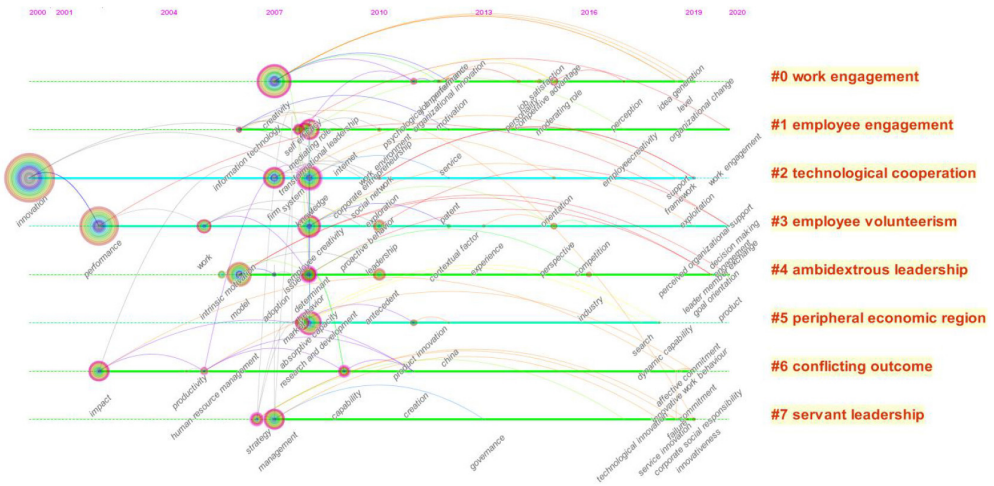
Research Hotspots

As keywords are the concentration and generalization of the core content of the literature, the analysis of keywords is beneficial to identify the research hotspots of a certain research field or discipline. After adopting the log-likelihood ratio (LLR) to cluster the keywords, 21 clusters were obtained (8 clusters at the individual level, 6 clusters at the work team level, and 7 clusters at the organizational level), and the detailed information of the clusters was listed in **Table 5**. These clusters were arranged along with horizontal timelines in **Figure 6**. As shown in **Figure 6** and **Table 5**, the most frequent clustering labels in the three levels are about knowledge management process such as "knowledge management," "knowledge integration," "knowledge sharing," and "knowledge transfer," and leadership types such as "ambidextrous leadership," "servant leadership," "shared leadership," and "transformational leadership."

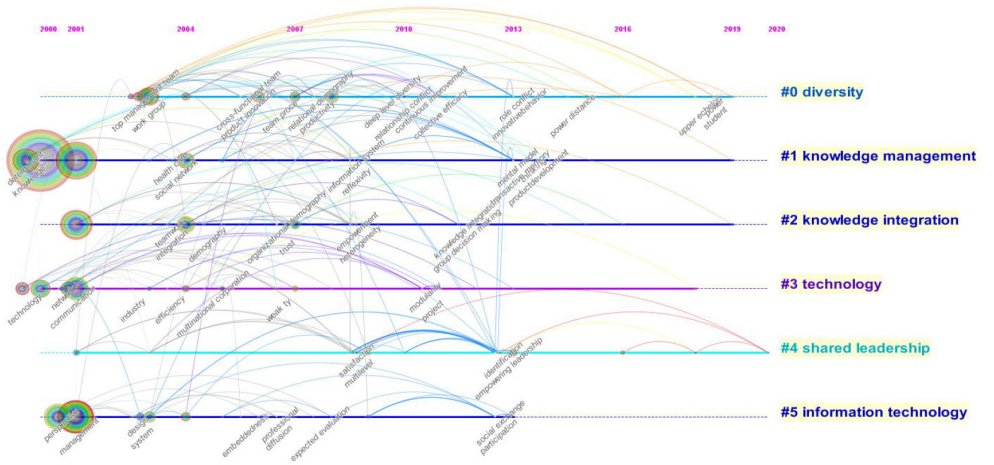
TABLE 5 | Clusters of research hotspots of innovation research at different levels.

Level	Cluster ID	Name of cluster label	Cluster size
Individual	0	Work engagement	17
	1	Employee engagement	14
	2	Technological cooperation	13
	3	Employee volunteerism	12
	4	Ambidextrous leadership	11
	5	Peripheral economic region	11
	6	Conflicting outcome	10
	7	Servant leadership	9
Work team	0	Diversity	31
	1	Knowledge management	24
	2	Knowledge integration	24
	3	Technology	23
	4	Shared leadership	23
	5	Information technology	22
Organizational	0	Transformational leadership	35
	1	Organizational ambidexterity	27
	2	Knowledge sharing	27
	3	Antecedent	24
	4	Learning	23
	5	Knowledge management	22
	6	Knowledge transfer	21

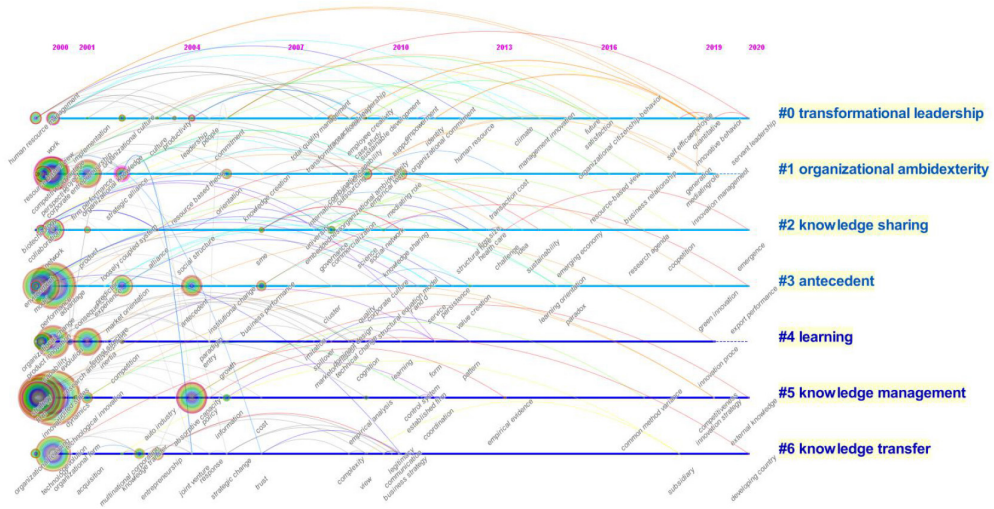
At the individual level, the top three research hotspots are "work engagement," "employee engagement," and "technological cooperation" (see **Figure 6** and **Table 5**). The first-ranked hotspot, "work engagement" (or "job engagement"), and the second-ranked hotspot, "employee engagement," have the same meaning in the innovation literature, which refer to a measure of the vigor, dedication, and absorption experienced by the employee (Schaufeli et al., 2006). The connotation of work engagement can be roughly divided into three parts, namely, cognition, emotion, and behavior (Sundaray, 2011). Due to its positive impact on several individual and business outcomes such as individual productivity, business turnover, and managerial effectiveness (Blomme et al., 2015), work engagement has attracted scholars' attention since 2006 (see the second line of individual innovation timelines in **Figure 6**). According to some major keywords in the first line of individual innovation timelines in **Figure 6**, scholars argued that work engagement was an important mediator in the relationship between several antecedents (e.g., job characteristics) and employee innovation (e.g., De Spiegelaere et al., 2014). Other researchers also emphasized the interaction between employee creativity and work engagement (e.g., Choi et al., 2015). Scholars' enthusiasm for the research on work engagement continues until 2020 (see the second line of individual innovation timelines in **Figure 6**) by reviewing previous studies and exploring its impact in the new environment (e.g., organizational change). "Technological cooperation" ranks the third among the research hotspots of individual innovation, referring to the agreement



Individual



Work team



Organizational

FIGURE 6 | Knowledge maps of the research hotspots of innovation research at different levels (timeline view).

for developing and executing a technological process to increase competitive advantage by combining or sharing skills and resources (Arranz and de Arroyabe, 2009). As its significant positive role in leveraging the capability of the company to adapt to a highly dynamic and complex environment (Alves et al., 2007), technological cooperation has attracted scholars' attention since 2000 (see the third line of individual innovation timelines in **Figure 6**). Besides, studies on technological cooperation began to increase in 2007 and continued through 2019, mainly investigating the creative behaviors and processes of the employee in firms with technological cooperation, especially manufacturing firms (e.g., Alves et al., 2007).

At the work team level, the top three research hotspots are "diversity," "knowledge management," and "knowledge integration" (see **Figure 6** and **Table 5**). Although "diversity" (ranks first) had been studied extensively by scholars in the late 1990s (e.g., Cady and Valentine, 1999), it gained renewed attention in 2003 when Van der Vegt and Janssen (2003) shed light on the joint impact of interdependence and group diversity on innovation (see the first line of work team innovation timelines in **Figure 6**). The popularity of diversity research continued to increase until 2011 and then gradually decreased. Some main keywords in **Figure 6** show that the focus of diversity research has gradually shifted from demographic diversity or specific teams (e.g., top management team) to cultural diversity and the deep mechanisms of diversity impact on innovation. For example, Bouncken et al. (2016) conducted a longitudinal qualitative study and found that cultural diversity had a negative impact on innovation with difficulties arising in different working and communication styles, as well as conflicts in power distance. Both the second-ranked topic "knowledge management" and the third-ranked topic "knowledge integration" are important capabilities that promote team innovation. The concept of knowledge management is broader than knowledge integration as the former refers to the way to acquire, store, retrieve, share, and transfer all the information among members or across teams (Farr et al., 2003), while the latter refers to the synthesis of individual team members' information through social interactions (Robert et al., 2008). As shown in **Figure 6**, the research boom of knowledge management appeared in 2000, and the popularity lasted until 2013 before it began to decline, covering topics related to the specific process of knowledge management (e.g., knowledge sharing and knowledge gathering) and types of innovative outcomes (e.g., radical innovation) (see the second line of work team innovation timelines in **Figure 6**). Besides, the research boom of knowledge integration was from 2001 to 2012, investigating the effect of knowledge integration on team innovation in a complicated and dynamic environment (see the third line of work team innovation timelines in **Figure 6**). For example, Koch (2011) proposed a conceptual framework of the relationship between knowledge integration and innovation and emphasized that innovation depended on efficient knowledge integration.

At the organizational level, the top three research hotspots are "transformational leadership," "organizational ambidexterity," and "knowledge sharing" (see **Figure 6** and **Table 5**). "Transformational leadership" ranks the first among the research hotspots of organizational innovation, referring to behaviors of leaders who motivate employees to exceed expected levels of job performance and implement organizational goals (Sarros et al., 2008). According to Bass and Avolio (1995), transformational leadership consists of charismatic role modeling, individualized consideration, inspirational motivation, and intellectual stimulation. Although many studies have confirmed the positive effects of transformational leadership on individual creativity (e.g., Basu and Green, 1997), it was not until 2000 that the research on transformational leadership was extended to the organizational level (see the first line of organizational innovation timelines in **Figure 6**). One of the most influential studies in this period was that Jung et al. (2003) conducted an empirical survey in 32 Taiwanese firms, which proved a direct and positive link between transformational leadership and organizational climate. Recent studies have paid more attention to several emerging innovation outcomes (e.g., green innovation) and specific innovation processes (e.g., support for innovation). As a critical means to improve the competitive advantage of the company, "organizational ambidexterity," the second-ranked hotspot, refers to the ability to balance two contradictory innovations, namely, exploratory innovation of existing knowledge and exploitative innovation of new possibilities (Raisch and Birkinshaw, 2008). There is an increasing interest in innovation research on organizational ambidexterity from 2000 to 2010 (see the second line of organizational innovation timelines in **Figure 6**), focusing on the general enablers and solutions of organizational ambidexterity, such as the integration and differentiation tactics (Andriopoulos and Lewis, 2009). After a decline from 2010 to 2017, research on organizational ambidexterity gained renewed attention in 2018, mainly investigating specific enablers and solutions, such as the use of high-performance work systems (Úbeda-García et al., 2018). The other research hotspot is "knowledge sharing," a behavior or process of the exchange of employees' knowledge and experiences at both individual and organizational levels (Lin, 2007). With the development of knowledge-based economy, knowledge sharing has been the focal point of innovation research between 2000 and 2014 (see the third line of organizational innovation timelines in **Figure 6**). Studies mainly examined two forms of knowledge sharing, knowledge donating and knowledge collecting, from the perspectives of antecedents and impacts. For example, Lin (2007) confirmed that enjoyment in helping others, knowledge self-efficacy, and top management support had a significant influence on knowledge-sharing processes; Wang and Wang (2012) argued that both explicit and tacit knowledge sharing had positive correlations with organizational innovation and performance.

CONCLUSION

The study identifies the knowledge framework for innovation research from 2000 to 2020 within the three levels (i.e., individual, work team, and organizational levels), which includes the dimensions of temporal distribution, the scientific community, intellectual structure, and research hotspots. The main findings

are the following. First, publication data indicate an overall increasing trend at all the three levels and the main position of research at the organization level among the three levels. Second, the common parts of the scientific community for innovation research at different levels include high number of articles published countries such as United States, China, and United Kingdom, and highly cited authors such as Teresa Amabile and Christina Shalley, indicating the possibility of the cross-level research at individual-team and team-organization interface. Third, the commonalities of the intellectual structure contain highly cited journals such as *AMJ*, *AMR*, *JOM*, *ASQ*, and *OS* and highly cited references about topics of linking empowering leadership and employee creativity, the effects of personal and contextual characteristics on creativity, and review of innovation and creativity in organizations, providing the theoretical and methodological basis, empirical examples and future directions for cross-level innovation research. Specifically, there are more influential empirical studies and literature reviews on the individual and work team levels, and influential studies on organizational innovation pay more attention to theoretical interpretation. Finally, research hotspots concerning the knowledge management process and leadership types are found to be studied on multiple levels. Through the analysis, scholars are provided with similarities and differences at all three levels of innovation research and then enhance a comprehensive understanding of innovation with the multilevel perspective.

There are inevitably some limitations in this study. On the one hand, this research only summarizes articles in the Web of Science-Social Science Citation Index database. Some other databases involving innovation research in organizations such as ProQuest One Business are ignored and can be included in future studies. On the other hand, although several manual screening criteria were set to filter articles, there may be subjective bias. Besides, further studies can be conducted with meta-analyses to build a multilevel innovation research mechanism model.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

RP and JC participated in the whole process of writing the essay. WW gave the ideas and instructions on the whole manuscript. All authors contributed to the article and approved the submitted version.

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Competitive Debate: A Successful Inter-team Gamification Experience in the Human Resources Subject

Guillermo A. Sánchez Prieto, María José Martín Rodrigo and Antonio Rua Vieites*

Faculty of Economics and Business Administration, Universidad Pontificia Comillas, Madrid, Spain

Students demand more active and participating teaching innovation methods, and activities such as presentations are not enough to satisfy those demands. In this research, competitive debate is used as inter-team gamification with third year students from a Business School studying the Human Resources Management subject. Out of this experience, qualitative and quantitative data are obtained. Results reinforce the continuation of classroom competitive debate due to the evidence of its motivational, learning, and communication skills improvement, and knowledge acquisition effects. The possibility of application with actual professionals is seriously considered.

Keywords: communication skills, human resources, gamification, presentations, teaching innovation, competitive debate

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****Correspondence:***
Guillermo A. Sánchez Prieto
gsprieto@icade.comillas.edu

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INTRODUCTION

New student generations, as well as workers, demand teaching and training in more dynamic and participative ways. The millennial thinking, linked to active participation and decision-making capacity, influences this way of understanding work and education. Thus, this generation, in its intuitive learning model, looks for almost immediate results and compensation which provokes the use of gameful resources and active results as one of the more effective learning methods for these new generations (Rodríguez-Casado and Rebolledo-Gámez, 2017). For this generation, learning through videogames is one of the principal learning strategies together with mobile learning and gamification. In relation to this last method, gamification, there is not a clear consensus in the scientific community about its definition and usability in learning environments (Deterding et al., 2011; Seaborn and Fels, 2015) although Kapp (2012b) defines it as "the use of mechanics, aesthetics, and thinking of games to engage, motivate, promote learning, and resolve problems." Seaborn and Fels (2015) conclude that "gamification has two key ingredients: it is used for non-entertainment purposes: it draws inspiration from games, particularly the elements that make up games without engendering a fully-fledged game" in this line, inter-team competitive gamification through competitive debate is used in this experience to teach and grade the knowledge about training in human resources (HR), not just to play, which is what debate tournaments are after fundamentally. To Dichev and Dicheva (2017), gamification is "the introduction of game design elements and gameful experiences in the design of learning processes" which is exactly what was done in this case, taking the activity of competitive debates and applying it to a classroom to learn some specific knowledge. After reviewing numerous papers, Huotari and Hamari conclude that gamification refers to "a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation" (Huotari and Hamari, 2017). That is the idea for debate in the classroom, which should deliver a gameful experience with which students find

an added value for their learning. Based on another four works, Zainuddin et al. (2020) define gamification as "the process of applying game elements to non-game contexts" and in this case it is taken as a game, a competitive debate, with most of its elements and is being applied to the classroom context for learning and grading. From a concept point of view and in the specific case of competitive debate applied to education, it fits into the category of gamification according to Sánchez et al. (2020). In this case, inter-team gamification refers to "groups of players compet[ing] with other groups and thus several players share the goal to jointly obstruct[ing] the goals and actions of others" (Morschheuser et al., 2019). That is exactly what happens within a debate, one team explains reasons pro or affirmative and the other team presents the con or negative reasons of a subject during the first shift, later on, each team has to perform rebuttals against each other. At the end, a jury appoints a winning team.

Likewise, numerous studies endorse the positive relation of debate and critical thinking. Some of the studies have proved this relation in different countries and different educational environments (Allen et al., 1997; Darby, 2007; Mubaraq, 2016; Celada-Perandones et al., 2018). Because of that, debates are a useful tool in the development of critical thinking since an individual who thinks critically tends to live rationally, reasonably, and empathetically (Núñez-López et al., 2017, quoting Willson, 2012). However, some authors such as Greenstreet (1993) considered, with evidence, that the relationship between debate and critical thinking was not sustained.

Up-to-the-moment questions, such as if debate is a valid communication skills training technique or valid to teach certain knowledge, have been researched on the educational environment especially in higher education (Reverter, 2018). As far as our bibliographic search shows, the only experience of debate with professionals was conducted by a group trained in communication skills from the State Department of the United States of America (Benton, 2015). These results only measured participants learning sensation.

After reviewing literature about gamification, several demands are observed. The scientific community demands changes and reorientations in the study of gamification. Some authors ask for new gamification tools that are more personalized and smaller in size (Ortega-Arranz et al., 2017). In that sense, a competitive debate is always unique and unrepeatable. Contrary to the fact that in certain video games in which the player always goes through the same levels or in a test with points where players find the same questions repeated, each debate is unique, due to the interaction, competition, and collaboration. Others claim to investigate the application of dynamics that require low technology (Rapp et al., 2019; Zainuddin et al., 2020). This is exactly the case of the competitive debate, in which computer technology is not necessary, so this demand can be tested with competitive debate. It has been proposed, although not in a massive way, to investigate the user experience when testing gamification (Klock et al., 2020) and that is what is done in this study. Likewise, the need to carry out empirical studies is expressed in order to conduct research with more accuracy (de Sousa Borges et al., 2014; Dichev and Dicheva, 2017). Although it is true that in this case we are just presenting a first experience, the next step of this work would be to test the degree of effectiveness of competitive debate, for example, when training professionals in communication skills. It would be done through an experiment, with a control group and several experimental groups. Through our literature search, we found that the greatest demand is to deepen the human interaction in gamification, as well as work in collaborative-competitive environments (Burguillo, 2010; Huotari and Hamari, 2011; Rapp et al., 2019; Sailer and Homner, 2019). It is precisely in competitive debate that one competes against the other team, and it is necessary to collaborate within your own team. In addition, human interaction, through dialectical exchange, is the cornerstone of it. All of this is a clear example of human interaction in competitive environments. Besides, inter-team gamification has been "largely ignored by gamification" (Morschheuser et al., 2019) and needs to be researched (An, 2020).

From the literature review, it can be stated that there is research about gamification, competitive debate, and training in communication skills but they exist independently from one another. This paper intends to combine these three elements, obtaining and applying a model by observing and analyzing different aspects related with the experience of students and their perception about this kind of teaching practice related to learning acquisition. In addition, through literature searches we determined that publications on gamification are mainly related to IT, science, and engineering, although the domain of computer science is clear (Dichev and Dicheva, 2017; Swacha, 2021). However, there are hardly any publications on experiences in social science University subjects such as the experience reported in the area of HR in this case.

The objectives of this research are:

a. Determine if competitive debate inter-team gamification improves the learning sensation of the contents by students, more specifically in the HR subject.
b. Determine if using competitive inter-team gamification through debate, students have the sensation of improving their communication skills.
c. Predict the potential receptivity of inter-team gamification through competitive debate as the training method of inter-team gamification for future business managers.
d. Analyze the receptivity toward competitive debate by students as a grading method compared with other ways (papers, exams, presentations, or group papers).

Gamification is becoming a trend in the HR training environment (Osipov et al., 2007; Kapp, 2012a; Ramírez, 2014). Likewise, such applications are universal in the environment of marketing, sales, productivity, and workers motivation. Some of the most common elements of gamification are usually points, rewards, leaderboards, etc. but this case has focused on applying the competitive part of inter-team gamification through debate and has not emphasized more common elements. Attention has been paid to elements that are not often researched such as competition, collaboration, the use of low technology, and

inter-team gamification. As a matter of fact, looking for inter-team gamification in Google offers just 151 results. On the other hand, it was the intention of the research team to not focus on the way in which gamification is implemented but on the essence of gamification, the use of games in non-gaming contexts (Kapp, 2012b).

In reference to gamification and communication skills, the studies that have been found in this research mainly focus on virtual reality and gamification techniques focused on reducing anxiety or fear of public speaking rather than teaching communication. It is more therapeutic than formative.

In reference to debate applied in a teaching environment, experiences have been performed in higher and not higher education. Several studies have been conducted about classroom debate in numerous academic disciplines. Specialties such as engineering, law, or nursing have used debate as a teaching tool, although not as a grading tool (Mitchell, 1998; Bellon, 2000; Kishida, 2003; Abhijit and Macchiette, 2005; Merrell et al., 2017; Sapitri, 2017; Galiano et al., 2018).

Only one reference proposes a competitive classroom debate model as a tool in the HR subject (Sánchez, 2017). However, such a model does not present empirical references or experiences about its application. The present work presents some necessary evidence to discuss the feasibility of competitive debate at a University classroom for a HR subject.

Benton's experience (Benton, 2015) was the only available use of debate for professional training purposes found in our search. In his research, performed at the State Department of the United States of America, debate was used as a training tool for communication skills with department workers.

TABLE 1 | Debate training timing.

Issue	Explanation	Time (min)
Introductions	What is the goal of the activity and what is it about. Professors introductions.	10
Debate issue or resolution	The goal is proving the jury what training solution is better. Debate is presented as training and grading tool.	10
Format, times, and mechanics of the debates	What is each debate part for and how much time lasts. • 4 min. Opening presentations, • 5 min. 1st refutation, • 5 min. 2nd refutations • 3 min. Conclusions	10
Research	Explaining the evidence concept and practice of evidence research.	15
Argumentative lines design	Debate teams must outline their three or four ideas about why their training solution is better than the other solution.	15
Debate rubric explanation	Explanation of rubric with Q and A.	15
Disposition of argumentative order almost definitive	Teams define openings, argumentation development and conclusions for their speeches.	15
Positions assignment	Each team decides what team member does what during the debate and in what order.	5
Organization of tasks among students	Each team decides who does what during the week before debates on research and others tasks.	10

Source: self-elaboration.

PARTICIPANTS AND STEPS TO PERFORM A COMPETITIVE DEBATE IN THE CLASSROOM

Forty-two students studying HR in their third year of the Business Administration degree were chosen for this experience. The group was balanced in terms of gender. When the experience took place, March 2019, the teams were already prepared as they had had to perform presentations about different training solutions in their HR development course since the beginning of the semester. Each team was formed of four or five students, and each team was asked to research and present a new training trend in business such as:

- Corporate Universities
- Personalized Learning Environments
- E-learning
- Massive Online Open Courses
- Mentoring
- Coaching
- Outdoor training
- Gamification.

Thus, each team, after a research and preparation period, was asked to defend their training solution and attack the one of the opposing team with the purpose of persuading a jury about which tool was more powerful as a training method. The matches were made in a way that training solutions belonged to categories as alike as possible. Thus, matches were as follows: Corporate Universities vs. Personalized Learning Environments (PLE), E-learning vs. Massive Online Open Courses (MOOC), Mentoring vs. Coaching, and Outdoor Training vs. Gamification.

Students received 2-h basic debate training. In this training, the professor of the subject was present but did not have an active role. The other trainer, specialized in debate, was introduced to the class as a consultant not as a scientist. This trainer explained fundamental concepts related to the debate format: opening presentations, rebuttals, counter-rebuttals, and conclusions. Likewise, the difference among debates about facts, values, or solutions, which are the three types of debate issues according to their nature, was explained (Cirlin, 1999). The training had a practical part in which steps to develop a debate classroom for the HR subject explained by Sánchez (2017) were executed by students. **Table 1** explains the previous training structure before the debates took place. In this training, it was explained how points were achieved and how these points could lead to a better grade as a reward.

One week before the debates, students prepared their debates by researching about their training trend, looking for strengths of their training solution and weaknesses of the opponent's solution. During this week, students' work was not supervised. Students were free to work autonomously as would be the case for a written paper or a classroom presentation.

Each debate had two teams while two other teams acted as the jury. Finally, whether a team won was be decided by a hand raising vote by the teams. The jury's opinion was not considered because it would have slowed down the development of the debates due to the brief time available for reaching a decision. The professor of the subject used the judge's rubric to grade the teams, so winning meant a reward on the grade.

RESEARCH METHODOLOGY

The strategy was to quantitatively and qualitatively measure students' perception of the experience. A mixed methodology was implemented, in which quantitative and qualitative tools were used. This methodology combined numerical and verbal or textual data in order to understand complex problems. For Hernández Sampieri, learning is one of those problems that justifies a mixed approach, as it provides more value than a single approach and accurate information. In this case, we faced a situation in which an attempt was made to explain something as subjective and experiential such as a game experience with inter-team gamification through competitive debate applied to HR learning (Hernández Sampieri 2016, pp. 534–536). Similar experiences in which the opinion of students was measured with a mixed method regarding gamification experiences can be found in previous research (Lopes et al., 2019; Ndlovu and Mhlongo, 2020).

As for the sample, 42 students from the HR class of the Business Administration degree participated in the experience. Regarding the gender of the participants, this was balanced. The average age of the students was around 21 years. This sample included the participants of the experience, although the number of responses to the questionnaires was less, as will be seen. The sample is superior to other studies on gamification in the University environment such as de Almeida Souza et al. (2017) in which a sample of 18 students was used, from whom quantitative results were obtained and within these, 6 collaborated in in-depth interviews. In a study by Ndlovu and Mhlongo (2020), 31 responses from 34 students were obtained when measuring satisfaction. The case of Scholz et al. (2021) used gamification in a history course in the third year of University and provided a sample of 15 participants of which they obtained results from 12 respondents, also using a mixed method.

A descriptive analysis of the measured variables (percentages, averages, standard deviation) and parametric techniques (Student's *t*) or not (Chi square), according to circumstances, were used to determine if responses presented a bias different to indifference. Thus, for instance, if the item was measured from 1 to 10 it was considered a parametric contrast if the average was 5.5 in the *t*-test for one sample. Thus, hypothesis rejection implies that students' opinions would lean significantly toward mean values over the average or below the average, but not remain as an average group indifference when answering a question. In the case of ordinal variables with a lower number of categories, Chi square was used that shows a null hypothesis of the percentage distribution of the categories as uniform. So, if the hypothesis was rejected, the group was sensible to the question or opinion asked. Also, it was analyzed if there were differences marked by dependent variables, with a contrast test for equality of means or the Mann-Whitney test.

It is necessary to take into account that there are almost no methodological references due to the lack of publications that combine the mentioned elements (inter-team gamification, low technology gamification, debate, and HR teaching at University).

A set of items was defined as well as a set of other elements.

Questions to evaluate or measure:

- Intention of attendance to HR subject after the experience
- Interest for training as part of the HR subject content
- Interest for the specific training solution they defended in the debates
- Interest or curiosity by debate and personal communication
- Sensation of capacity to perform public speaking after the experience
- How entertaining was the activity for students
- Comparison of the debate activity as a grading tool to: exams, group papers, individual papers, presentations in class
- Recommendation or not of the activity to other students
- Relevance of the activity in a real company to teach communication skills, decision-making in a team, or talent detection.

Elements that may condition perception variables that can condition the other variables:

- Previous participation in competitive debate
- Role or function performed in the debates (starting presentation, conclusion, jury…)
- Natural proclivity for public speaking
- Gender
- Approximate average grade
- Nationality
- Professional goals.

The research team ruled out hypotheses due to the limited literature on the three elements together: competitive debate, HR teaching, and inter-team gamification. Likewise, the aim of the article was not to measure skills or look for causalities, the objective was to measure receptivity using a gamified technique through inter-team competition with the allocation of points and prizes. Regarding data processing, SPSS version 24 was used.

Regarding the qualitative part, an open evaluation form of the activity was distributed through Moodle after the whole experience was completed. The evaluation asked for testimonials about what they liked from the activity and what did not,

COMMUNICATION CAPACITY	Has the speaker a structured speech?	
	Is he/she natural and expressive in the gestures?	
	Keeps eye contact with public and jury?	
LOGOS	Defines his/her training solution clearly with credible sources?	
	Explains how the training solution comes up?	
	Explains why results are profitable for business?	
	Explains its functions and objectives?	
	Explains why the solution is better than the other solution?	
	Explains what limitations/fails has the other solution?	
DEBATE	Gives the floor to the other teams? (admits two or three questions)	
	Responds to questions quickly and clearly?	
	Uses the shift in what corresponds? (Build arguments, refute, conclude)?	
	Individual Punctuation	
	Punctuation for the team (sum of each speaker)	

FIGURE 1 | Rubric of evaluation for debates. Source: Self elaboration.

through a personal, free, and voluntary written reflection. They were not asked to evaluate or consider any specific aspect of the experience.

The development of the debates went on without any remarkable incidents. Just to mention, some of the exchange students were not aware of certain aspects of the debate format. For instance, two foreign students understood they could share the floor in the same shift, something not allowed by the rules of these debates. A certain passiveness was observed in some students when they were not debating, this meant they were watching the debates as part of the public.

A grading rubric was used, as explained in **Figure 1**, so the professor and students who acted as a jury, could adequately evaluate the debates; this constituted the point allocation part of gamification. The rubric measured three competences: communication capacity, logos, and debate capacity. The scale to measure each item was zero (unsatisfactory) or one (satisfactory), this way the professor and judges could grade faster than if they had to grade each item from 1 to 10. Thus, in order to grade each student, the professor added the points that each student obtained to what a student would get as a grade. For instance, if a student accumulated 12 points, he would get a 10, the maximum grade in Spain, and a student that obtained 5 points would get a grade of 4. The professor could also grade according to the team score. Thus, if the team accumulated a lot of points by complying with many items, the grade would be higher.

TABLE 2 | Interest in training, their training solution, and debate/communication.

	Training	Issue	Debate	Entertainment	Communication improvement
Scale from 1–10	**Percentage**	**Percentage**	**Percentage**	**Percentage**	**Percentage**
1	6.1	3	0	0	15.2
2	3	0	6.1	3	0
3	6.1	6.1	6.1	6.1	15.2
4	3	6.1	6.1	0	9.1
5	18.2	30.3	21.2	12.1	18.2
6	30.3	18.2	12.1	15.2	12.1
7	21.2	15.2	24.2	18.2	15.2
8	12.1	15.2	9.1	21.2	12.1
9	0	3	9.1	15.2	3
10	0	3	6.1	9.1	0
Average	5.61	5.91	6.18	7.00	4.91
p-Value (Ho mean 5.5)	0.0747	0.216	0.079	0	0.15
Standard deviation	1.870	1.860	2.100	2.031	2.363
N	33	33	33	33	33

Activity entertainment for students and improvement on communication. Source: self-elaboration.

ANALYSIS, RESULTS, AND DISCUSSION

The quantification of results was conceived by measuring students' opinions about the technique used in the classroom with an evaluation questionnaire. The qualitative part was completed with students' written testimonials without any specific guidelines. Following this, quantitative results were taken together with the qualitative results. Finally, we were unable to obtain the evaluation of all participating students in the debates because some missed class the day in which the questionnaire was handed out so finally, out of 42 participants, 33 responses were obtained which constitutes a certain limitation and does not allow us to generalize. Following this, the quantitative and qualitative responses given by students were analyzed.

Intention of Attending the Subject

Students were asked about their intention of attending the subject after the debate activity. This question was measured with an ordinal scale: 1 more than before, 2 same as before, 3 less than before. It was intended to test the hypothesis that participating in debates stimulates attendance to class. However, this question may hide the sociological principle known as "socially desirable response bias." This means, the students may respond in a way that is appealing to professors, researchers, or give any response that may be considered socially desirable. Thus, if we consider the response as valid, the debate activity motivates students to attend more than before in 36% of students, same as before in 61% of students, and less than before in 3% of students. It was revealed that a predisposition to attend class more than before ($t = -3.546$ p-value $= 0.001$; Chi-square $= 16.545$, p-value $= 0.000$) existed in the students. **Table 2** shows the statistical summaries for each one of the following variables. It corroborated one of Monarca's affirmations (Monarca, 2013) when explains that classroom participation improves the teaching proposal that it generates. The conclusions of other gamification papers, including computational gamification, in which participants showed more interest after they gained the experience of gamification are confirmed, although in this case, we just determined the intention of attending the subject (Laskowski and Badurowicz, 2014; Lister, 2015; Pinter et al., 2020).

Interest in Training, Training Solutions, and Communication

In this part, we analyzed the intensity of students' interest in three aspects related to the debate: interest in training as part of the subject content, interest in the training solution they defended (*e-learning*, corporate universities…), and interest in debate and communication *per se*. The 1–10 scale measured the degree of interest for each item (training, training solution defended, and debating and communication) from 1, the interest did not increase at all to 10, my interest increased a lot more.

Although a clear interest increase was apparent in the three mentioned aspects, since averages are around 6, these averages are not very high or significantly superior to the 5.5 value. Thus, the testimonial of a student may help to discover why interest may be lost when students are in the classroom watching debates as spectators: "*As learning material to me it seems bad. Maybe, the presentation that you have that to do and the issue you are going to speak about you have to master it, besides the disadvantages that may have the competition. That really does help for learning. The problem comes when you have to pay attention to other debates. In my particular case, out of the other three debates performed in class, one I did not pay attention (I was thinking about something else), and in the other two I was more attentive to how speakers spoke than what they said in order to discredit the rest, than learning as I would learn in a classroom about an issue*" (C1).

In general, in the three measured aspects, it was observed that superior punctuation, from 6 to 10, accumulated more than half of the responses. To a greater extent was the interest on training (63%), while the interest in the training solution they defended was 54% and the interest on debate accumulated 60% of the responses superior to 6.

On the other hand, another student spoke about the effort of joining the experience, although they perceived learning benefits and showed motivation "*The experience was very good since I love to do new things and learning, above all to prepare a debate, the search for evidence and the preparation facing possible arguments of the opponent, requires of a good strategy and that I love. On the other hand, the research work behind is very long and it was performed in a week with mid semester exams of all the subjects and with other papers to turn in and that was very complicated to manage and organize*" (C2). This finding aligns with the results obtained by other researchers such as Dabrowski et al. (2015), Lopes et al. (2019) and Ndlovu and Mhlongo (2020) in which students declared a higher interest of the content of the subject.

All the engagement has an explanation based on gamification mechanics. The reasons why competitive classroom debate provoked student engagement is that competitive debate complies with most of the 10 mechanics that Werbach and Hunter explain as causing this engagement (Werbach and Hunter 2012, p. 79). Challenge (the task is clear and is a challenge, to convince the jury who is right). There is a chance (not so much in terms of the appearance of random elements from the game itself, but in terms of what the other team can do which is unpredictable). Competition (one team wins and other loses the debate). Cooperation (team members must cooperate with each other to achieve victory). Feedback (from the jury, the team members, their classmates, and the teacher). Acquisition of collectible or useful resources (they are not present if we consider them as elements that are obtained in the game and that help to achieve the goal). Rewards (the grade may be better depending on how they perform in the debate). Transactions (as such there are no transactions, in terms of elements of the game that can be exchanged, but there is interaction between both teams). Turns (initial exposure, rebuttals, etc.). Win states (only one team will have the vote of the jury). This compliance with most of the mechanics explains the engagement of the students, if we consider that mechanics are those basic processes that drive action and generate player engagement (Werbach and Hunter 2012, p. 80).

Perception of Capacity Improvement for Public Speaking

In this part, we measured the sensation of learning in respect to public speaking. Thus, students were asked to what degree they considered they improved their capacity for public speaking in a scale from 1 (same as before) to 10 (a lot more). Most of them thought they increased their capacity for public speaking; only 15% of the cases thought they were just like before in respect to their communicative capacity. Thus, the percentages of higher punctuation, among 6 and 9, constitutes a bit $>42\%$, while percentages ≤ 5 are something $>57\%$. These data confirm that students perceive a clear advance in their public speaking capacities, superior to 5.5 (p-value $= 0.161$), maintaining the opinion at a medium point, mean of 4.91. If compared with other papers of similar populations, we will find different results. Thus, in the case of a digital app, 37% of the students found the app useful for presentations when learning English (Barrett et al., 2021). The percentages about perceived usefulness obtained in our study about gamification and HR are superior.

Entertainment of the Debate Activity

One of the considerations that the research team took into account before the experience was that competitive debate in the classroom could be an entertaining activity. Students were asked up to what point this activity was entertaining for them, on a scale from 1 (not entertaining) to 10 (very entertaining). Thus, more than 90% of the sample responses were above 5, confirming it as a clearly entertaining activity, notably overcoming the uniform mean value of 5.5 (p-value $= 0.000$). Therefore, routine disruption favors learning, and entertaining empowers and makes learning easier. A student also said: "*it has been easier learning the concepts and specifications of the different types of training, since it has been a different activity to the ones we are used, we have given more attention and dedication, in the previous preparation as in the observation of other groups in class, at least from my point of view*" (C3).

To summarize, a clear increase (higher than 5.5) in participants' interest in debate and training was observed, with a 10% statistical trust level, although a lower increase was seen in the issue they defended (p-value $= 0.216$). Besides, students considered competitive debate to be very entertaining (p-value $= 0.000$). Although they did not recognize a strong improvement in their communication capabilities (p-value $= 0.16$), the position of students on their improvement in communication skills was above the average. However, if we consult the testimonials written by students, they showed that the interest on the debating issue may be stimulated by the competition effect. Thus, a student said: "*Our group had the opportunity to defend the Corporate Universities. In order to no know very well the issue, all group members felt motivated to look for the maximum possible information and make sure of deepening much, in order to respond any question that we got from the opposing team and being able to make rebuttals*" (C5). Another student offered similar reasoning "*Also, I'd like to remark that the thematic wasn't very appropriate, from my point of view, because it was about learning the concepts of training and, however I just understood mine ones and the ones of the team with which we debated. Simply because we are focusing in debating and winning to other group, more than learning what was each methodology about*" (C6). This allows us to question what would happen if all the debaters dealt with the same issue. A more probable result is that the level of knowledge would increase due to the fact that participants would obtain more information listening to other debates which could be profitable for their own debates and turn into a grading benefit. The competition effect or gamification *per se* promotes putting effort into learning, one student agrees: "*I also believe that the fact of having to prepare this sort of competition, makes you involve more in the research of the issue. I believe that it gets major interest and involvement by some*

students with practices such as this than the usual presentation in class" (C7).

Another student commented in which it was clear that although the debates were an entertaining activity and also demanding, learning also occurred: "*once the two days of debate ended, my conception about this activity changed radically. I had laughed a lot more, it seemed interesting and overall, without realizing, I had very clear differences of each training model. Almost without putting effort into it trying to know what was it about, I had been able to retain a great quantity of information, more than with a regular presentation, sincerely I would have been unable.*" (C8).

Most of the comments mentioned the cost-benefit relation, preparation cost—learning benefit. In this line, another student explained as follows: "*I thought that was a learning way more useful than other methods used in class, since it had a very practical approach and pushed you to learn, not just about the issue that we were debating, but also about the issue of the opposing team. I discovered that this is useful, since generally, if the learning method is something such as presentations, just research the issue that your group must present, but you are motivated to both investigations. I liked the task, since it was a work in a group interaction*" (C9). The findings confirm the positive effect of combining competitive collaboration in gamification, especially when modifying or influencing behavior (Sailer and Homner, 2019). Likewise, the thesis of the same authors is confirmed in which they indicate that collaboration and competition is especially indicated for skills improvement. Therefore, this coincides with Burguillo's thesis in which it is stated that competition can cause social pressure which increases the level of commitment of the participants and can have a constructive effect when participating in learning. In this regard, qualitative testimonials and survey data tell us that having to compete is a catalyst for better performance (Burguillo, 2010). Also, the testimonials of the most motivated students and learning and searching information aligned with the conclusions of Morschheuser et al. (2016) by which inter-team competitions provide clear goals in groups and create clear barriers between groups with positive influences on the group members' individual performances.

Table 2 shows statistical summaries for each one of the analyzed variables.

Comparison of Debate With Other Grading Possibilities

The usual ways of grading students at this University are memory-based exams, resolution of a practical case, group papers, individual papers, and presentations. The intention of this question consists of measuring whether the debate was better perceived than other grading methods. Thus, students were asked if they thought they learned more or less than with usual grading methods (exams, group papers, individual papers, in-class presentations). The measuring scale ranged from 1 (learned much less) up to 5 (learned much more). The comparison with other grading methods was interesting. Thus, percentages around the possibilities "learned something else" and "I learned much more" accumulated more than half of the responses for exams, papers, and the individual papers with 67, 61, and 51%, respectively. However, compared with the individual presentations, 45% of the respondents said "I have learned something else" and "I have learned a lot more." These percentage similarities may be due to the fact that classroom presentations are similar to debate. In fact, the response distribution, compared to classroom presentations, accumulated the majority of responses around the option "I learned the same." Strong results allow us to affirm that competitive debate is better perceived than an exam (p-value = 0.002), a group paper (p-value = 0.007), an individual paper (p-value = 0.000), and even than a classroom presentation (p-value = 0.005). Other questions that these results raise include if the learning is real and if objectively measured knowledge acquisition would offer different numbers, especially as the competition effect, in which one is supposed to win, may overshadow learning. Thus, an exchange student declared "*I am a competitive person and activities like this one, are very fun for me. Although is possible that someone may focus too much on winning and not in understanding. The truth is when the opposition was speaking during my debate, all the time I was thinking how to respond for winning and I was not listening to learn. I do not know if this happened to other people, but for me, when is a winner and looser situation I am very short for understanding.*" However, the same student though the activity was more positive than negative in general.

As mentioned, we compared whether the students thought they had learned more about the subject through debate than using other methods (three would mean indifference). The response was clear, students thought that they learned more than doing exams (mean = 3.73, p-value = 0.002), papers (mean = 3.79, p-value = 0.000), group papers (mean = 3.52, p-value = 0.007), or presenting in class (mean = 3.55, p-value = 0.005).

All these quantitative data were reaffirmed by qualitative data. Thus, a student expressed "*I am thankful for having such committed professors and, up to the moment, who are aware that the old teaching methods are not good anymore and try to bring into class revolutionary methods that are used in the other side of the world.*" (C11). The debate, as an exam, was perceived as something new and good. The same student observed values and added benefits in debating as a grading method: "*Making students debate and argument about any issue makes them learn more than if the professor relates the contents as if it would be a book. Classroom debate for me is the formalization of the "discussions" generated in class when students ask and question a professor about some issue. The debate generates a critical sense that memorizing a subject does not give you which is important to foment, maybe not so formally (with all of the rules and paraphernalia that debate has, but it does a little approaching).*" (C12). It is appropriate to notice that this student previously participated in debates.

One student expressed her wariness the activity although acknowledged the fact that presenting before an audience made her look for more information and therefore learn more. However, the general evaluation was positive: "*The debate activity we did, from the beginning scared me a lot. I am a very shy*

person and public speaking it's hard for me, and to be something so spontaneous and long (5 minutes speaking alone), I was afraid. I was very nervous beforehand, and also right in the moment. But the sensation with which I left after speaking, was of tranquility and complete satisfaction. I would not like to repeat the activity simply because of the nerves, but I admit that is good for us to get out of the comfort zone once for a while (…) at the same time, the fact of being nervous took me to get more information about the issue for being able to defend myself. Therefore, I believe that fulfills the function of learning that the activity had." (C13).

A student, reluctant at the beginning, afterwards expressed his appreciation for the activity valuing it better than exams. "*It is a good way to find out about issues that are unknown or little known to us. It foments the search of good arguments, backed up by reliable sources. It is a very dynamic way of learning and touches deeper than a paper or a regular and normal presentation and in which, generally, it's researched about an issue without a purpose apparent. In occasions you learn, but in many other, once the work is finalized, you just start from scratch. However, when debating and confronting arguments you learn much more about an issue or issues that are treated.*" Various initial testimonials relayed reluctancy which then transformed into a positive attitude toward the debating activity: "*Therefore, although at the beginning it shocked me a bit, the issue of debating in HR class, I am glad I did it and see exactly how it was. (…) in conclusion the activity that at the beginning did not seem very interesting since I had never done before something alike, finally, I liked it, enjoyed and learned.*"

The discomfort that comes with participating in a debate is the main reason that provokes learning. Likewise, being a new tool, debate motivates and provokes that exceptional effort. Thus, an exchange student explained: "*Although it was completely different to usual methods, I liked this activity very much. That is because it got me in an uncomfortable position. Being uncomfortable is not the ideal state but is an opportunity for personal growth. Besides, in the future for my career there are going to be cases where possibly I have to do this, then, it is better to start practicing right now. This exercise makes me feel that also allowed me to learn very much. I say this because in order to prepare my debate, I also had to do research about the other group. Then I was learning of the two issues to get ready.*"

Recommendation of the Activity to Other Students

One of the ways to determine if a training activity has been successful is asking if participants would recommend this activity to other persons of a similar profile. If the activity is recommended the receptiveness has been good and if not, it may be deduced that the experience has been more negative than positive. In this case the majority (88%) would recommend it to similar people. While, 12% would not. In this 12%, a certain bias comes into play as the activity may not be adequate for certain profiles, not because it is not good *per se*. Participants clearly would recommend this activity (proportion = 0.88, *p*-value = 0.000).

The testimonial of a student may explain why he would recommend the activity based on the amusement he found, the engagement that it promoted, and the personal improvement he reached. "*Besides, I found the activity very fun because we could train how to react to questions about an issue that was presented in real time. It was very good that we all took it seriously and had the opportunity to generate tension in the rival group, this made the debates easy to follow. I believe this activity has broken, a bit, the classroom routine and has done well to everyone, because at the same time we explored part of the contents we got in contact with other dynamics such as debate. In the other hand, it has given to shiest people, like me, the opportunity of trying ourselves in front of our mates. Besides, it was very good that we had a previous session so it would be clear the debate format in order to prepare it better.*" (C17). In favor of the debate method explained at the beginning, the student remarked that the previous training was useful.

Another student said that the debate had added value and therefore would recommend the more personal aspect, not only the intellectual or academic value of the activity: "*cognitive and communicative activities were developed and personally, I believe is an activity that prepares students for the moment in which they have to face real situations of debate or possible negotiations. (…) is an activity that brings security and confidence, and this is a fundamental element in people's career, and not only speaking from purely professional point of view, but also personal.*" (C18).

Another element that students were aware of, thanks to qualitative feedback, was if they had to repeat the experience, they would offer different recommendations. Thus, a student explained that, although difficult, the experience had been positive. One of the key points was that the activity was compulsory. "*I am a person to whom results difficult public speaking and this activity has been much more difficult to perform, I did not know how to express myself correctly as I normally do, but for being a first time I believe is normal. If I would have the opportunity to do it again voluntarily, it would be a difficult decision to me and even if I'd think about repeating but because of the simple fact that I do not open myself to public speaking, although probably I would end up doing it because it would help me to improve the way I express myself and the way I trust in myself.*" (C19). Therefore, students who put in a lot of effort also declared an exceptional personal reward in the intellectual and emotional fields.

Perception of the Debate Activity Validity in a Company for Different Applications

For the future, we intended to discern if actual students, future managers, would consider this training possibility valid or not. Thus, we asked if the activity could be valid in a company for training in communication and making decisions in a team or finding talent, with a dichotomous response (1: Yes; 0: No). Decision-making through debate is applicable from the point of view that a jury has to make a decision about what solution is better out of the two presented. Talent detection it is proposed in order to identify talent when people

TABLE 3 | Comparison of the learning sensation with other grading ways and competitive debate.

	Exams	Group papers	Individual papers	Presentations
Scale	**Percentage**	**Percentage**	**Percentage**	**Percentage**
Much less	9.1	0	3	0
Something less	6.1	9.1	12.1	15.2
The same	18.2	30.3	33.3	39.4
Something more	36.4	33.3	33.3	21,2
A lot more	30.3	27.3	18.2	24.2
Average	3.73	3.52	3.79	3.55
P	0.002	0.007	0.000	0.005
Standard deviation	1.23	0.96	1.03	1.03
N	33	33	33	33

Source: self-elaboration.

TABLE 4 | Validity of debate as a training solution for different business skills.

	Training communication	Decision Taking	Talent Detection
Scale	**Percentage**	**Percentage**	**Percentage**
Yes	84.8	60.6	72.7
No	12.1	36.4	24.2
Total	**100.00**	**100.00**	**100.00**
N	32	32	32
P	0.000	0.217	0.007

Source: self-elaboration.

have to speak in public. This research shows that students would recommend it for training in public speaking with 85% of affirmative responses, followed by talent detection with 73%, and ending with ranking the use for decision-making at 60%.

It is contrasted if the proportion was equal to 0.5 (indifference) and it was observed that students thought that this experience may have validity for a company when teaching communication (proportion = 87.5%, p-value = 0.000) and for talent detection (proportion = 75%, p-value = 0.007) but there was not a consensus about its validity for decision-making in teams (proportion = 62.5%, p-value = 0.217), as can be observed in **Tables 3**, **4**.

Independent Variables

In this part, we checked if the before mentioned variables presented an association or significative difference in relation to the following variables. The following ones are demographic and academic variables: gender, average grade, nationality, enjoys public speaking, won or lost the debate, and previous experience in debate with the idea of finding if there could be any differences in the dependent variable according to the set of independent variables.

Students were asked if they participated in debate activities before this experience. The aim of this question was to discern if the group had any previous experience in competitive debate and if the activity could have had a significative impact. Most of students (85%) had not participated in debate activities previously. There were no variations in any analyzed aspects among students that had performed in a debate and the ones who did not. In fact, there were no differences between teams that won or lost. Out of the five persons that had previously participated in debates there were no differences in whether they won or lost the debate. Thus, three of them won, one lost, and another did not respond about the result.

On the other hand, 51.5% of participants were men and the rest were women, the average grade of participants was 6.96 in a 0–10 grading scale (D.T. = 0.850), and 84.8% of them were of Spanish nationality. There were differences in the average grade (p-value = 0.0013), the female students had higher grades (average = 7.44) than the male students (average = 6.63).

There were no differences in the analyzed variables according to gender, except when asked about the result in the debates in which their team participated (p-value = 0.035). Thus, among the men, 64.7% of their teams won, and among the women, 25%.

There were no differences in any of the analyzed variables among Spaniards and exchange students, except whether they had learned more with this activity than with exams (p-value = 0.045); exchange students disagreed with such an affirmation (mean = 2.80) more than the Spaniards (average = 3.89), and the average grade (p-value = 0.074) was higher for the exchange students (average = 9) that the Spaniards (average = 6.88). One explanation might be the use of oral skills in a foreign language and under the pressure of a competition at a certain disadvantage compared to the rest of the majority of the group could have an opposite effect and be perceived as extra difficult.

There was no difference in the analyzed variables between students whose team won or not, except what was mentioned about gender.

No association was detected among proclivity for public speaking with any of the dependent variables. Students from this University were used to doing presentations and the majority of the answers confirmed that the students had no problems when public speaking. Because of this, competitive debate was particularly welcome.

Aside from this, it seemed that a clear positioning in respect to proclivity to public speaking did not exist, this variable was measured according to a 1–4 scale, 1 being "I very much like public speaking", and 4: "I avoid it if possible." Since it was not possible to reject the average value of the different values which was 2.5 (p-value = 0.808), an average of 2.45 with a standard deviation of 1.063 was apparent. Thus, 24.2% of participants confirmed that they very much like public speaking, another 24.2% said that they can enjoy it, 33.3% declared that they do it if they must, and 18.2% said they would avoid it if possible. These results are in line with Chapman and Rich (2018) who concluded that "Correlational data indicated that being a member of any measured demographic (e.g., gender,

age, student status) was not a barrier to finding gamification motivating," which may explain the lack of potential explanations for this part.

CONCLUSIONS

In general, students that participated in the inter-team gamified competitive classroom debate valued the activity and found it valid for their knowledge and skills development. The majority of students considered this activity to be an adequate method to grade and even better than traditional grading formulas. Likewise, inter-team debate was also seen as an adequate technique for its use in the business environment.

The technique of competitive debate as a gamified activity in the classroom provoked a motivation increase in the students to attend class more than before the experience. The classroom debate, as a new and playful activity, promoted motivational behaviors.

Competitive inter-team gamification through classroom debate increased the interest of students in all of the knowledge areas. They declared an increment of interest for HR training, for the training solution students defended, as well as debating or communication in general. The aspects in which students showed higher interest were communicating and debating. Thus, it may be concluded that, in this experience, the learning perception about debating was higher than the issue of the debate.

Most of the students thought their capacity for public speaking improved after participating in the debates. The gamified inter-team debate technique in the classroom was confirmed as a powerful transversal training method in communication skills. Thus, most of the students, stated that they felt they had improved their public speaking level.

Most of the classroom considered the activity of competitive debate an entertaining learning exercise. To this respect, it may be noted that participants considered it entertaining, but only if they had an active position (judge or debater) and not that much when they were mere spectators.

The debate, as a grading model, was also better received than the traditional formulas such as exams, group papers, and individual papers, although with a similar degree of appreciation in respect to oral presentations in the classroom.

Most of the students would recommend this activity to other students with a similar profile to theirs. This shows the excellent reception of a gamified activity in the classroom such as competitive debate.

Students that joined the experience thought that this technique could be extrapolated to the training business world to teach communication skills or detect talent, and to a lesser extent, although also positively, for decision-making as a team.

Facing implementation and improvement, the training period before the debates was appropriate since it was positively valued in the qualitative part by various students who said that feeling positive helped during the process.

In summary, low technology inter-team competitive gamification offers positive results to motivate and engage students in the learning of HR and the practice of communication.

LIMITATIONS AND FUTURE RESEARCH

One of the research limitations was the sample size of the survey which was ultimately formed of 33 people, although 42 students participated in the experience. This initial limitation was compensated with the qualitative analysis, which allowed us to tune conclusions. An increase in the sample size is necessary for future research, it could be especially interesting to reiterate the experience, not only with students but with professionals to analyze the impact and receptivity of such a training technique in a professional environment.

For future research, it is possible to study the impact of inter-team gamification as a tool aimed at effectiveness in terms of knowledge acquisition, thus, an investigation can be carried out in which the acquisition of knowledge is measured with a multiple choice exam and with a control group. It is possible to carry out experiments for the acquisition of skills and knowledge in the business world.

Another possible investigation would consist of expanding the assessment of common elements in gamification such as points, badges, or leaderboards during the debate process which probably would require high technology. Likewise, in this line, it would be necessary to investigate the perception of the students with respect to the levels of difficulty through inter-team gamified debate.

Another possible research focus would be a bibliometric analysis and of the current state of inter-team gamification due to the scarcity of research in this regard.

The use of inter-team gamification, through debate or other mechanics, in order to assign grades remains unresearched.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

GS, MM, and AR conceived the research, designed the article, and developed all the tables and figures used in this article. All authors contributed to the article and approved the submitted version.

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On the Impact of Information Technologies Secondary-School Capacity in Business Development: Evidence From Smart Cities Around the World

Virginia Barba-Sánchez[1], Luis Orozco-Barbosa[2] and Enrique Arias-Antúnez[2]*

[1] ENSITMA R.G., Department of Business Science, Universidad de Castilla-La Mancha, Albacete, Spain, [2] I3A, Department of Computer Systems, Universidad de Castilla-La Mancha, Albacete, Spain

Smart City initiatives across the globe have spurred increasing demand for high-skilled workers. The digital transformation, one of the main building blocks of the Smart City movement, is calling for a workforce prepared to develop novel business processes. Problem-solving, critical and analytical thinking are now the essential skills being looked at by employees. The development of the so-called STEM curriculum, Science, Technology, Engineering, and Mathematics is being given a lot of attention by educational boards in response to preparing young generations for the Smart City work market. Based on the IMD Smart City Index, PISA, and World Bank reports, we develop a model for assessing the impact of the IT secondary school capacities on Smart-City business developments. The model reveals the relationship between the technological capacity of the secondary-school, and the business activity of a Smart City. Moreover, the study shows the existence of a positive relationship between the IT capacity of secondary schools and the resulting entrepreneurial activity of the city. Our results are of interest to decision-makers and stakeholders responsible for designing educational policies and agents involved in the digital transformation and development of Smart Cities initiatives.

Keywords: Smart City, IT facilities, STEM, business activity, secondary education

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****Correspondence:***
Virginia Barba-Sánchez
Virginia.Barba@uclm.es

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INTRODUCTION

The Smart City concept (Giffinger et al., 2007; Hollands, 2008, p. 306; Kondepudi et al., 2014; Albino et al., 2015; Ben-Letaifa, 2015, p. 141; Richter et al., 2015, p. 214) has been attracting the attention of city authorities for more than a decade. Nowadays, nobody questions that Smart City is something more than a fashionable label (Kraus et al., 2015). In fact, Smart City initiatives around the world are seen as a major revolution in the sustainable development of urban areas (Kitchin, 2014; Hollands, 2015) providing a framework of governance aiming to manage resources in a more efficient way (Achaerrando et al., 2012) as well as facilitating an environment conducive to entrepreneurship (Richter et al., 2015). Most of the Smart City definitions have been summarized in Ramaprasad et al. (2017) and reviewed in Sánchez-Corcuera et al. (2019).

Information and communications technologies infrastructures and services are key to the development of Smart City (Samih, 2019) and more importantly to the creation of new business models by enabling the automation and optimization of processes as a driver of entrepreneurial and innovative ecosystem (Sauer, 2012; Bifulco et al., 2016; Barba-Sánchez et al., 2019; Florida et al., 2019). In fact, "Smart cities initiatives try to improve urban performance by using data, information and information technologies (IT) to provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration among different economic actors, and to encourage innovative business models in both the private and public sectors" (Marsal-Llacuna et al., 2015). Within this process, the role of education in the growth of economic activity as an accelerator of the process of technological diffusion and training of human capital is widely recognized (Nelson and Phelps, 1965; Akhvlediani and Cieślik, 2020). Acs et al. (2005) state that "... part of public sector expenditure devoted to education, and education has been shown to be positively associated with entrepreneurship" or "both expenditures on education and economic growth are positively related to entrepreneurship." It is evident that education, being one of the key pillars of our society, plays a major role on the success of Smart City initiatives.

At the beginning of this century, the need for new education paradigms have been deemed necessary to keep abreast with technological developments and social/economic changes. This movement gave birth to the STEM education paradigm. This paradigm has as one of its main goals to provide students with the skills required to join the labor force in critical sectors of growth of the most advanced economies. Different to previous curriculum changes, the STEM curriculum goes a step ahead on the teaching/learning methodology and aims of simply learning the technical and scientific principles of technical core areas (International Technology Education Association (ITEA/ITEEA), 2009). STEM education initiatives are being tailored to contribute to the acquisition and development of problem-solving, critical thinking, and analytical thinking abilities and capacities. Students are guided to better lead real-world connections in the curriculum (Brown et al., 2011; Süheyla, 2019). STEM education includes activities motivating students' interest and orientations toward science, technology, engineering, and mathematics fields while acquiring skills required in today's workplaces.

The main contribution of this study is to provide a new approach to ascertain the relationship between education, with a focus on the IT education paradigm, and economic growth, also providing empirical evidence in a new context, the Smart City, and for non-university educational levels. Furthermore, other contributions have to do with citizens' perception of the intelligence of the Smart Cities and how their satisfaction in this respect can also influence local economic growth; and with the role played by citizens' prioritization of education in this economic growth. The paper therefore focuses on the foundational issue of secondary education quality and highlights its contribution on fully exploiting the productivity potential of urbanization. In effect, our study shows the benefits of concentrating investments on competitive cities rather than spreading it across all the periphery and the need of ensuring equality of opportunity for individuals to exploit their potential.

Different to most studies, this work investigates the impact of secondary education IT capacities, rather than tertiary or higher education, over the business activities in the context of Smart City initiatives. The rationale behind our choice is due to the increasing training and use of IT technologies in the early stages of education and more important, to the importance of spurring secondary students' interest in tertiary STEM education. The paper takes as starting point the data of the report IMD Smart City Index (2019) by IMD World Competitiveness Center's Smart City Observatory in partnership with Singapore University of Technology and Design. The report ranks 102 cities around the world and "uniquely focuses on how citizens perceive the scope and impact of efforts to make their cities smart, balancing economic and technological aspects with humane dimensions."

The paper is structured as follows. Section "IT Education: A Key Element of Smart City Initiatives" introduces a general overview of IT education and its relevance on the development of the workforce in the context of the ongoing Smart City initiatives. Sections "IT Education: A Key Element of Smart City Initiatives, IT Secondary-School Capacity and Smart City, and Smart City and Business Activity" introduce the hypothesis of our model establishing the relationship between the deployment of IT secondary education services, and the level of satisfaction that the citizens have over the success of Smart City's economic development. In particular, Section "IT Education: A Key Element of Smart City Initiatives" motivates the relationship between, IT school capacities and the resulting Smart City business activity. Section "IT Secondary-School Capacity and Smart City " then relates the Smart City and the resulting business activity. Section "Smart City and Business Activity" looks at the relationship between, education in general with emphasis on IT education capacities resulting in business activity. Section "IT Education and Business Activity" describes the sources of information used in the numerical evaluation of the proposed model. Section "Empirical Evaluation" presents the empirically results of the proposed model. Section "Main Findings and Discussion" summarizes and analyses the main findings derived from the model results. Section "Conclusion and Future Research" outlines the conclusion, shortcomings, and future research lines.

INFORMATION TECHNOLOGIES EDUCATION: A KEY ELEMENT OF SMART CITY INITIATIVES

Recent works have shown the importance of STEM learning at secondary in attracting students to STEM fields in tertiary education (Chachashvili-Bolotin et al., 2016). We should notice that the studies being carried out on the evaluation of STEM curriculum have focused on the benefits or shortcoming of the increasing use of IT in schools (Hu et al., 2018; Xiao et al., 2019). The work presented herein goes a step beyond by taking into account not only the IT infrastructure put in place worldwide

in secondary education institutions, but it also looks into the abilities of educators and students. In this context, the teaching staff requires to keep up with the latest IT developments and students have to play a more active role in the learning process. The ultimate goal of this work is to identify the relationship between the overall IT secondary education capacities and the resulting entrepreneurial activity of the ongoing Smart City initiatives; where the capacities comprise the IT infrastructure and teaching staff skills.

Hazelkorn et al. (2015) stated that "Science education should be an essential component of a learning continuum for all, from pre-school to active engaged citizenship" and "Science education should focus on competences with an emphasis on learning through science and shifting from STEM to STEAM by linking science with other subjects and disciplines." As a result of the study conducted by Hazelkorn et al. (2015) the authors proposed the Framework for Science Education for Responsible Citizenship. This framework provides a comprehensive set of objectives, recommendations and actions. Among the set of recommendations, the framework states that STEM education should be complemented by introducing students into entrepreneurship. This vision has been shared by others. In a recent report by Johnson and Mansfield (2019) from Monash University, the authors state: ". . . entrepreneurial education has the power to transform. Adding it to STEM programs in schools provides students with crucial future-ready skills and an array of new career possibilities." Furthermore, we should realize that STEM education has to be complemented by introducing students into entrepreneurship.

As evidence of the importance of IT in the early stages of education and the lack of workers in these areas, the Obama administration established the program Stem for All [S4A] (2016). Similar initiatives in Europe, e.g., European Commissioner for Education, Culture, Youth, and Sport stress the relevance of training young students in STEM areas starting at the early years of education (EU STEM Coalition, pp. 5). Notice that Obama Administration actions, and being continued under Trump administration, as well as those proposed by the EU STEM Coalition are in line with the seven criteria that characterize a smart partnership defined in the EDUsummit15 (Davis et al., 2015; Leahy et al., 2016).

Moreover, for the purpose of the work presented here, the following Sustainable Development Goals of the 2030 Agenda have especial relevance (2030 Agenda, 2015):

- Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Meeting the first goal should ensure the universal access to quality education throughout all the phases of education, including early stages. The second could be achieved in part throughout the education and training of high-educated individuals and entrepreneurship.

Taking into account the great interest and the number of resources being put into STEM education and IT capacities, the main question is:

> *how much are the STEM Education curricula and IT infrastructures at Secondary School contributing to the success of ongoing Smart City initiatives, and more precisely to their economic wealth?*

This question is increasingly being brought due to the increasing role played by STEM in the economy of our countries. In words of Freeman et al. (2019) "We (also) need to understand better the links between STEM education, research, and the economic wealth of a country and wellbeing of its citizens." One of the key criteria of this smart partnership characterization is "(to) enhance the quality of education *via* digital technologies (ICT)" (Davis et al., 2015: 10). In fact, according to Chai et al. (2019) "the teachers' efficacies of integrating technology into science, mathematics and engineering subject predict their efficacy of integrative STEM teaching." Similar ideas are described in Chen et al. (2019).

It is important to clarify that the worldwide adoption of STEM curriculum still in its infancy stages. Bearing this fact on mind and the fact that the implementation of STEM curriculum will highly rely on the IT capacities of the school, the main aim of this study is to develop a model revealing the relationship between the IT capacity of the secondary-school, and the business activity of a Smart City. Toward this end, the PISA report provides statistics related to the IT infrastructures and IT teaching staff skills. As already explained in the introduction, this information is complemented by other data sources.

INFORMATION TECHNOLOGIES SECONDARY-SCHOOL CAPACITY AND SMART CITY

In recent years, a holistic vision of Smart City has emerged in the academic world, centered on the human being and balancing social, cultural, environmental, economic, and technological aspects (Mora et al., 2017), as a response to the techno-centric vision (Zanella et al., 2014). This latter vision has been largely criticized as being very focused on the underlying infrastructures used on the implementation of novel urban services (Hollands, 2008). By placing the focus on the citizen, recent studies have identified that education, learning, and knowledge are key elements to successful Smart City initiatives (Leahy et al., 2016). Moreover, smart partnerships must be inherent to Smart City development leading to Smart Citizens. A smart partnership must include different actors in education including teachers, researchers, organizations but also government, industry, civil society (Davis et al., 2015). That is to say, smart partnership for education should involve the main actors in charge of developing Smart City initiatives. In fact, one key element of a Smart City is Smart Education; and Smart Education should be seen as the backbone for successful and ever-growing development of Smart City initiatives.

Smart City developers should acquire the skills and knowledge to understand the overall scope of what it is involved in

a Smart City including services requirements and the latest available technology. They should continuously update their STEM-knowledge base making use of the latest IT technologies allowing them to gain timely and ubiquitous access to high-quality educational contents. A good example of this trend is the Smarter Education initiative as a part of the global Smarter City initiative by IBM (Rudd et al., 2009; IBM, 2012). In fact, our work is aligned with Williamson's vision (Williamson, 2015) which states that "education is being positioned as a laboratory space for the enactment of big data practices and as a social mechanism for the production of 'smart citizens' who can participate actively and productively in the big data dynamics of the smart city."

This study undertakes the development of a model for evaluating the impact of IT secondary school ecosystems on the process of constructing the Smart City vision by considering the technological facilities and, more importantly, the teaching staff IT abilities. The model is initially constructed on the following hypotheses:

Hypothesis 1: The school IT capacity influences citizens' satisfaction with the city's infrastructure.

Hypothesis 2: The school IT capacity influences the adoption of IT by the city.

Hypothesis 3: The adoption of IT by the city mediates the relationship between the school IT capacity and the citizens' satisfaction with the city's infrastructure.

SMART CITY AND BUSINESS ACTIVITY

The conception of the Smart City as an ecosystem of new innovation opportunities for large and small regional companies, pointed out by Hollands (2008), is still valid (Lee et al., 2014), regardless of whether it is understood that a Smart City has other purposes beyond the economic development of the city. In this sense, Friedrich et al. (2021) describe a Smart City as a hybrid organization composed of competing institutional logics: the market logic versus the social welfare logic. In this sense thanks to the so-called smart computing technologies, an innovation habitat is generated (Entrepreneurship for Sustainable Development, 2018), enabling the exploration and exploitation of new opportunities and business models not exclusive limited to ICT sector (Kraus et al., 2015; Barba-Sánchez et al., 2019). Proof of this cross-sectorial impact has been evidenced by its resilience in times of economic crisis (Paroutis et al., 2014).

A Smart City combines an attractive location for the development of emerging industries and entrepreneurship, thanks to potential inter-firm linkages (Richter et al., 2015; Snieska et al., 2019), with smart development, thanks largely to network effects in the adoption of technologies (Lee et al., 2014). Ultimately, in the words of Hollands (2008), a Smart City can be understood as a high-tech variant of the entrepreneurial city. However, the success of this type of initiative is based on the attraction and retention of trained people, so the satisfaction of citizens with the infrastructure of these smart cities can be key to effectively increase the business activity. Based on this latter statement, we propose to include the following hypothesis into our model:

Hypothesis 4: Citizens' satisfaction with the city's infrastructure influences business activity.

The inclusion of the citizens' satisfaction with the city' infrastructures should allow us to examine the role of the ongoing Smart City initiatives, characterized by the penetration of IT into numerous city management tasks and activities.

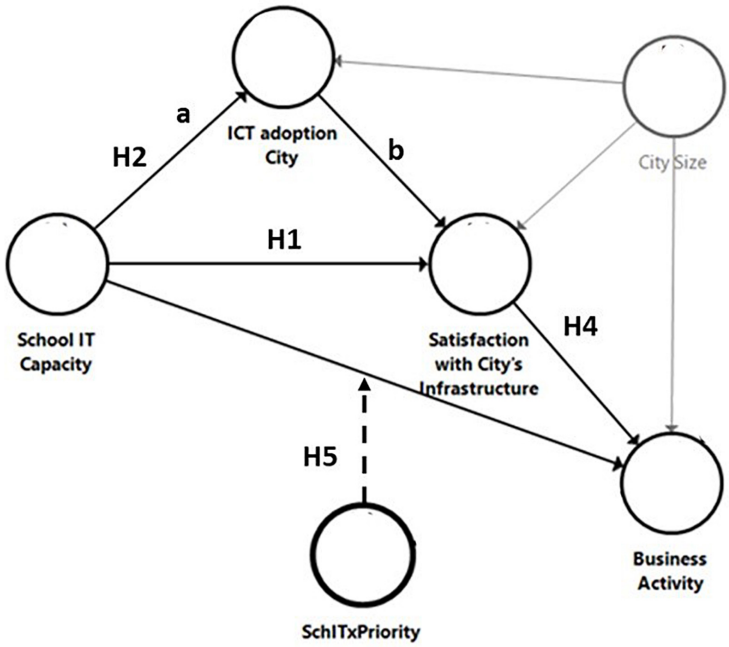
INFORMATION TECHNOLOGIES EDUCATION AND BUSINESS ACTIVITY

According to Carnevale et al. (2011), STEM workers are the source of growth and innovation. However, one indicator of the importance of STEM skills is that there are not enough STEM-skilled workers to successfully contribute to the global-economy demands. In fact, from 2003 to 2013, the number of people working in occupations related to STEM grew by 12%, three times faster than the total employment rate in the EU. Occupations in these fields now account for 7% of all jobs and the demand for skills linked to these disciplines is anticipated to increase, particularly in the area of information and communications technology (ICT) (EU Stem Coalition, 2016).

As we stated in the introduction, Nelson and Phelps (1965) or Akhvlediani and Cieślik (2020) remark the importance of the role of education in the growth of economic activity as an accelerator of the process of technological diffusion and training of human capital. Nevertheless, a large part of success in education comes from teacher's knowledge. In fact, although the STEM paradigm is closely related to technology, it is important to note that besides of counting with the IT infrastructure, its effective use in the teaching/learning processes is essential to get the most from the investments and efforts made by all actors (Tondeur et al., 2016). This return will heavily rely on the teaching staff training and involvement in integrating the use of IT technologies (Law et al., 2016; Tondeur et al., 2016).

However, the lack of technological knowledge on the part of teachers, which has been noted in the specialized literature (Kovarik et al., 2013; Chai et al., 2019), questions the validity of the concept of education as a diffuser of technology and a generator of business activity. Thus, it is observed that countries with fewer years of schooling and/or enrollment rates, which are common measures of the level of human capital training, sometimes show higher rates of economic growth than countries with higher aggregate educational levels (Akhvlediani and Cieślik, 2020). In this sense, authors such as Hanushek and Kimko (2000) point out that the most reliable educational level measures should focus on items related to schooling quality.

In this work, we address the development of a model to evaluate the impact of citizen priorities given to education on the generation of skilled workers and entrepreneurial activity. To this end, we propose the following hypothesis:



H3: School IT capacity -> ICT adoption city -> Satisfacción with city's infrastructure (a x b)

FIGURE 1 | Proposed model.

Hypothesis 5: The priority that citizens give to education moderates the relationship between the technological capacity of the school and business activity.

The inclusion into the model of the priority given by the citizens to the education, Hypothesis 5, as a variable that modulates the quality of the educational ecosystems should add light on the role played by all the elements of the school ecosystems.

As already mentioned, our study takes a starting point the data reported in the IMD Smart City Index (2019), and PISA reports. However, different from most up-to-date studies evaluating the secondary education programs' outcomes, we explore the relationship between IT secondary education ecosystems and growth factors, mainly business activity, in a Smart City-based economy.

To sum up, the proposed model is represented in **Figure 1**.

EMPIRICAL EVALUATION

Data and Variables

In the framework of this research work, the following four sources of information have been used: the 2018 PISA, the IMD Smart City Index (2019), 2020 World Bank report (Doing Business, 2020), and United Nations Human Development Index (HDI, 2020). Different to most recent works making use of the PISA report and other sources of information (Hu et al., 2018; Xiao et al., 2019) on assessing the school performance of youngsters, the main goal of our study is to develop a model relating the efforts being made on developing and deploying IT resources and the business development of Smart City initiatives. According to Dolma (2010: 172, paragraph 1 on section 4), when the variables of the inquiry are operationalizations of the attributes of entities with different levels, there is no inconvenience in conceptually accepting that the higher level variables are an individual attribute of the lower level unit of analysis. Thus, both School IT Capacity and business activity are considered contextual attributes of the city.

Furthermore, since the focus of our research is on secondary education, we should note that the effect of secondary education on business activity will occur with a time lag (Simmons(ed.), 2016). This effect is the so-called "time lag dilemma." Therefore, we have correlatively organized the years of the information sources: the oldest corresponding to years of school IT capacity followed by the ones relating to business activity. Accordingly, we have extracted from the various reports the following variables:

School IT Capacity: Data for this variable are retrieved for the well-known PISA report (PISA Data, 2018). In particular, we have chosen the following eleven items from the 2018 PISA database collected under the heading of School's capacity using digital devices:

a. The number of digital devices connected to the Internet is sufficient
b. The school's Internet bandwidth or speed is sufficient
c. The number of digital devices for instruction is sufficient
d. Digital devices [. . .] are sufficiently powerful in terms of computing capacity

e. The availability of adequate software is sufficient
f. Teachers have the [. . .] skills to integrate digital devices in instruction
g. Teachers have sufficient time to prepare lessons integrating digital devices
h. Effective professional resources for teachers to learn how to use digital [. . .]
i. An effective online learning support platform is available
j. Teachers are provided with incentives to integrate digital devices in [. . .]
k. The school has sufficient qualified technical assistant staff.

ICT adoption City: 18 items related to Technology pillar of a city from IMD-SUTD Smart City Index (SCI) 2018 (IMD Smart City Index, 2019) have been considered. This report ranks 102 cities worldwide by capturing the perceptions of 120 residents in each city. Technology pillar describing the technological provisions and services available to the inhabitants.

Satisfaction with City's infrastructure: 18 items from SCI 2018 (IMD Smart City Index, 2019) with respect to the structures pillar referring to the existing infrastructures of the cities have been used.

School Priority: The data for this variable have been achieved from SCI 2018 (IMD Smart City Index, 2019). According to this report, "Priority Areas summarizes the areas that the respondents perceive as the priority area for their city. From a list of 15 indicators, survey respondents were asked to select 5 that they perceived as the most urgent for their city." School Priority is one of the these15 indicator.

Business Activity: In order to get the information related to this variable 4 items have been taken into account:

a. New Business Density: This item considers new registrations per 1,000 people ages 15–64. Data have been collected from Doing Business (2020) report, excepting China and United States, which data were taken from www.statista.com.
b. The ease of doing business score measures the gap between a particular economy's performance and the best practice and serves as basis for the ease of doing business rankings. The values for this variable has been obtained from Subnational Doing Business (2020) that considers 543 locations in 78 countries.
c. United Nations Human Development Index. The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The values for this variable have been got from HDI (2020).
d. Gross National Income per capita expressed in US dollars for 2017 year. Those data have been achieved from IMD Smart City Index (2019).

Finally, the size of the city, as measured by the number of inhabitants according to the United Nations World's Cities in 2018 report (United Nations Population Division, 2018), was used as a control variable, since it can affect both business activity and the decision to adopt ICT by those responsible for the city, as well as citizens' perception of the adequacy of the city's infrastructure.

To test the hypotheses, structural equation modeling (SEM) has been applied as it is especially recommended to test mediation hypotheses (Nitzl et al., 2016). Specifically, we used the partial least square (PLS) technique with the SmartPLS 3.2.9 statistical program (Ringle et al., 2015).

Results

Assessment of the Measurement Models

Before contrasting the hypotheses proposed in the model, the measurement model must be evaluated by examining the individual reliability of the indicators of each construct, the reliability of the construct, the convergent validity, and the discriminant validity. To ensure the individual reliability of the indicators, they should all have loads equal to or greater than 0.707. However, Hair et al. (2017), point out that items whose loads are between 0.401 and 0.707 should also be retained, as long as this does not affect the quality of the measurement model, in order to preserve the content validity of the scales used. In our case, all loads are above the recommended values.

Table 1 shows the values of each construct with respect to the three measures of construct reliability, Cronbach's Alpha and Dijkstrqa-Henseler's rho_A, Composite reliability. For all constructs, the three measures exceed the minimum value of 0.7 and even the most advisable value of 0.8. With respect to convergent validity, measured by the Average Variance Extracted (AVE), all constructs exceed the minimum value of 0.5.

As for the discriminant validity, **Table 2** includes both the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT), which is more demanding, according to Henseler et al. (2016). In both cases, the constructs in our model meet the necessary conditions. In the first of them, the square root of the HTMT of a construct (in the main diagonal) is greater than its correlations with the rest of the constructs (lower part of the diagonal); and in the second of them, all the values of the HTMT are below 0.85 (upper part of the diagonal).

Assessment of the Structural Model

Once the measurement model has been evaluated, the structural model is evaluated by analyzing the collinearity between the constructors through the VIF values and the significance of the relationships between the constructors. In our model, all VIF values are well above the recommended value of 3

TABLE 1 | Reliability estimates and convergent validity of the measurement model.

Construct	Cronbach's Alpha	Dijkstrqa-Henseler's rho_A	Composite reliability (CR)	Average variance extracted (AVE)
School IT capacity	0.969	0.979	0.974	0.774
ICT adoption city	0.980	0.982	0.981	0.747
Satisfaction with city's infrastructure	0.969	0.974	0.972	0.665
Business activity	0.842	0.902	0.898	0.696

All constructs are estimated in Mode A.

(Hair et al., 2019), being the highest of 1.467 between School IT Capacity and Business Activity.

To test the significance, a bootstrapping (10,000 resamples) based on percentile confidence intervals has been performed. As seen in **Table 3**, with respect to direct effects, the technological capacity of the school significantly influences the satisfaction of citizens with the infrastructure of the cities (H1: $\beta = 0.134$; $p < 0.05$), as well as the level of ICT adoption ($\beta = 0.773$; $p < 0.001$) and the size of the cities ($\beta = -0.384$; $p < 0.001$). It should be noted that the latter has a negative impact, i.e., the larger the size of the city, the lower the citizen satisfaction with its infrastructure becomes. This finding is a relevant result taking into account that the sample is made up of cities with a population between 374,000 and 38,001,000 inhabitants. Furthermore, the technological capacity of the school also significantly influences the level of ICT adoption in the cities (H2: $\beta = 0.421$; $p < 0.001$). In this case, the size of the city positively and significantly influences the level of ICT adoption in cities ($\beta = 0.204$; $p < 0.05$). Finally, the citizen satisfaction with the city's infrastructure significantly influences the city's business activity (H4: $\beta = 0.227$; $p < 0.10$). Our analysis also shows that priority that the citizens give to education and the city size also significantly influence business activity. In contrast, it is observed that the technological capacity of schools does not a significantly influence the city's entrepreneurial activity. The latter outcome could have several possible explanations, e.g., a time lag that would be interesting to analyze in future research. Another possible explanation could be the existence of mediating variables, which have not been hypothesized in this paper. We should therefore explore this moderating effect at the end of this section.

With respect to the explanatory power of the model, the construct Citizen Satisfaction with the city's infrastructure has an R2 of 0.745, so the model explains more than 67% of the variance of this construct, indicating substantial explanatory capacity, according to Chin (1998). Specifically, the level of ICT adoption by the city explains 58.6% of the endogenous variable, while the other two exogenous variables explain less than 10%. However, in the case of the constructs Level of ICT adoption by the city and Business activity, the explanatory capacity of the model is weak, since both have an R2 below 0.33, although they exceed the minimum required of 0.19.

Table 4 shows the results of the mediation of the ICT Adoption Level by the cities in the relationship between the Technological capacity of the schools and the Satisfaction of the citizens with the infrastructure of the city (H3: $\beta = 0.460$; $p < 0.001$). This mediation is partial, given that the direct effect is significant, and complementary, given that both the direct and indirect effects are positive (Nitzl et al., 2016). It should be noted that the size of the indirect effect, which is estimated through the Variance Accounted For (VAF) index, is much larger than the direct effect. Moreover, this partial mediation is an indication that there could be another additional mediating variable whose indirect effect also has the same direction as the direct effect.

Finally, we study the relationship between Technological Capacity of Schools and Entrepreneurial Activity to answer the moderating effect of Education as a Citizen Priority (Hypothesis 5). In **Figure 2**, we observe that for higher levels of this variable, this effect increases based on the size of the interaction ($0.102 + 0.141 = 0.243$) and for lower levels, this effect decreases, even changing sign ($0.102 - 0.141 = -0.039$).

In summary, the five hypotheses proposed are corroborated by the empirical data analyzed. The technological capacity of the school has a positive and significant influence on both the satisfaction of citizens with the city's intra-structure (Hypothesis 1) and on the adoption of ICT by the city (Hypothesis 2). Moreover, the latter mediates the relationship between the first two (Hypothesis 3), so two relevant effects are observed: one direct and the other indirect through the mediating variable. Citizen satisfaction with the city's infrastructure also has a positive and significant influence on the city's business activity (Hypothesis 4). Finally, the priority that citizens give to education moderates the relationship between the technological capacity of the school and business activity (Hypothesis 5). The results of the estimated model are shown in **Figure 3**; specifically, the path coefficients (β) and the determination coefficients (R^2).

TABLE 2 | Discriminant validity of the measurement model based on Fornell-Larcker and $HTMT_{0.85}$ criteria.

Construct	School IT capacity	ICT adoption city	Satisfaction with city's infrastructure	Business activity
School IT capacity	**0.880**	*0.420*	*0.478*	*0.330*
ICT adoption city	0.410	**0.864**	*0.765*	*0.284*
Satisfaction with city's infrastructure	0.471	0.758	**0.816**	*0.351*
Business activity	0.256	–0.084	0.310	**0.834**

Diagonal elements (bold) are the square root of variance shared between the constructs and their measures (AVE).
Italic values above the diagonal elements are $HTMT_{0.85}$ values.
Values below the diagonal elements are the correlations between constructs.

MAIN FINDINGS AND DISCUSSION

The results reported in this study reveal the relationship between the technological capacity of the secondary-school capacity, and the business activity of a Smart City. Past studies have recognized the role of education as a disseminator of technology and generator of entrepreneurial activity in urban areas (Nelson and Phelps, 1965). However, the empirical evidence to date has been contradictory (Akhvlediani and Cieślik, 2020). In this sense, the novelty of this study is that the inclusion of the relevance of IT secondary education as a moderating variable of this relationship provides revealing information (**Figure 2**). The study shows the existence of a positive relationship between the IT capacity of secondary schools and the resulting entrepreneurial activity of the city. However, when the priority given to the IT capacity of schools is low or even negative, the effect over the entrepreneurial activity is negligible.

This result shows that in environments concerned with education, where there is a greater awareness of the vital role of education in socio-economic development, business activity is mainly based on the technological skills and knowledge that citizens have acquired. Furthermore, our model and results allow us to identify the shortcoming of some previous studies that have not revealed that significant investments in education should lead to more remarkable economic growth (Akhvlediani and Cieślik, 2020). Thus, the level of citizen awareness of the importance of education multiplies, positively or negatively, the effect of such investments in education. Therefore, our recommendations to education policymakers go in this direction. That is to say, social awareness of the value of education should dignify the role of the educational institution and teachers in parallel with the allocation of resources. Furthermore, promoting a vision of the school as an ecosystem where teachers and students interact by developing their skills and exploring their knowledge as sources of benefit would undoubtedly help citizens improve their perception of the usefulness or desirability of allocating resources to education.

On the other hand, it is observed that the intelligence of the city influences its business activity, in line with the results of Barba-Sánchez et al. (2019). The novelty of this study is that the intelligence of cities has been broken down into the two dimensions identified by the IMD Smart City Index (2019): technological, which measures the level of ICT adoption by cities, and structural, which reflects the level of services available in the city through citizen satisfaction with them. Our model indicates that the technological capacity of the city is influenced by the technological capacity of the school and directly affects the structural dimension of the city's intelligence, which in turn contributes to its business activity. Although there are more and more studies that support the economic growth capacity of smart cities, their attractiveness for business location (Snieska et al., 2019) and even their capacity to generate sustainable competitive advantages (Strielkowski et al., 2020), our results show the complexity in the relationship between city intelligence and economic growth. Hence, the recommendation that follows has to do with the involvement of citizens in the definition and implementation of the concept of Smart City in a specific environment. It is not only a matter of implementing technology in all areas of the socio-economic life of the city, but also of understanding the needs of its citizens and satisfying them in a more efficient way. It is neither understandable nor efficient,

TABLE 3 | Effects on endogenous constructs.

Construct	Direct effect	*t-value*	*p*-value	Percentile confidence interval	Explained variance (R^2)
Satisfaction with city's infrastructure (R^2 = 0.745)					
H1: School IT capacity	0.134	2.379	0.017	[0.019, 0.244]	0.063
ICT adoption city	0.773	15.321	0.000	[0.670, 0.872]	0.586
City size	−0.384	6.880	0.000	[–0.499, −0.281]	0.096
ICT adoption city (R^2 = 0.210)					
H2: School IT capacity	0.421	5.222	0.000	[0.254, 0.566]	0.173
City size	0.204	2.555	0.011	[0.045, 0.360]	0.037
Business activity (R^2 = 0.304)					
School IT capacity	0.102	0.808	0.419	[–0.126, 0.360]	0.026
H4: Satisfaction with city's infrastructure	0.227	1.910	0.056	[–0.018, 0.446]	0.070
Education priority	0.324	3.782	0.000	[0.154, 0.487]	0.039
H5: School IT x priority	0.141	1.863	0.062	[–0.016, 0.281]	0.046
City size	−0.330	3.493	0.000	[–0.525, −0.148]	0.123

Paths from hypothesis assessed by applying a two-tailed test at 5% of significance level [2.5%, 97.5%].
Bootstrapping based n = 10,000 bootstrap samples.

TABLE 4 | Summary of mediating effect tests.

Hypothesis	Total effect path (*p*-value)	Direct effect path (*p*-value)	Indirect effect		
			Path (*p*-value)	PCI	VAF (%)
H3: School IT capacity → ICT adoption city → Satisfaction with city's infrastructure	0.460 (0.000)	0.134 (0.024)	0.326 (0.000)	[0.191, 0.449]	70.87
School IT capacity → Satisfaction with city's infrastructure → Business activity	0.206 (0.048)	0.102 (0.419)	0.104 (0.070)	[–0.010, 0.216]	50.49

PCI: Percentile Confidence Interval.
Paths from hypothesis assessed by applying a two-tailed test at 5% of significance level [2.5%, 97.5%].
Bootstrapping based n = 10,000 bootstrap samples.

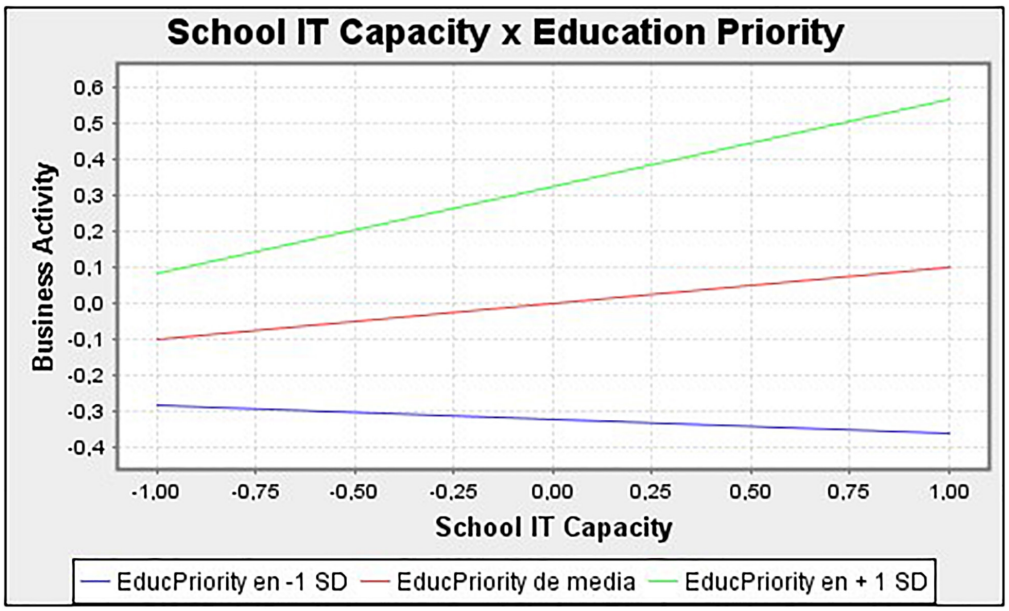


FIGURE 2 | Simple slope graph of the moderating effect using PLS.

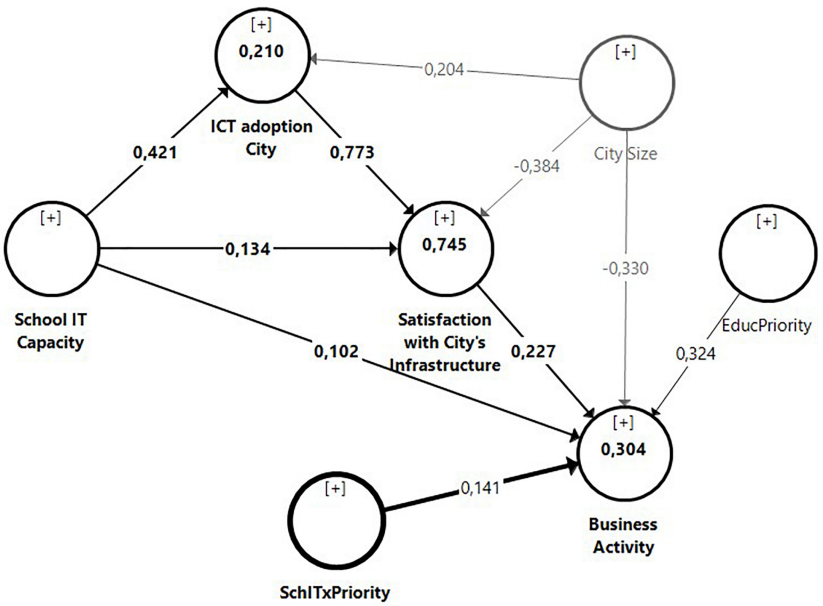


FIGURE 3 | Final PLS estimated model.

in line with Zandbergen and Uitermark (2020), to have a Smart City without "smart citizens" who value the possibilities offered by such an intelligent environment and have the capacity to take advantage of them for their greater well-being and quality of life (Ugljanin et al., 2020). There is no doubt that the promotion of STEM studies in the field of secondary education can contribute to forming these "smart citizens," capable of making their well-being compatible with the Sustainable Development Goals of the 2030 Agenda.

CONCLUSION AND FUTURE RESEARCH

The main findings of this work have verified the benefits of investing and adapting the secondary school curricula on the development of smart city initiatives. Efforts to provide secondary schools with adequate IT capabilities by public-private institutions contribute to the adults of the future assuming more successfully and satisfactorily their responsibilities as workers and citizens of environments in which digital transformation

and IT integration is an unstoppable fact, ratifying the first two hypotheses. Furthermore, it is confirmed that the IT endowment of the city mediates the relationship between the IT capacity of the school and the satisfaction of the cities with the IT infrastructure of their city, which is undoubtedly consistent with a policy that is committed to IT integration in all social areas in a stable manner over time. In other words, if adolescents are trained for tools that will not be provided to them in their adult life, they may feel frustrated in such an environment, corroborating hypothesis three.

On the other hand, it is empirically contrasted that the Smart City is a favorable environment for economic development and entrepreneurial activity (hypothesis 4), in the same sense that has been previously pointed out by the specialized literature (Sauer, 2012; Barba-Sánchez et al., 2019; Snieska et al., 2019). However, the novelty of this work is the ratification of the moderating role that the priority given to education in a given environment has on the relationship between the IT capacity of high schools and the entrepreneurial activity of that environment (hypothesis 5). In this sense, the practical recommendations to those responsible for educational policies go in the direction of promoting IT from an early age, not only as a way to improve future economic development through the better preparation of their professionals, but also to favor the integration of their citizens in all aspects of their city, reducing their sense of frustration with institutions.

However, further efforts should be carried out requiring the availability of more and wider variety of data sources. First, the unit object of this study is the city. However, this has not been the unit of measurement for all variables. While for the variables IT adoption city, satisfaction with city's infrastructure, education priority and city size the data refers to the city itself. In the case of the other two statistics, school IT capacity and business activity, they are only available at the country level. Although this fact does not distort the results obtained, since these variables are considered as individual attributes of the cities, it is proposed for future research to test the model at the country level by performing Hierarchical Linear Modeling (HLM), as suggested by Dolma (2010). In addition, there is a debate in the reference literature about city limits, differentiating the concept of city proper, which identifies administrative boundaries, from that of metropolitan area, defined as the zone of economic and social influence of that city proper (United Nations Population Division, 2018). Authors such as Sassen (1991) or Andersen et al. (2011) are committed to extending the focus of interest to these metropolitan areas, given that city limits, understood in political-administrative terms, are diluted in socio-economic and cultural terms. In this line of our future research efforts, there are two main challenges: the consensual definition of the physical limits of metropolitan areas and the difficulty of obtaining specific data on them.

Second, the IMD-SUTD Smart City Index (SCI) 2018 (IMD Smart City Index, 2019) only collects information on medium and large cities, with a clear bias toward small cities. In particular, Geneva is the city with the smallest population with 371,000 inhabitants (United Nations Population Division, 2018). As we have already mentioned, the citizens of medium-sized cities do not perceive significant differences in the quality of the infrastructures deployed in their cities and those available in larger cities. However, they perceive some negative aspects derived from greater size (see Rérat, 2012). In this sense, it would be worth replicating this research in smaller cities (less than 300,000 people) to explore if the conclusion also apply to smaller communities.

Another factor worth of exploring will include additional mediating variables between school IT capacity, satisfaction with city's infrastructure and business activity, such as the importance of introducing students into entrepreneurship. In this sense, in the report by the OECD (Organization for Economic Cooperation and Development), Lackéus (2015) pointed that "all students can and should train their ability and willingness to create value for other people. This is at the core of entrepreneurship and is also a competence that all citizens increasingly need to have in today's society, regardless of career choice." Thus, it would be interesting to investigate in future works the influence of entrepreneurial education on satisfaction with city's infrastructure and business activity.

Furthermore, an issue that we have also not addressed in this research paper is the time lag in the effects of ICTs (a long-run perspective on ICTs) that Haider et al. (2021) have observed. According to these authors, the most notable effects of ICT incorporation in an organization are only observable with a considerable delay, even of several years, due to the long processes of ICT adoption and integration. In this sense, a longitudinal analysis of the effects of the integration of ICTs both in schools and in cities, in the Business activity could highlight the existence and relevance of such delays.

Finally, another interesting line of future research would be to examine in greater depth the impact of the priority that the population of a territory gives to education on its own economic development. In our case, we have measured this variable in a unidimensional way. Nevertheless, the complexity of gathering the perception of individuals advises the use of multidimensional scales that identify, for example, the priority educational areas with respect to STEM content or entrepreneurial education for quality education, in line with the definition made by the Sustainable Development Goals (SDG 4) (2030 Agenda, 2015).

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: https://www.oecd.org/pisa/data/, https://www.doingbusiness.org/en/reports/subnational-reports, https://www.imd.org/research-knowledge/reports/imd-smart-city-index-2019.

AUTHOR CONTRIBUTIONS

VB-S contributed to searching and processing of the data, statistical analysis, tables, and results. LO-B made intellectual contribution to the work and reviewed the final version of the manuscript. EA-A developed the literature review and wrote

the manuscript. VB-S and EA-A developed the discussion and conclusion. LO-B and EA-A contributed to searching for references. All authors contributed to the article and approved the submitted version.

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Multinational Enterprises' Knowledge Transfer Received Dimensions and Subsidiary Innovation Performance: The Impact of Human Resource Management Practices and Training and Development Types

Yu Xie[1,2], Francis Boadu[3], Zhen Chen[4] and Adwoa Serwaa Ofori[5]*

[1] Research Center for Enterprise Management, Chongqing Technology and Business University, Chongqing, China, [2] School of Management, Chongqing Technology and Business University, Chongqing, China, [3] Faculty of Entrepreneurship and Enterprise Development, Kumasi Technical University, Kumasi, Ghana, [4] Dazhou Central Hospital, Dazhou, China, [5] Registry, Kumasi Technical University, Kumasi, Ghana

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***Correspondence:**
Zhen Chen
imcaspar@gmail.com

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In this paper, we adopt the resource-based view theory as the theoretical framework to empirically investigate the relationship among knowledge transfer received dimensions (i.e., tacit and explicit), human resource management practices, training and development types (i.e., on-the-job training and development, and off-the-job training and development) and subsidiary innovation performance. Using a survey dataset from 314 subsidiaries of foreign multinational enterprises located in China, we find that: (1) knowledge transfer received dimensions contribute to subsidiary innovation performance; (2) human resource management practices can positively moderate knowledge transfer received dimensions and subsidiary innovation performance; (3) the positive effect of human resource management practices on the knowledge transfer received dimensions- subsidiary innovation performance link increases when on-the-job training and development and off-the-job training and development is high. The study also provides insight into how knowledge transfer received dimensions, human resource management practices, and training and development types matter importantly to the subsidiary's innovation performance.

Keywords: knowledge transfer received dimensions, HRM practices, training and development, subsidiary innovation performance, emerging economies

INTRODUCTION

In the knowledge-based economy, innovation has been recognized as a fundamental route for socio-economic growth (Poblete, 2022). Innovation plays a momentous function in competition at both the state and enterprise levels as it is a central driving force to economic growth (Boadu et al., 2021a). Academics' accentuated the concept as a dynamic capability that surges potentials for enterprises in addressing customer desires, outweighing rivalry, and aligning their strengths with and exploiting marketplace opportunities (Boadu et al., 2021a). Thus, enterprises' success predominantly hinges on the innovation competency that enables them to be malleable and

adapt to the speedy variation of the market arena (Li et al., 2019; Boadu et al., 2021a). Today's volatile, uncertain, complex, and ambiguous (VUCA) transnational market environment has thrust multinational enterprises and their affiliates to seek survival antidotes to boost their innovation capabilities for the fiercely competitive battle among the major players.

Among different antecedents affecting innovation, knowledge management processes (such as acquisition, storage, and transfer) are considered as an important weapon for enterprises' innovation performance, leading to growth, competitiveness, and survival in the international marketplace. Particularly, effective knowledge transfer processes allow enterprises to inflate internal knowledge resources with external knowledge resources and transform them into dynamic capabilities such as innovation (Boadu et al., 2018, Boadu et al., 2021a). Indeed, knowledge transfer is often considered a fundamental survival approach in the era of the knowledge economy, and the vital foundation of innovation to build blocks for organizational achievement (Roy and Sarkar, 2016). Academics assert that enterprises with excellent knowledge transfer can sustain their innovation performance in the market arena (Roy and Sarkar, 2016; Boadu et al., 2018; Zia, 2020). Thus, the concept improves a variety of business and marketing performance (Ganguly et al., 2019; López-Cabarcos et al., 2019; Arnett et al., 2021). Admittedly, it is an indispensable contributing factor to corporate innovation performance.

Although, knowledge transfer and firm innovation performances have received the attention of researchers in many disciplines in the extant literature. The current study contends that there is a shred of paucity evidence in the extant literature on how firms adopt knowledge transfer received (KTR) mechanisms to innovate, as researchers have accentuated the impact of knowledge transfer [i.e., from the multinational enterprises' headquarters (HQs) to the subsidiary] and reverse knowledge transfer (i.e., from the subsidiary to the multinational enterprises HQs) (Gaur et al., 2019) on firm innovation performance to the detriment of KTR (Boadu et al., 2018). Boadu et al. (2018) defined KTR as a process by which a subsidiary puts in a request and acquires knowledge (i.e., tacit and explicit) based on strategic information of the cross-border operations and focal business environment from multinational enterprises' headquarters.

Thus, the study intends to scrutinize the opportunities that KTR dimensions (i.e., tacit and explicit) bids to emerging market subsidiaries vis-à-vis innovation performance. Expressly, the relationship mechanisms of human resource management (HRM) practices and training and development types on the linkage amongst KTR dimensions and subsidiary' innovation performance (SIP) have been rare. We contend that the effects of these contextual mechanisms should not be secluded from a theoretical model in which a capability and SIP rapport are present (Schilke, 2014; Boadu et al., 2021a), in emerging economies, specifically the Chinese economy. The country supports enterprises to use their unique resources to innovate as innovation has shifted from a "nice" to have to a "must-have" phenomenon for enterprises to pursue competitiveness and sustainability. Indeed, the Chinese market environment offers a mesmeric and apposite context to scrutinize the association between tacit and explicit KTR, HRM practices, and training and development dimensions. The research issue is novel, intriguing, and exigent that will significantly contribute to innovation ingenuities in the extant work.

First, existing scholarships demonstrate that the strength of knowledge transfer hinges on numerous contingencies comprising inner and outer strategic assets and competencies (Papa et al., 2020; Boadu et al., 2021a). Though, the former and the latter comprise entrepreneurial opportunities, environment dynamism, and HRM practice influence knowledge transfer acquired. As a result, the current study proposes to extend scholarships on how KTR work together with organizational-level contextual variable to surge the innovation performance of subsidiaries by contending that HRM practices play a significant role in deciphering KTR into grander SIP. Hence, we contend that HRM practices can support KTR to accomplish its full potential. HRM practices refer to a package of activities that mutually complement the skills, abilities, and motivations of the workforce (Guest, 2017; Li et al., 2019). More importantly, workforces within the organization hunt for external knowledge and incorporate it with internal knowledge to boost organizational operational activities and innovation outcomes (Papa et al., 2020). In addition, the innovation culture is spread among workforces as a strategic intangible asset that moves action en route for ingenuity and shared beliefs (Li et al., 2019). Thus, the concept is a potent avenue to achieve desired results of an organization (Papa et al., 2020; Zhou et al., 2021). Previous scholarships have established that HRM systems constitute the driving factors behind innovation performance and enterprises' competitive advantage (Kaabi et al., 2018; Lee et al., 2019). However, the combined effect of HRM practices and tacit and explicit KTR dimensions on innovation performance is scant (Sánchez et al., 2015; Sarala et al., 2016). Thus, additional concrete substantiation is vital to discover and explicate the probable facilitating impact of HRM practices on the correlation between tacit and explicit KTR and SIP.

Secondly, the study also explores how training and development dimensions affect the interaction of HRM practices and KTR dimensions on SIP. Training and development reflect a complex system that consists of changing the boundary of organizational effectiveness and the workforce through programs to influence the competitive advantage toward success and survival (Zhu et al., 2018). In today's knowledge-intensive era, major international business actors design comprehensive training and development programs for their workforce to develop new skills and creative ideas and discover new opportunities (Boadu et al., 2018) for innovation consequence and competitive advantage of an organization. Previous scholarships have established a more significant association between on-the-job and off-the-job training and development and innovation outcomes (González et al., 2016; Boadu et al., 2018; Dostie, 2018). The combined effect of training and development types, HRM practices, and tacit and explicit KTR on innovation performance is scant in extant works. As a result, investigating the joint effect of training and development behaviors, HRM practices and tacit and explicit KTR on SIP

is inescapable to have an impeccable comprehension of the antecedent conditions of innovation.

In addressing these gaps, this study draws on the resource-based view (RBV) theory to develop a conceptual framework to scrutinize the variables' probable associations, which is rare in the extant works? Hence, the current study intends to analyze 314 datasets from multinational enterprises subsidiaries operating in China via hierarchical linear modeling (HLM) to address the following questions:

- RQ1: Does tacit and explicit KTR affect SIP directly?
- RQ2: Does the association between tacit and explicit KTR and SIP be more pronounced when the firm has a high degree of HRM practices?
- RQ3: Does training and development types further strengthen the moderating effect of HRM practices on the linkage amongst tacit and explicit KTR and SIP?

Our study contributes to the current body of literature. First, our study extends the RBV by stressing the derelict interactions between resource received from multinational enterprises HQs and resource application: how the KTR as a resource received from multinational enterprises HQs institute the application of innovation performance - which represents a valuable contribution of this study. Second, from the RBV perspective, knowledge workforces are intangible assets that are indispensable to attaining a competitive edge; these workforces are driven by commitment (Li et al., 2019), which is a precondition for innovation culture. Our conclusion extends the RBV by shedding light on HRM practices in emerging markets: how subsidiaries can improve their KTR dimensions through HRM practices to make full use of KTR dimensions to innovate and achieve sustainable development. Third, by identifying training and development types and HRM practices' effects on the KTR dimensions on the application of innovation performance, we reveal an important interactive effect among the variables – an under-explored area in the knowledge and HRM literature.

The rest of the study is organized into four parts. Part 2 deals with the theory and hypotheses development. Extant works are reviewed to elucidate the association among the variables. The next part (3) describes the method applied to assess the proposed logical framework of the study. Part 4 reports the results of the research. It deals with the assessment of descriptive and correlation as well as hypotheses tests. Finally, part 5 presents the discussions and conclusions of the study, with a concentration on the theoretical and practical contributions, limitations, and future trajectory.

THEORY AND HYPOTHESES

Resource Based-View

We adopt RBV as the theoretical context. First, the term RBV originated from research on firm-specific abilities (Lippman and Rumelt, 1982). It has been applied in different contexts to explain how firms can obtain a competitive edge and greater performance. Thus, it focuses on how enterprises leverage their strategic resources that are valuable, sporadic, and rigid to copy by the competitors in the business environment to obtain a competitive edge and superior performance (Barney, 1991; Li et al., 2019). Exponents of the RBV accentuate that the deployment of tangible and intangible resources supports enterprises in sustaining a long-term innovation performance and continuous competitive advantage as they apply an organizational response (i.e., strategic assets and capabilities) to become more sensitive to variations in the market environment (Boadu et al., 2018; Eapen and Krishnan, 2019). Thus, the theory is deemed to be appropriate for this study due to its critical value for the development of resources and capabilities. More interestingly, if the critical resources are rare and pricy for rivals to replicate or to substitute them with alternative resources that can accomplish similar tasks, the organization achieves lasting superior performance and continues competitive advantage from those strategic resources. The study contends that resources and capabilities such as knowledge, HRM practices, and training and development satisfy the above criteria of the RBV for generating and supporting higher innovation performance and competitive advantage. Boadu et al. (2018) stated that RBV helps a firm in sensing its unique resources for enhancing performance and a competitive advantage for an organization. We contend that RBV can help firms leverage the effect of existing resources on firm performance via resources configuration and integration. Firms that learn to use knowledge resources will synthesize novel organizational processes and product development, which are essential for the competitive edge. The RBV offers that while the positive innovation consequence of knowledge is not guaranteed, KTR dimensions are vital to organizational effectiveness, competitiveness, and sustainability (Boadu et al., 2018). As a result, independent of expected or unexpected and preferred or adverse innovation outcomes in the short or long term, the impetus for the introduction of KTR dimensions is to permit subsidiaries to attain their strategic aims. Thus, we contend that KTR dimensions (Boadu et al., 2018) are a vast resource that can support organizations in explicating innovation outcomes. As scholars (e.g., Papa et al., 2020; Boadu et al., 2021a) have noticed that the strength of knowledge transfer hinges on numerous contingencies comprising inner and outer strategic assets and competencies (e.g., HRM practices) to foster innovation performance. HRM practices stimulate the workforce's capability (e.g., recruitment), motivation (e.g., compensation), and opportunity (e.g., participation) to contribute to innovation outcomes (Appelbaum et al., 2000). The primary aim of the HRM practices is to nurture, inspire, and offer opportunities to display splendid job comportments for an enterprise's continued competitive edge and grander innovation performance (Ostroff and Bowen, 2016; Li et al., 2019). While applying RBV to the HRM practices, tacit and explicit KTR, and SIP relationship, we ponder on the importance of knowledge and human resource (i.e., workforce) as critical resources and consistent with the view of RBV. For instance, knowledge and human resource that share the characteristics of rarity, unpredictability, and rigidity for actors to copy or reproduce can play a significant role in firms' superior innovation performance (Guan and Frenkel, 2018; Li et al., 2019). We, therefore, contend that HRM practices in an organization aiming at enticing, inspiring, gratifying, and

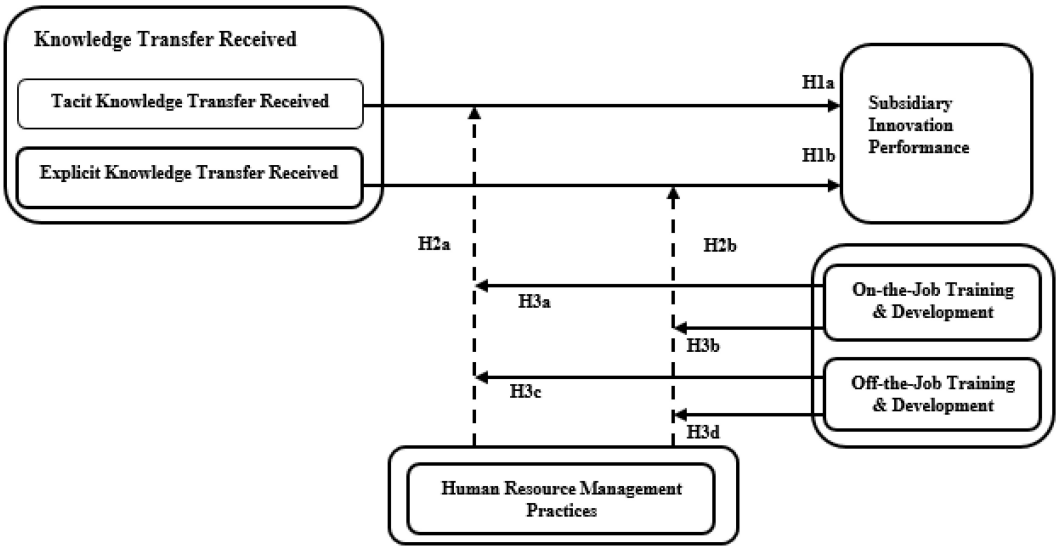

FIGURE 1 | Logical framework.

sustaining employee job behaviors can support KTR dimensions for process and product innovation to achieve superior SIP. To advance our understanding of how HRM practices facilitate the effect of KTR dimensions on SIP, the study considers the extent to which the facilitation depends on the training and development types. While applying RBV to the training and development types, HRM practice, tacit and explicit KTR, and SIP, we argue that employees develop high morale when managers or policymakers of an establishment provide higher-level competency training and development programs to upgrade their inspiration, level of self-awareness, skills, and abilities to enhance HRM activities and tacit and explicit KTR activities for greater innovation performance which invariably is capable of influencing organizational success. **Figure 1** underneath displays the logical framework and the subsequent section considers the hypotheses development.

Hypotheses Development

Knowledge Transfer Received and Innovative Performance

Drawing on the RBV, an enterprise's knowledge resources are critical for sustaining a competitive advantage in a turbulent market environment (Xue et al., 2019). Advocates of RBV contend that for enterprises to maintain their posture and superior competitive advantage in today's market, which is full of complexity, uncertainty, and volatility, espousing knowledge is considered the most crucial factor that can offer valuable, unrivaled sporadic, and exclusive resources to outweigh the competition (Boadu et al., 2018; Li et al., 2019). Thus, the changing market setting has made organizational knowledge a vital element than capital, labor, or land in most organizations worldwide in sustaining enterprises' innovation outcomes. For example, in the international market arena, the process of creating an innovative performance (e.g., new product, service, and patent application) cannot be accomplished without the contingent nature of knowledge generation.

As a result, knowledge transfer is essential in utilizing knowledge to advance innovation activities in a business organization. The concept involves the transmission of knowledge from one organization (e.g., multinational enterprises) to another (e.g., subsidiary). It is a vital aspect of the leveraging, diffusion, and formation of knowledge and a central procedure for multinational enterprises' knowledge management (Wang et al., 2014). Also, it plays a significant function in the long-term existence of multinational enterprises. In addition, knowledge transfer aids multinational enterprises to exchange valuable legacy, novel problem-solving strategies, and techniques for the improvement of organizational innovation performance and efficiency (Foss and Pedersen, 2019).

Practitioners and researchers consider the transfer of knowledge embodied in organizations and people as an important antecedent to innovation outcome (Van Wijk et al., 2008; Manfredi Latilla et al., 2018). They believe that if business organizations can transmit the critical capabilities (knowledge) embedded within the organization, it will offer a foundation for a different type of innovation, which can lead to a competitive edge over other competitors. In other words, innovation success involves the process which hinges on knowledge interface, conversion, and exploitation. For example, previous studies have made advances in terms of relating knowledge transfer to a firm's innovative performance (Buckley et al., 2004). Chirico et al. (2011) assert that knowledge transfer impacts significantly on firm performance and sustainable growth.

Palacios-Marqués et al. (2013) studied the Spanish biotechnology and telecommunications industries, concluding that firms that associate themselves with knowledge transfer enhance their performance. However, researchers notably Nonaka (1994) distinguish knowledge transfer into two continua, tacit and explicit, respectively, and examine their influence on

firm performance. These streams of studies have considerably enhanced the understanding of a firm's uses of tacit versus explicit knowledge in different performance contexts. Even though from the extant literature, few existing empirical analyses produce contradictory results on the impacts of explicit and tacit knowledge transfer on firm performance (Dhanaraj et al., 2004; Anh et al., 2006; Becerra et al., 2008). Dhanaraj et al.'s (2004) work on Hungarian international ventures reveals a positive coefficient for the linkage amongst explicit knowledge and performance, and a negative coefficient for tacit knowledge. In contrast, scholarship steered by Anh et al. (2006) in Vietnamese international joint ventures reveals a positive coefficient for the linkage amongst tacit knowledge and performance and insignificant relation for explicit knowledge. These inconsistencies in the literature may cause by the following: (i) An absence of homogenous measurement as several researchers have developed several instruments to measure tacit and explicit knowledge; (ii) Use of different methodology by researchers; (iii) Difficulty in accessing data; (iv) Causal procedures or contingency conditions; and (v) A lack of consensus on the content domains.

Besides, previous studies have also overlooked KTR, defined as a process by which an enterprise request and acquires knowledge (i.e., tacit and explicit) based on strategic information of the cross-border operations and focal business environment from HQs (Boadu et al., 2018). In this study, we followed Nonaka's (1994) distinction of knowledge transfer (i.e., tacit and explicit) and used it to examine KTR effects on innovation performance.

Tacit and Explicit Knowledge Transfer Received and Subsidiary' Innovation Performance

Numerous academics have divergent definitions for the construct "performance" in the extant literature (Chen et al., 2011). However, the import of most of the definitions largely accentuated technical effectiveness (Chen et al., 2011). Innovation performance is the benefit of an enterprise's technological innovation activities, underlining the incorporation of all groundbreaking, radical, and cutting-edge elements (Boadu et al., 2021a). Knowledge transfer stimulates the enhancement of organizational innovation performance. It is a key to promoting the innovation capability of enterprises (Boadu et al., 2021a). From the knowledge transfer perspective, (Nonaka, 1994) divides knowledge transfer into two ways: tacit and explicit, respectively. First, Bolisani and Bratianu (2018) describe tacit knowledge as know-how built on individual experiences, insight, and opinions. Such individualistic and contextual-specific knowledge is concealed and deep-rooted within the individual's action and experience (Gaur et al., 2019). Thus, the salient features of tacit knowledge are that knowledge is fundamentally personal in nature. Scholars have recognized the concept as a critical asset and contribute to developing positive dispositions toward growth and change as enacted by individuals in an organization (Sprinkle and Urick, 2018). Admittedly, tacit knowledge transfer has a pivotal impact on firms' performance, innovation performance, and sustainable competitive edge (Farooq, 2018; Quartey, 2019).

Secondly, explicit knowledge is a know-what type of knowledge that can easily be codified and formalized (Bolisani and Bratianu, 2018). It is one of the essential knowledge dimensions (Polanyi, 1966) that firms depend on to create a competitive advantage. Such knowledge type can be in the form of words and information written in manuals and specifications. Admittedly, it is relatively easy to recognize, accumulate, hoard, and re-claim (Bolisani and Bratianu, 2018) to trigger innovation processes. Explicit knowledge transfer can improve employees' capabilities to propose new ideas, which, in turn, enhance innovative performance. The RBV theory suggests that enterprises with intangible resources such as explicit knowledge can create innovative goods and services to address customers' needs and capture substantial international market shares to usurp a competitive edge. Thus, explicit knowledge transfer is a critical resource that supports contemporary IB enterprises operating across the globe to drive innovation and performance (Wang and Li, 2016).

We, therefore, argue that knowledge transfer dimensions are an indispensable conduit for enterprises to enhance innovation and performance. The RBV posits that knowledge is a strategic organizational attribute (Boadu et al., 2018) for enterprise value creation and sustainable competitive edge (Grant, 1996). Extant studies have proved a robust rapport among knowledge transfer dimensions and performance output (Ahammad et al., 2016; Magnier-Watanabe and Benton, 2017). For instance, Ahammad et al. (2016) conclude that knowledge transfer dimensions profoundly affect enterprises' performance. Similarly, Magnier-Watanabe and Benton (2017) discover a positive association amongst tacit and explicit knowledge transfer and performance. However, other authors, like Dhanaraj et al. (2004) discover the opposite result among the variables (-tacit impact and +explicit impact) in their studies on Hungarian transnational enterprises. While, Anh et al. (2006) studies on the effect of tacit and explicit knowledge transfer on performance revealed that tacit and explicit knowledge transfer has a significant and an insignificant effect on firm output, respectively. On the innovation front, studies have proved a strong rapport among tacit and explicit knowledge transfer and innovation output (Cavusgil et al., 2003; Harlow, 2008; Wang and Li, 2016; Terhorst et al., 2018; Asbari et al., 2019; Pérez-Luño et al., 2019; Berraies et al., 2021). Liu et al.'s (2019) studies on the impact of knowledge transfer dimensions on emerging market multinational enterprises' innovation performance reveal a positive result.

In the context of subsidiaries, the current research contends that tacit and explicit KTR from HQs can affect SIP, which, in turn, enhances competitive advantage. Thus, drawing upon the RBV, we predict that subsidiaries can leverage tacit and explicit KTR for innovation performance. Accordingly, we state that:

Hypothesis1_a: There is a positive relationship between tacit KTR and SIP.

Hypothesis1_b: There is a positive relationship between explicit KTR and SIP.

Effect of Human Resource Management Practices

From the perspective of the RBV, certain scholars have recognized that not only should an enterprise's resources be valuable

and inimitable to expedite superior lasting performance but also the enterprise must have an apt structure or system in place to take advantage of these resources (Barney, 1991; Li et al., 2019). Extant works have predominantly accentuated the direct association between individual strands or bundles of resources and performance, while less consideration has been dedicated to how management can apply their resources more efficiently (Wiklund and Shepherd, 2003). Therefore, the current study contends that HRM practices defined as a package of activities that mutually complement the skills, abilities, and motivations of the workforce (Guest, 2017; Li et al., 2019) can explicate the managerial routes that enable enterprises to acquire valuable and inimitable workforce. These valuable and inimitable workforce characteristics create a "human capital value" (Boxall and Purcell, 2016). Though, any human capital value may condense in the long run. Therefore, enterprises' HRM practices or strategies should be well-defined and aligned to the empowerment of the enterprise's workforce, which, in turn, fosters the enterprise's evolution and upsurge the enterprise's culture (McGregor, 1960). HRM practices can (a) Surge the worth and rareness of the knowledge via internal development and (b) Spur workforce comportment in the desired route. Li et al. (2019) assert that HRM practices can affect the workforce's capability (e.g., knowledge and skills) to execute tasks. Indeed, from an organizational perspective, strategic scholars have regarded the management of workforces within an organization as one of the central engines supporting firms to reach and realize their goals (Ostroff and Bowen, 2016; Li et al., 2019). From the extant scholarships, authors have established evidence of positive effects of bundle HRM practices on knowledge (Jimenez-Jimenez and Sanz-Valle, 2012), knowledge transfer or sharing (Chuang et al., 2016; Li et al., 2019), and innovation performance (Jackson et al., 2014; Kaabi et al., 2018; Lee et al., 2019). Other scholars have established a positive correlation between individual HRM practices (e.g., compensation, participation, recruitment, and appraisal) and knowledge creation and innovation (Andries and Czarnitzki, 2014). For instance, with compensation schemes, workforces' sense incentivized to perform well as these advantages are even resilient (Andries and Czarnitzki, 2014). Besides, job satisfaction and commitment inspire workforces to be ingenious, intricate in the enterprises' ethics and assist in establishing an innovation philosophy (Li et al., 2019).

Given the significance of HRM practices in enterprise resource development; the current scholarship intends to scrutinize whether the effect of HRM practices on a tacit and explicit KTR can explain the SIP. According to the RBV, firms can incorporate well-structured HRM practices in their corporate maneuvers (Díaz-Chao et al., 2015) to convey intense variation to corporate strategies and resources in an aggressive environment, which, in turn, improve their innovation output and competitive advantage. We contend that HRM practices are crucial and can work in tandem with tacit and explicit KTR in an organization. Thus, the interaction of HRM practices and tacit and explicit KTR can play a decisive function in promoting organizational procedures and operational activities, which, in turn, enhances SIP in an organization. Lazzarotti et al. (2015) postulate that enterprises should prudently manage bundle HRM practices to promote knowledge transfer and innovativeness.

When a firm has a high level of HRM practices, it can speedily reflect and address human capital matters. From this perspective, KTR can stimulate organizational processes and operational activities, thus crumpling the firm's HRM practices for shaping human capital issues (Besson and Rowe, 2012). Drawing upon the RBV, HRM practices may nurture social relations among workforces by enhancing their capabilities, commitment, and motivation to access, mobilize, and grasp vital KTR information (Caligiuri, 2014), which, in turn, may enhance the innovation, leading to successful SIP. Therefore, we suggest that the combined effects of HRM practices and tacit and explicit KTR can surge the SIP. The study proposes a two-way interaction into a SIP. Thus, we hypothesize that:

Hypothesis 2_a: The association between tacit KTR and SIP is more pronounced when the firm has a high degree of HRM practices.

Hypothesis 2_b: The association between explicit KTR and SIP is more pronounced when the firm has a high degree of HRM practices.

Training and Development Types, Human Resource Management Practices, Tacit and Explicit Knowledge Transfer Received, and Subsidiary' Innovation Performance

Training and development can be defined as a process apply to transfer to the workforces' pertinent skills, knowledge, and capability to enhance their performance on current and future assignments (Esteban-Lloret et al., 2018). Training and development are also a process of improving organizational efficiency, workforces' skills or capabilities, and productivity (Boadu et al., 2018). The training and development process helps maximize an enterprise's ability to create an environment for perpetual learning that facilitates the exchange of knowledge and ideas among workforces, which permits them to work and accomplish aims more professionally (Li et al., 2019). The present study accentuates the types of training and development, namely, on-the-job training and development and off-the-job training and development, respectively (Boadu et al., 2018) due to its critical effects on prime organizational results such as enterprise innovation and performance (González et al., 2016; Boadu et al., 2018; Dostie, 2018). On-the-job training and development refer to a process whereby an organization equips and motivates workforces daily with practical training and other developmental skills in the workplace (Boadu et al., 2018), while off-the-job training and development refer to a process whereby an organization equips and motivates employees occasionally in a classroom, workshop, simulation exercise with theory and practical's in a place away from the workplace (Boadu et al., 2018). The former approaches training and development activities by engaging knowledgeable professionals with more experienced to teach or give practical instructions to the workforce at the desk or the bench. In the same vein, team leaders, executives, superintendents, mentors can be contacted to teach workforces on matters concerning individual or group assignments and

projects (Armstrong and Lorentzen, 1996; Boadu et al., 2018). More importantly, such activities enhance workforce efficiencies, competence, creativity, innovation, capability, and commitment to accept new technologies and techniques, memorize and reproduce for optimal innovation outcome (González et al., 2016; Boadu et al., 2018; Dostie, 2018). While, the latter approaches training and development activities by engaging consultants or staff members in the training department of the organization to give prescribed training programs taken in a form of dialogues, colloquium, and case studies in a place away from the workplace (Armstrong and Lorentzen, 1996; Boadu et al., 2018). Such programs offer workforces full attention to concentrate on the learning activities, experiment with new ideas, and generally undertake self-analysis, which is necessary for permanent behavior change. Admittedly, the concept offers an opportunity to introduce workforces to new information, ideas, and experience outside what prevails in the job environment. Pertinently, it addresses employees' deficiencies in the working environment; and prepares them to grasp and absorb the latest information and strategies in the market environment, which can impact positively on new product and service development to enhance innovation capability.

Extant scholarships have identified training and development as key contributing factors behind innovation output (González et al., 2016; Boadu et al., 2018; Dostie, 2018). Dostie's (2018) studies on Canadian firms revealed that training and development types are crucial ways of increasing innovation. Boadu et al. (2018) asserted that training and development types are indispensable foundations and criteria for surging firms' innovation performance in multinational enterprises' subsidiaries operating in emerging economies. Bauernschuster et al. (2009) studies on German firms spanning from the 1997–2001 period established a robust and statistically significant effect of on-the-job and off-the-job training and development on innovation. Other scholars have established a positive linkage amongst training and development and staff productivity (Feltrinelli et al., 2017; Khan et al., 2017) and performance (Deming, 1982).

Drawing on RBV, enterprises that succeed in training and developing workforces to offer knowledge in assemblages and the entire workplace are probable to synthesize novel concepts and prospects and expedite innovation capability (Boadu et al., 2018). However, the concept of training and development types affects dissimilarity in the organization; it can be high or low on-the-job and off-the- job training and development. At the highest level, enterprises become proactive in accessing diversified ideas and concepts to enhance training and development programs. At the lowest level, enterprises become deskbound to search for diversified ideas and concepts crucial in developing training and development programs. Considering the significant nature of training and development in organizational growth; we intend to investigate whether a higher degree of training and development types strengthens the interactive effects between HRM practices and tacit and explicit KTR on SIP. Although, extant works demonstrate the individual effects of training and development types, HRM practices, and tacit and explicit KTR on innovation performance (Boadu et al., 2018; Li et al., 2019). Drawing upon the RBV, we contend that during training and development programs, workforces pay attention to acquiring new skills, knowledge, and experience within and outside precincts of the workplace by observing, imitating, and modeling others who are credible and more knowledgeable in a social context, memorize and reproduce to enhance the combined effects of HRM practices and tacit and explicit KTR on SIP. We, therefore, posit that the combined effects of training and development types, HRM practices, and tacit and explicit KTR can lead to SIP. The study proposes a three-way interaction (i.e., between training and development types, HRM practices, and tacit and explicit KTR) into a SIP. Thus, we hypothesize that:

Hypothesis 3_a: The facilitating influence of HRM practices on the linkage amongst tacit KTR and SIP surges when on-the-job training and development are high than low.
Hypothesis 3_b: The facilitating influence of HRM practices on the linkage amongst explicit KTR and SIP surges when on-the-job training and development are high than low.
Hypothesis 3_c: The facilitating influence of HRM practices on the linkage amongst tacit KTR and SIP surges when off-the-job training and development are high than low.
Hypothesis 3_d: The facilitating influence of HRM practices on the linkage amongst explicit KTR and SIP surges when off-the-job training and development are high than low.

MATERIALS AND METHODS

Participant and Data Collection

Before the survey questionnaire's final design, we pretested the draft questionnaire to assess its clarity and appropriateness for the study. First, we engage five scholars from the area of knowledge, innovation, and HRM to moderate the questionnaire and provide feedback. This encounter provided a platform to assess and refine each question for precision, comprehensibility, and consistency. Second, we further survey the revised questionnaire on thirty-three MBA students from universities in China who are experts in international business. Our preliminary investigation reveals that the constructs' internal consistency is not a problem.

To gather subsidiary-level response data in the Chinese context to test the hypotheses, we adopted a survey approach to precisely measure the study's theoretical constructs as the knowledge transfer phenomenon is quite definite, and the associations among constructs are statistically testable. We draw our sample from subsidiaries of foreign multinational enterprises focusing on manufacturing and service industries. This area belongs to knowledge-intensive and high-technology environments related to high research and development outflow and short product cycles. Through, a random sampling approach, we launched the survey to 465 senior executives in the MBA and EMBA programs of the authors' university, spanning from July to October 2018, to address the research hypotheses. Explicitly, we set the following conditions for the potential executives to satisfy: (1) the executives' firm must be in existence for not less than 3 years; (2) the executives must have three or more years of international business experience; (3) the executives

must have 6 or more years of work experience; and (4) the executives must have a first degree or above. After that, we sent an email message to executives of subsidiaries to explain the study's purpose, the result's application, the relevance of the result to subsidiary practitioners and policymakers, and asked if they would join in the survey. A sizeable number of top executives responded positively to partake in the survey. Then, we applied the following process for the data collection: First, we forwarded our questionnaire via email to executives for possible responses. Second, we sent another email to the executives in 3 weeks time to draw their attention to the task ahead. In all, 399 top executives returned their questionnaires for the survey, and 314 responses remained usable. These procedures yielded a response rate of 67.52%, which is appropriate.

Measures

We used a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree) to rate all the survey items. These items were translated from English to Chinese and back to English.

Independent Variable

We used two independent variables to measure SIP. These variables are tacit and explicit KT, respectively. Each dimension was measured with a four-item scale adapted from Dhanaraj et al. (2004) and Boadu et al. (2018). Sample items include "Relationships related know-how and skills from headquarters are shared with us." and "Our subsidiary receives know-how related to the market (e.g., customers, suppliers, competitors, regulators) from headquarters."

Dependent Variable

We used subsidiary innovation performance as our dependent variable. It was measured with a five-item scale adapted from Chen et al. (2011). We asked the executives to compare their innovation performance with the foremost contestants in the recent 3 years. Sample items include "our subsidiary's number of novel products or services have increased." and "Our enterprise speed of new product/service development is better."

Moderators

We selected HRM practices and training and development types as moderators for the study. First, authors (Huselid, 1995; Delery and Doty, 1996; Li et al., 2019) have underlined how certain HRM practices elements are significant to innovative performance. We adopted four items concerning the key constructs (i.e., compensation, participation, recruitment, and appraisal) associated with innovation from the existing scales developed by the above authors. Sample items include "Our subsidiary permits workforces to propose improvements in the way things are done." and "Our subsidiary pay reflects differences in employee contributions." Second, on-the-job and off-the-job training and development were measured using a four-item scale, each adapted from Delery and Doty (1996) and Rowden (2002). Sample items include "Our subsidiary offers workforces gradual training to learn from their trial and error." and "Our subsidiary organizes mockup exercises for workforces to upgrade their abilities and know-how."

Control Variables

We include various control variables (i.e., subsidiary size, subsidiary age, industry type, and R&D intensity) that could impact the SIP (Boadu et al., 2018). First, we control subsidiary size and age as the logarithm of the date of inception of operation and the number of workforces, respectively (Boadu et al., 2018). Second, we control for industry types (service and non-service), which service is code as (1), and non-service is code as (0) to establish the industry effects. Third, we control for R&D intensity by using the level of R&D outlay (low, medium, and high) relative to key competitors in the industry.

Test of the Measurement Model

The current paper engaged SPSS 25.0 to test and calculate all the relevant measurements to evaluate the measurement model. Thus, the paper performed a sequence of assessments and calculations in the areas of reliability, validity, average variance extracted (AVE), and composite reliability (CR) to measure the construct uniqueness of the six target variables (see **Table 1**). First, we tested the reliability of the survey scales using Cronbach's alpha coefficient; and our conclusions demonstrate that all factors are larger than 0.60 (i.e., exceeding the recommended threshold of 0.60), indicating a high level of credibility for all variables (Fornell and Larcker, 1981). Second, we applied exploratory factor analysis to test the validity of the model; and our results reveal a good validity. Third, we calculated the AVE and CR of all items; and our investigation reveals that the scores surpassed the suggested threshold of 0.50 and 0.60, respectively, indicating a high level of convergent validity. Lastly, we followed the Fornell-Larcker criterion (Hair et al., 2017) to gauge the study's discriminant validity (DV). From **Table 2**, the results reveal that the correlations between each factor and other factors were lesser than the AVE (see diagonal values in bold), confirming a satisfactory DV of the constructs (Hair et al., 2017). Further, we use the Psycho_v1.0 plugin to calculate the heterotrait-monotrait (HTMT) matrix. The results show that the HTMT coefficients between variables are all less than the suggested value of 0.85 by Henseler et al. (2015), and the Bootstrap confidence interval does not contain 1. Therefore, the HTMT test results further indicate that the variables in this paper have good discriminant validity.

Non-response Bias and Common Method Bias

The study conducted two biases tests: Non-response Bias (NRB) and Common Method Bias (CMB), respectively. First, we followed Lambert and Harrington (1990) to examine the NRB of the study. NRB occurs when there is a possible bias between the valid survey and the invalid survey in a study (Lambert and Harrington, 1990). The study compared the mean differences between the 339 valid surveys and the 25 invalid surveys on four key study variables and demographic characteristics (i.e., subsidiary age, size, R&D intensity, and industry type) using t-tests. Besides, we used independent samples *t*-test (at a 5% significant level) to compare the mean differences between early respondents and late respondents on demographic variables (Armstrong and Overton, 1977; Shi et al., 2021); none of the

TABLE 1 | Measurement test.

	Constructs	No. of items	KMO	AVE	CR	Cronbach's α
1.	Explicit KTR	4	0.726	0.506	0.804	0.674
2.	Tacit KTR	4	0.743	0.540	0.824	0.711
3.	HRMP	4	0.741	0.550	0.829	0.724
4.	On-the-Job T&D	4	0.784	0.609	0.862	0.786
5.	Off-the-Job T&D	4	0.773	0.603	0.858	0.779
6.	SIP	5	0.853	0.620	0.891	0.846

HRMP, human resource management practices.

TABLE 2 | Descriptive statistics, Pearson intercorrelations, and discriminant validity.

Variables	1	2	3	4	5	6	7	8	9	10
(1) Sage	**1**									
(2) Ssize	0.199**	**1**								
(3) Services	–0.125*	–0.203**	**1**							
(4) R&D Intensity	0.017	–0.038	0.081	**1**						
(5) On-the-Job T&D	0.089	–0.060	–0.069	0.163**	**(0.780)**					
(6) Off-the-Job T&D	0.070	–0.067	–0.066	0.104	0.540**	**(0.777)**				
7. Explicit KTR	0.030	0.073	–0.083	0.011	0.151**	0.210**	**(0.711)**			
(8) Tacit KTR	0.064	0.097	–0.039	0.016	0.199**	0.230**	0.222**	**(0.735)**		
(9) HRMP	0.068	0.058	–0.096	0.052	0.368**	0.327**	0.177**	0.096	**(0.742)**	
(10) SIP	0.022	0.202**	–0.062	0.310**	0.234**	0.217**	0.153**	0.181**	0.245**	**(0.787)**
Mean	2.7038	2.9936	0.5159	2.0478	4.8169	4.8455	4.8479	4.7317	4.8336	4.6975
SD	1.02283	1.41646	0.50054	0.65010	1.05420	1.06892	0.89447	0.90209	0.99619	1.04887

Sage, subsidiary age; Ssize, subsidiary size. N = 314; two-tailed tests.
**p < 0.05, **p < 0.01.*

statistics reveals a significant difference for the study. Hence, our results suggest that the data is free from NRB. Secondly, researchers' major concern about marker variable (MV) effects has been to eliminate them in all variables because this will yield more accurate estimates of zero-order correlation coefficients (Lindell and Whitney, 2001). We examined CMB by following Podsakoff et al. (2003, 2012) and Hair et al. (2017), guidelines. CMB occurs when a study counts on a single participant or the same source to collect data to assess both independent and dependent variables. The study adopted several procedural and statistical approaches to lessen the potential perils of CMB. First, we spend quality time explaining the study's purpose to the participants. Moreover, we assure the participants that their opinions and perceptions are paramount, and for that matter, there is no "right" or "wrong" answer. Second, we followed Harman's single-factor test method to perform an unrotated factor analysis to avoid CMB (Podsakoff et al., 2003). The variance explained rate of the first factor was 18.63%, the variance explained rate of the second factor was 13.27%, and the variance explained rates of the other factors were all less than 10%. It can be seen that there is no obvious CMB challenge in the dataset in this paper, as none of the factors contribute more than 50.0% of the total variance (Podsakoff et al., 2012).

Statistical Approach

We used SPSS 25.0 program to run all the measurement tests. Besides, we estimated HLM to consider how knowledge transfer dimensions, HRM practices, and training and development types can influence SIP. We adopted this approach due to the multilevel and nested nature of our data for the study. The approach details that foreign subsidiaries in a province and across the provinces are most likely to be similar (Gooderham et al., 2015). A significant merit of the HLM is its ability to tolerate misplaced data at all echelons, apart from the uppermost phase. It also accounts for the unequal dimension of time intermissions.

EMPIRICAL RESULTS

Descriptive Statistics, Pearson Intercorrelations, and Discriminant Validity

Table 2 provides descriptive statistics, Pearson intercorrelations, and DV of all exogenous variables. The correlation amongst the various variables: on-the-job training and development ($\beta = 0.234^{**}$, $\rho = 0.01$), off-the-job training and development ($\beta = 0.217^{**}$, $\rho = 0.01$), explicit KTR ($\beta = 0.153 =^{**}=$, $\rho = 0.01$), tacit KTR ($\beta = 0.181^{**}$, $\rho = 0.01$), and HRM practices ($\beta = 0.245 =^{**}=$, $\rho = 0.01$), is significant, as indicated in **Table 2**. Besides, except for subsidiary age and industry type, all the control variables are significantly correlated with SIP. The correlation results provide an excellent base for regression analysis. The study also carried out a test to check the collinearity of the constructs. We check the value of VIF for all predictive variables and interaction terms. We record the highest VIF value

TABLE 3 | Results of the hierarchical linear regression of hypotheses.

Variables	Dependent Variable: SIP								
	M 1	**M 2**	**M 3**	**M 4**	**M 5**	**M 6**	**M 7**	**M 8**	**M 9**
Sage	–0.031(0.053)	–0.039(0.052)	–0.033(0.052)	–0.065(0.05)	–0.029(0.051)	–0.056(0.05)	–0.052(0.05)	–0.065(0.05)	–0.048(0.051)
Ssize	0.211(0.039) ***	0.198(0.038) ***	0.203(0.038) ***	0.176(0.037) **	0.184(0.037) **	0.179(0.037) **	0.183(0.037) **	0.166(0.037) **	0.183(0.037) **
Services	–0.049(0.108)	–0.046(0.107)	–0.040(0.107)	–0.029(0.103)	–0.024(0.104)	–0.026(0.103)	–0.014(0.102)	–0.023(0.101)	–0.013(0.103)
R&D Intensity	0.323(0.081) ***	0.320(0.080) ***	0.320(0.081) ***	0.282(0.078) ***	0.300(0.078) ***	0.275(0.078) ***	0.284(0.078) ***	0.263(0.077) ***	0.286(0.078) ***
Tacit KTR		0.152(0.052) **		0.129(0.051) *		0.087(0.053)		0.061(0.052)	
Explicit KTR			0.133(0.052) *		0.110(0.052) *		0.054(0.053)		0.054(0.054)
HRMP				0.207(0.051) ***	0.192(0.052) ***	0.167(0.054) **	0.138(0.054) *	0.13(0.054) *	0.124(0.054) *
On-the-Job T&D						0.103(0.058)	0.123(0.056) *		
Off-the-Job T&D								0.114(0.055) *	0.133(0.055) *
Tacit KTR × HRMP				0.174(0.045) **		0.138(0.046) **		0.126(0.046) *	
Explicit KTE × HRMP					0.145(0.046) **		0.122(0.045) *		0.17(0.049) **
HRMP × On-Job-the-T&D						0.008(0.044)	0.007(0.044)		
HRMP × Off-the-Job T&D								0.150(0.057) *	0.063(0.052)
Tacit KTR × HRMP × On-job-the T&D						0.120(0.039) *			
Explicit KTR × HRMP × On-Job-the T&D							0.168(0.052) **		
Tacit KTR × HRMP × Off-Job T&D								0.196(0.049) **	
Explicit KTR × HRMP × Off-the-Job T&D									0.133(0.04) *
R^2	0.134	0.154	0.149	0.219	0.202	0.231	0.235	0.252	0.227
F	13.095 ***	12.405 ***	11.954	13.511 ***	12.349 ***	10.411 ***	10.612 ***	11.562 ***	10.193 ***

****p < 0.001, **p < 0.01, *p < 0.05, (Standard error), N = 314.*

of 1.9, which is < the accepted starting point of 5 (Hair et al., 2017). This result clears us away from multicollinearity.

Test of Hypotheses

Direct Effect

Hypothesis 1_a suggests that there is a positive relationship between tacit KTR and SIP. From **Table 3** (Model 2), our investigations indicate that tacit KTR is a critical factor that influences SIP ($\beta = 0.152^{**}$, $\rho = 0.01$). Besides, the entrance of tacit KTR provides further significant clarification power 15.4 % ($R^2 = 0.154$, $F = 12.405 =^{***}$, $p = 0.001$) in the variation of SIP. Thus, hypothesis 1_b is confirmed.

Hypothesis 1_b states that there is a positive relationship between explicit KTR and SIP. From **Table 3**, Model 3, the results show the coefficient of explicit KTR as positive ($\beta = 0.133^{*}$, $\rho = 0.05$) and significant, indicating a strong impact of explicit KTR on SIP. Besides, the entrance of explicit KTR provides further significant clarification power 14.9 % ($R^2 = 0.149$, $F = 11.954^{***}$, $p = 0.001$) in the variation of subsidiary innovation activities, therefore supporting hypothesis 1_b.

Moderation Effect

Hypothesis 2_a predicts that HRM practices positively moderate the relationship between tacit KTR and SIP. From **Table 3**, Model 4, the beta for the interaction effect between tacit KTR and HRM practices are significant and positive ($\beta = 0.174 =^{**}$, $\rho = 0.01$, $R^2 = 0.219$). As can be seen from Model 4, HRM practices moderate the association among tacit KTR and SIP. To more intuitively show the relationship between variables, we further use the process plugin to draw a moderation effect graph, as **Figure 2** shown. **Figure 2** illustrates that the effect of tacit KTR on SIP is stronger when HRM practices are high (+1 SD). In other words, when HRM practices become higher, the SIP generated by the same tacit KTR becomes higher. Thus, HRM practices positively moderate the relationship between tacit KTR and SIP, the study finds support for hypothesis 2_a.

Hypothesis 2_b states that HRM practices positively moderate the linkage amongst explicit KTR and SIP. The results in **Table 3**, Model 5 confirm the facilitating role of HRM practices on the association among explicit KTR and SIP are statistically significant ($\beta = 0.145^{**}$, $\rho = 0.01$, $R^2 = 0.202$). Indeed, the beta coefficient indicates that HRM practices have influencing tendencies on the correlation between explicit KTR and SIP as positive. In addition, to more intuitively show the relationship between variables, we further use the process plugin to draw a moderation effect graph, as **Figure 3** shown. **Figure 3** illustrates that the effect of explicit KTR on SIP is stronger when HRM practices are high (+1 SD). In other words, when HRM practices become higher, the SIP generated by the same explicit KTR becomes higher. Thus, HRM practices positively moderate the relationship between explicit KTR and SIP, the study finds support for hypothesis 2_b.

Moderated Moderation Effect

Hypothesis 3_a states that on-the-job training and development moderates the moderation of HRM practices on the tacit KTR-SIP link. **Table 3**, Model 6 illustrates the three-way interaction (i.e., tacit KTR × HRM practices × on-the-job training and development) ($\beta = 0.120^{*}$, $\rho = 0.05$, $R^2 = 0.231$), which attests to the relationship between the variables. Thus, the study affirms that the influence of HRM practices on the tacit KTR-SIP link is generally pretentious by in-house training and development. The study used process software to map the corresponding effects to illustrate further the moderate mechanism of HRM practices and on-the-job training and development. To more intuitively show the relationship between variables, we further use the process plugin to draw a moderation effect graph, as **Figure 4** shown. **Figure 4** shows that when on-the-job training and development become a higher "+1 SD" group (bottom of **Figure 4**), the positive influence of HRM practices on the tacit KTR-SIP link will become higher. Thus, on-the-job training and development positively moderated the moderating effect of HRM on tacit KTR and SIP, the study finds support for hypothesis 3_a.

Hypothesis 3_b projects that HRM practices' positive effects on the explicit KTR-SIP link will be strengthened by on-the-job training and development. **Table 3**, Model 7 demonstrates a robust positive three-way interaction, which indicates that on-the-job training and development moderates the influence of HRM practices on the correlation among explicit KTR and SIP ($\beta = 0.168^{**}$, $\rho = 0.01$, $R^2 = 0.235$). To more intuitively show the relationship between variables, we further use the process plugin to draw a moderation effect graph, as **Figure 5** shown. **Figure 5** shows that when on-the-job training and development become a higher "+1 SD" group (bottom of **Figure 5**), the positive influence of HRM practices on the explicit KTR-SIP link will become higher. Thus, on-the-job training and development positively moderated the moderating effect of HRM on explicit KTR and SIP, the study finds support for hypothesis 3_b.

Hypothesis 3_c proposes that the positive effects of HRM practices on the tacit KTR-SIP link will be strengthened by off-the-job training and development. The coefficient estimates for the three-way interaction effects is robust and statistically significant ($\beta = 0.196^{**}$, $\rho = 0.01$, $R^2 = 0.252$, *Model* 8, **Table 3**), signifying that off-the-job training and development influence HRM practices on the tacit KTR-SIP link. Building on this analysis and to more intuitively show the relationship between variables, we further use the process plugin to draw a moderation effect graph, as **Figure 6** shown. **Figure 6** shows that when off-the-job training and development become a higher "+1 SD" group (bottom of **Figure 6**), the positive influence of HRM practices on the tacit KTR-SIP link will become higher. Thus, off-the-job training and development positively moderated the moderating effect of HRM on tacit KTR and SIP, the study finds support for hypothesis 3_c.

Hypothesis 3_d proposes that the positive effects of HRM practices on the explicit KTR-SIP link will be strengthened by off-the-job training and development. The three-way interaction among the variables provides a significant level ($\beta = 0.133^{*}$, $\rho = 0.05$, $R^2 = 0.227$); see Model 9 in **Table 3**. In addition, the study used process software to map the corresponding effects to illustrate further the moderate mechanism of HRM practices and off-the-job training and development. To more intuitively show the relationship between variables, we further use the process plugin to draw a moderation effect graph, as **Figure 7** shown.

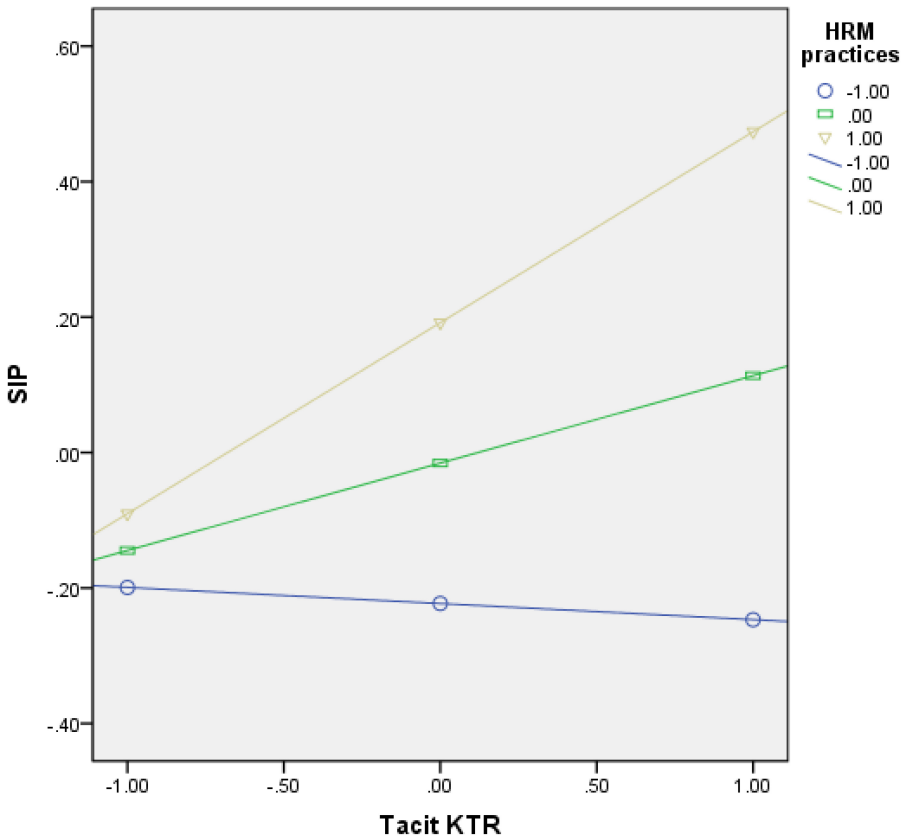

FIGURE 2 | The moderating effects of HRM Practices on the impact of tacit KTR and SIP.

Figure 7 shows that when off-the-job training and development become a higher "+1 SD" group (bottom of **Figure 7**), the positive influence of HRM practices on the explicit KTR-SIP link will become higher. Thus, off-the-job training and development positively moderated the moderating effect of HRM on explicit KTR and SIP, the study finds support for hypothesis $3_{d.}$

Robustness Test

In order to test whether the sample size has sufficient power, we performed power analysis using the pwr function in the R language package. In the tacit KTR-HRM practices × off-the-job T&D model with K = 3 (SD/+1SD/−1SD), Cohen's f value was 0.309. If the power value reaches 0.8 and is significant (sig. level = 0.05), the minimum sample size should be 35; similarly, the minimum sample size required to meet the conditions calculated in other models in this paper is also less than 40. The total sample size of this paper reaches 314, so the number is enough to avoid over-fitting or parameter overestimation.

In addition, to test the robustness of the models, we further performed a bootstrap test on all moderating effects (bootstrap 5000 samples, Confidence level for confidence intervals 95%). If the interval does not contain 0, it means that the moderating effect is robust. The M4–M9 bootstrap results are shown in **Table 4**. Bootstrap does not take into account the common factor extraction of the variables, so there is a slight difference from the hierarchical regression results. The bootstrap results in **Table 4** are basically consistent with the hierarchical regression results in **Table 3**, which indicates that the conclusions of this paper are robust to a certain extent.

DISCUSSION, IMPLICATIONS, AND CONCLUSION

Today's volatile global market environment has thrust multinational enterprises and their affiliates to seek survival antidotes for their operational activities. Academicians have recognized knowledge transfer as an important weapon for enterprises' competitive edge, growth, and survival in the international marketplace (Foss and Pedersen, 2019). Although scholarship has shown that knowledge management offers important signals to firm innovation, few studies have considered how knowledge transfer dimensions from headquarters make sense and influence innovation performance. Using the multinational foreign subsidiaries operating in the Chinese market as a context, we constructed a moderated moderation model to scrutinize the linkage amongst KTR dimensions and SIP as well as the effect mechanisms of HRM practices and training and development types on such relationships. Using a survey dataset from 314 subsidiaries of foreign multinational enterprises

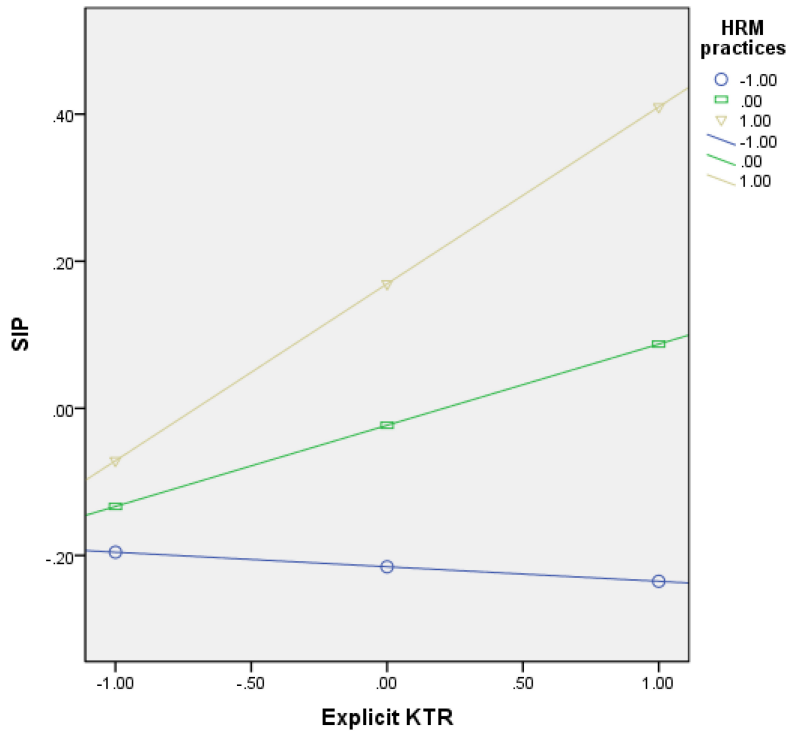

FIGURE 3 | The moderating effects of HRM Practices on the impact of explicit KTR and SIP.

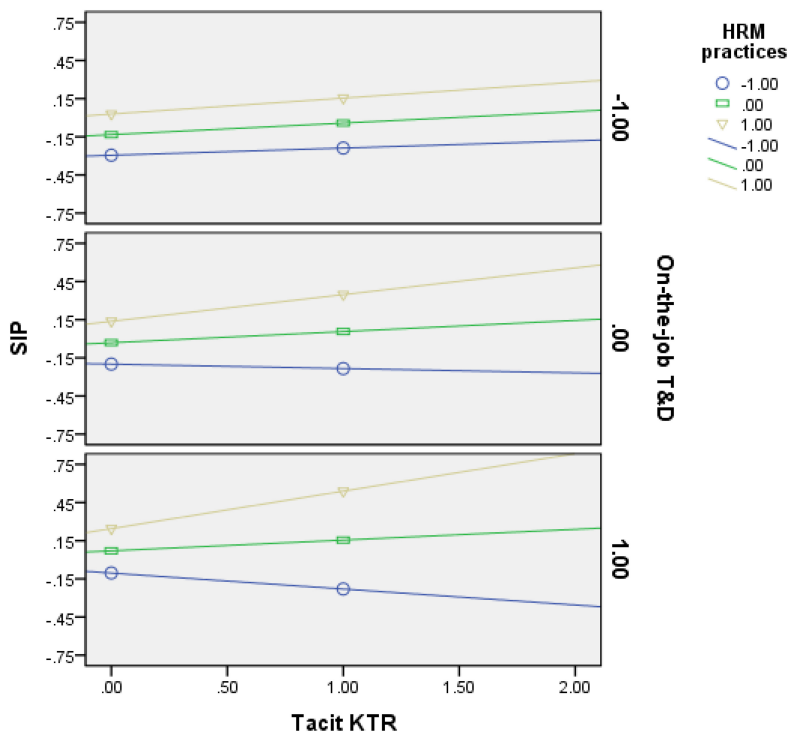

FIGURE 4 | The moderated moderation effects of on-the-job T&D on HRM practices, tacit KTR and SIP.

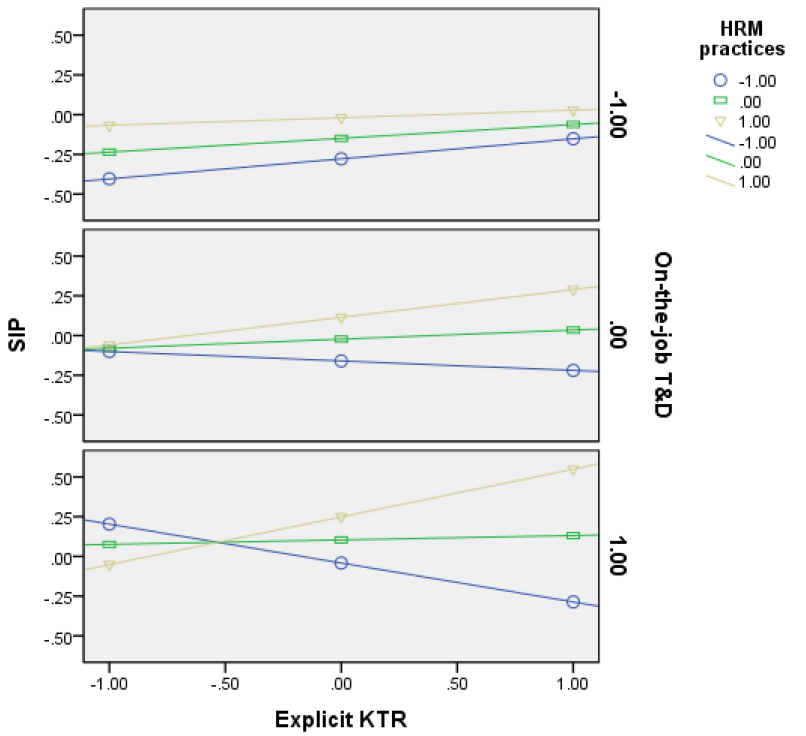

FIGURE 5 | The moderated moderation effects of on-the-job T&D on HRM practices, explicit KTR and SIP.

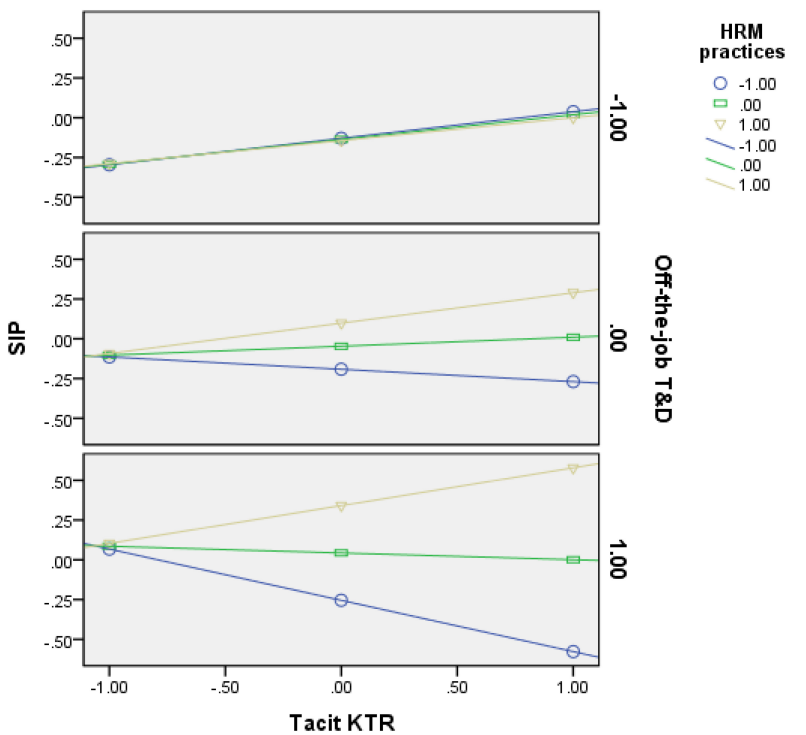

FIGURE 6 | The moderated moderation effects of off-the-job T&D on HRM practices, tacit KTR and SIP.

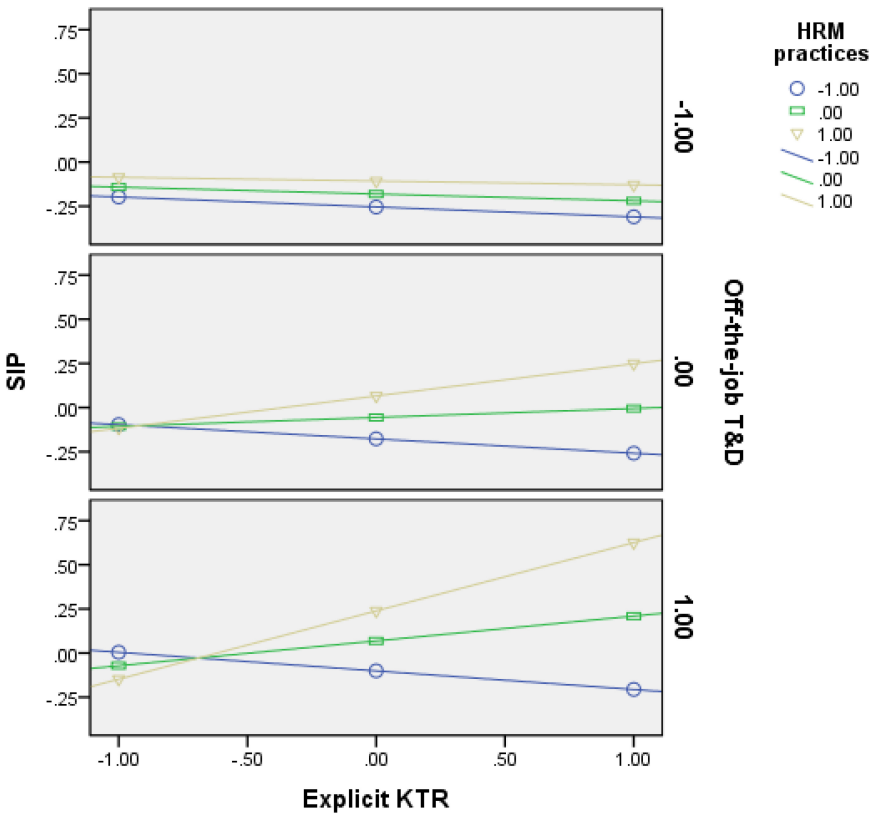

FIGURE 7 | The moderated moderation effects of off-the-job T&D on HRM practices, explicit KTR and SIP.

TABLE 4 | Robustness test by bootstrap.

Model	Coeff	Se	*p*	LLCI	ULCI
M4	0.1749	0.0525	0.0010	0.0717	0.2781
M5	0.1519	0.0537	0.0050	0.0461	0.2576
M6	0.0956	0.0442	0.0314	0.0086	0.1826
M7	0.1718	0.0590	0.0039	0.0556	0.2879
M8	0.1598	0.0537	0.0031	0.0542	0.2654
M9	0.1241	0.0456	0.0068	0.0345	0.2138

located in China, our HLM analysis yielded six overarching results for all the proposed associations while controlling for subsidiary age, size, R&D intensity, and industry type. First, KTR dimensions contribute to SIP. Secondly, HRM practices can positively moderate KTR dimensions and SIP. Thirdly, the positive effect of HRM practices on the KTR dimensions-SIP link increases when on-the-job and off-the-job training and development is high.

Theoretical Contributions

The study advances theory in several ways. First, the current paper contributes to advancing the RBV to comprehend what causes subsidiaries' innovation performance. Previous studies have dissected the association between knowledge transfer dimensions and performance (Dhanaraj et al., 2004; Anh et al., 2006; Ahammad et al., 2016; Magnier-Watanabe and Benton, 2017) and innovation performance (Cavusgil et al., 2003; Harlow, 2008; Wang and Li, 2016; Terhorst et al., 2018; Asbari et al., 2019; Pérez-Luño et al., 2019; Berraies et al., 2021). Liu et al.'s (2019) studies on the impact of knowledge transfer dimensions on emerging market multinational enterprises' innovation performance reveal a positive result. In contrast, tacit and explicit KTR and SIP have rarely been probed. From the statistical discoveries of this research, we suggest that tacit and explicit KTR are strategic resources that subsidiaries should leverage to shape and implement innovation performance, which, in turn, create a competitive advantage. Thus, the results indicate that KTR dimensions are a critical determinant of the subsidiaries' innovation performance and highlight that the tacit KTR effect on SIP ($\beta = 0.152^{**}$, $\rho < 0.01$) is greater than the explicit KTR effect on SIP ($\beta = 0.133^{*}$, $\rho < 0.05$). The conclusions reveal that tacit KTR plays a significant role in subsidiaries' superior innovation performance. The discoveries are somewhat in line with the theoretical research conducted by scholars like Arnett et al. (2021) and Crespo et al. (2022) which reveal a significant role of tacit knowledge in creating competitive differentiation. Interestingly, Crespo et al. (2022) assert that tacit knowledge exerts conflicting facilitating influences on the transfers of marketing knowledge, carrying dissimilar insinuations for a subsidiary's knowledge management. In all, our empirical results are somewhat in line with scholarships that

have proved a significant linkage amongst knowledge transfer dimensions and innovation outcome (Cavusgil et al., 2003; Harlow, 2008; Wang and Li, 2016; Terhorst et al., 2018; Asbari et al., 2019; Liu et al., 2019; Pérez-Luño et al., 2019; Berraies et al., 2021). While applying RBV to the knowledge-innovation outcome relationship, we postulate that knowledge is a critical resource and shares the characteristics of rarity, unpredictability, and rigidity for actors to copy or reproduce (Guan and Frenkel, 2018; Li et al., 2019). Thus, we provide novel insights into a critical antecedent in cultivating the innovation capability of subsidiaries in emerging economies.

Second, scholars like Sánchez et al. (2015) and Sarala et al. (2016) accentuated the significant role of HRM practices in organizations and pointed out that notable issues related to HRM practices' facilitating effect on the knowledge transfer-enterprise performance link remain underexplored. Previous research explains how HRM practices work in tandem with knowledge transfer to enhance innovation outcomes (Chuang et al., 2016; Li et al., 2019). These studies generally emphasize the mediation consequence of knowledge transfer in the linkage amongst HRM and enterprise innovation outcomes (Jackson et al., 2014). With a few scholarships accentuating the HRM practices' facilitating effect on the knowledge acquisition-innovation performance relationship (Papa et al., 2020). In response to calls by these authors (Sánchez et al., 2015; Sarala et al., 2016) for inspections of the HRM practices' facilitating effect on the knowledge-enterprise performance link, we proposed a two-way interaction model (i.e., HRM practices and tacit and explicit KTR) into innovation performance which has rarely been investigated. Our findings demonstrate that HRM practices and KTR dimensions are critical resources that subsidiaries should hinge on to implement innovation performance. The study discoveries are somewhat in line with the theoretical research conducted on the facilitating role of HRM practices on the correlation between knowledge acquisition and innovation outcome by Papa et al. (2020). While applying RBV to the above relationship, we postulate that human resources (i.e., workforce) are vital and strategic among the organization's resources (Barney, 1991; Li et al., 2019) and should be valued, rigid, and unpredictable in a way that it becomes problematic for actors to copy or reproduce (Guan and Frenkel, 2018; Li et al., 2019). Thus, well-developed HRM practices can enhance the workforces' capabilities, commitment, and motivation, to grasp vital knowledge transfer information (Caligiuri, 2014), and contribute effectively to innovation performance (Papa et al., 2020). Equally, the study compliments RBV theory and postulates that firms should project and implement HRM practices that aim at enticing, inspiring, gratifying, and sustaining employee job behaviors to support KTR dimensions for process and product innovation to achieve superior SIP. In other words, with well-developed HRM practices, subsidiaries are more able to cultivate groundbreaking products and services to achieve superior innovation performance (Andries and Czarnitzki, 2014; Papa et al., 2020). Hence, the present scholarship incorporates the RBV theory and demonstrates why and how HRM practices and KTR dimensions stimulate SIP.

Third, we provide fresh insight into the influencing mechanism of on-the-job and off-the-job training and development on the HRM practices effect on the KTR dimensions-SIP link. Although aspects of training and development types (Boadu et al., 2018; Dostie, 2018) and HRM practices (Kaabi et al., 2018; Lee et al., 2019; Li et al., 2019) have received attention separately in different models, but the variables' combined effect is rare in the extant work. Our conclusions from the HLM suggest that workforces develop high morale and pay attention when managers or policymakers of an establishment provide higher-level competency on-the-job and off-the-job training and development programs to acquire new skills and knowledge by observing, imitating, and modeling others who are credible and more knowledgeable in a social context, memorize and reproduce to enhance HRM activities and KTR dimensions activities for greater innovation performance which invariably is capable of influencing organizational success. In general, the results reveal that training and development types, HRM activities, and knowledge assets are the foremost driving forces of essential vicissitudes in the technological path, which is very vital for enterprises to adjust and infiltrate prevailing market configurations and obtain a competitive edge in emergent client markets. We have made significant progress in developing an unfathomable comprehending of the dynamic of firm resources and their counterbalancing effects within the knowledge and innovation literature. Besides, our conclusions complement the legitimacy of RBV at a knowledge and innovation level of analysis.

Practical Contribution

The findings emanating from the study suggest the following important practical implications for IB practitioners and policymakers. First, the role and significance of knowledge in innovation performance cannot be overemphasized in emerging economies (Boadu et al., 2018). Our findings suggest that emerging market subsidiaries, tacit and explicit KTR could be an effective way to promote innovation performance. These dimensions are integral elements of the RBV (Boadu et al., 2018) and can be considered as an essential asset for organizational success and sustainable competitive advantage (Quartey, 2019). We suggest that executives should pay attention and offer the necessary protection for firms' knowledge resources, especially tacit knowledge which is an unobservable resource to enhance innovation strategies (Sprinkle and Urick, 2018) toward sustainable competitive advantage (Quartey, 2019). Besides, we suggest that top management should strengthen their collaboration and cooperation with both internal and external partners for knowledge exchange. Certainly, the linkage can offer firms access to a direct or indirect resource (including a wide range of technology and specific talent) which can broaden their internal competence to speedily address customers and environmental needs, thereby improving innovation output. Secondly, the findings of the study direct to the significance of scrutinizing the influence of HRM practices, which can provide a dynamic role in the triumph of emerging market subsidiaries. We suggest that executives must comprehend HR

policies and promote initiatives to spark HRM practices to innovation, along with specific KTR activities that can be valuable to enhance innovation (Papa et al., 2020). In the same vein, executives must also invest in HRM practices and consider it as a critical asset to steer human resources (Guest, 2017; Li et al., 2019) to complement KTR dimensions toward achieving better innovation performance. Thus, effective and efficient HRM practices or designs may stimulate the workforce behavior in grasping KTR dimensions more effectively to create new ideas, products, and services to improve innovation output. Thirdly, the finding of a positive effect of on-the-job and off-the-job training and development on the impact of HRM practices on the KTR dimensions-SIP linkages, suggests that the training and development programs are critical motivational and learning resources for organizations. High-level on-the-job and off-the-job training and development encourage HRM practices, which can be valuable to SIP. We suggest that the executive must invest in training and development activities to boost workforce morale and creative thinking toward organizational activities. Regular seminars and training sessions can change workforce attitude and perception of crucial organizational issues and emphasize corporate novelty strategies, which can enhance grander innovation activities. Besides, we suggest that executives should focus on the universal application of on-the-job and off-the-job training and development, HRM practices, and KTR dimensions to enhance SIP. The amalgamation of these variables can create a variance in the industry. Fourth, pertinent government agencies should vigorously guide and inspire multinational enterprises' subsidiaries to "create capacity-building activities." For instance, government agencies can energetically guide enterprises to "create capacity-building activities" by enhancing related laws and protocols, granting preferential interest rates, and granting tax rebates and affordable loans, specifically in the pharmaceutical and electronics industries as they hinge on knowhow. An increase in enterprises' HRM activities can bring social cohesion among workforces and foster knowledge transmission, which, in turn, enhance their technological innovation capabilities. Also, an increased innovation capacity building can bring divergent innovative ideas from workforces to lift the country's innovation index. In addition, emerging market authorities should create an enabling environment that will shield the intellectual properties and transparency of multinational enterprises' subsidiaries toward the creation of a sustainable knowledge economy.

Limitations and Future Direction

The paper possesses some shortcomings. First, all the empirical findings exhibited by this research stem from quantitative data, which was employed to examine the research phenomenon; it could be necessary for future researchers to engage the qualitative method to shed more light on the association among the variables. Second, the current research only considers the association among the constructs under the control roles of subsidiary age, size, R&D intensity, and industry type to account for dissimilarities in innovation outcome without considering their moderating influences or the other moderating roles of strategic variables such as ownership type of subsidiaries, collaborative know-how, prior experience, learning capacity, and organizational supports (Boadu et al., 2021b; Shi et al., 2021). In future studies, we believe that researchers can scrutinize the correlation between the constructs under the moderating mechanisms of these factors to offer an unfathomable comprehension of the association among them. Besides, future researchers should consider other mediating variables (e.g., organizational agility and cross-border search capability) to expand the model. Third, hierarchical culture is assessed as contributing factor to innovation (Boadu et al., 2022), future inquiry needs to capitalize on the prospects of hierarchical culture by incessantly examining its association with knowledge management process to create superior innovation for subsidiaries. Fourth, the study focused on only foreign subsidiaries in China and did not consider other hosts and domestic peers. In future inquiries, researchers should include other host countries in their investigations. Especially, future studies could use multi-country data to examine the contingent effects of institutional environments on the relationships we explored in this paper. Finally, future researchers could engage contextual country-level factors such as government grants, and environmental dynamism among others to set the difference regarding the subsidiary's sensibility to knowledge transfer drives toward innovation capabilities.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

YX, FB, ZC, and AO contributed to conception and design of the study. YX and FB collected the data. YX, FB, ZC, and AO analyzed the data and wrote the initial draft of the manuscript and putting forward the main propositions. FB and AO were responsible for reviewing and editing the manuscript. All authors contributed to manuscript revision, and read and approved the submitted version.

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EDITED BY
Murad Ali,
Northumbria University,
United Kingdom

REVIEWED BY
Liudmila Liutsko,
Instituto Salud Global Barcelona (ISGlobal),
Spain
Conceição Santiago,
Polytechnic Institute of Santarém, Portugal

*CORRESPONDENCE
Victoria Mazoteras-Pardo
Victoria.Mazoteras@uclm.es

†These authors share first authorship

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Theorising about child maltreatment: Narrative review on health education models, conceptual frameworks and the importance of the information and communication technologies

Sagrario Gómez-Cantarino[1,2,3†], Victoria Mazoteras-Pardo[1,2*], José Rodríguez-Montejano[1], Cinzia Gradellini[4†], Aliete Cunha-Oliveira[3] and María Idoia Ugarte-Gurrutxaga[1,2]

[1]Faculty of Physiotherapy and Nursing, University of Castilla-La Mancha, Toledo, Spain, [2]Research Group Nursing, Pain and Care (ENDOCU), University of Castilla-La Mancha (UCLM), Toledo, Spain, [3]Health Sciences Research Unit: Nursing (UICISA: E), Coimbra School of Nursing (ESEnfC), Coimbra, Portugal, [4]Azienda Unità Sanitaria Local-IRCCS of Reggio Emilia, University of Modena and Reggio Emilia, Modena, Italy

Child maltreatment is conceived as a public health problem. Therefore, it is appropriate to analyse the explanatory models that deal with this behaviour, reflecting these postulates within the panorama of health education, which makes health professionals responsible for taking action. In order to do this, the theoretical context and the awareness of nursing students in relation to these theories must be analysed. In turn, the use of information and communication technologies in this field should be valued, due to their capacity to manage and systematise information, becoming a relevant tool when training future nursing professionals. Without forgetting that health informatics is a spectrum of multidisciplinary fields that includes the study of the design, development and application of computational techniques to improve healthcare. A review of the scientific literature was carried out, for which primary and secondary sources were consulted, tracing a search for data thanks to the keywords: 'nursing'; 'abuse'; 'children'; 'education' and 'theory'. During the second half of the 20th century, several health paradigms have been developed, which present different pathways to health education. There have also been three generations of theoretical models that attempt to analyse the public health problem of child maltreatment. This reflects the need for a transdisciplinary approach to child abuse, where there is no one explanatory model that is more appropriate than another, but where the choice of the health education paradigm and, within this, the most recommendable theory will depend on each situation.

KEYWORDS

nursing, abuse, children, education, theory, family, software, new technologies

Introduction

The human mind represents a state of consciousness and subconsciousness that cannot be directly assessed or defined. The cognitive and subjective processes of people are individual, which make it possible to conceive the reality of each user in a unique way. One tool by means of which the deepest region of human psychology can be analysed is psychoanalysis (Papel et al., 2005; Poscheschnik, 2009), a research technique consolidated by the neurologist Sigmund Freud around 1896 (Alvarenga, 2006). This procedure allows for a possible interpretation of dream manifestations, longings, lack of self-esteem or free association of details (Tubert, 2000). The historian Roudinesco and Plon (2005, p. 1232) went further into Freud's definition of psychoanalysis in 1922, determining that 'Freud provided the most precise definition of the psychoanalytic framework by underlining that its theoretical "pillars" were the unconscious, the *Oedipus complex*, resistance, repression and sexuality (…)' In turn, it is worth noting that the psychoanalysis proposed by Sigmund Freud constitutes one of the most important references for the understanding of the psychodynamic model, a conceptual framework that tries to provide a theoretical point of view on different elements, such as the human being and its development, or the proliferation of disorders, both physiological and psychological (Tubert, 2000; Roudinesco and Plon, 2005).

In the same way, these elements have been of special relevance in the field of education in Higher Studies, specifically in the Degree in Nursing, when forging a professional design of action and development of care. This requires an analysis of the complex reality of contemporary society, valuing its cultural aspects, social relations, the transmission of knowledge and the wide diversity of dynamic factors that make up the human being (Roudinesco and Plon, 2005), including information and communication technologies (ICTs). This factor, in relation to health sciences, has undergone multiple changes over time, even modifying the way of university teaching and health education. In fact, research in health informatics focuses on the applications of artificial intelligence in healthcare, generally centred in academic institutions. Therefore, the relationship between new technologies, health education and learning in health sciences is a relevant union in our days and, for this reason, it should be valued (Juanes Méndez, 2016). In order to develop such an interpretation of the prevailing reality, not only is the education provided at universities in the health sciences relevant, but also the self-realisation of the individual and the evolution of the inner world of students in this branch of health. This will allow a greater conception of human society by consolidating holistic and integral care, maintaining the perception that health is not something professional, but is based on the active and dynamic participation of people, with the aim of achieving the common good and individual improvements, with pre-eminence of the collective and social (Acuña González et al., 2014). This plays a relevant role when it comes to understanding Health Education (HE), understood as a set of intersectoral actions whose aim is to promote people's well-being, a key function of health professionals, by providing the human community with the necessary competences for the promotion and protection of their comprehensive health (Riquelme Pérez, 2012).

Within the field of health education, the World Health Organization (WHO) has proposed three theoretical educational methods, which present different perspectives (Papel et al., 2005), with the aim of teaching and raising awareness among the population about different situations, including child abuse, which has accompanied humanity throughout its history (Suárez, 2001; López Jaramillo et al., 2013). This is one of the most heartbreaking and violent acts that can be practised on children and that are accepted for religious or disciplinary reasons (Suárez, 2001). These practices of physical, social and psychological affliction of children have even been used as educational and learning methods. In fact, in Roman society, it was considered that the 'pater famili' abandoned, sold or even killed their children (Cunyas Chalco, 2019). It was not until the Middle Ages that infants were recognised as human beings, but with the conception of the child as a corrupt being, who must be socialised, redeemed through discipline and punishment (Fry, 1993; Enesco, 2009).

In the second half of the 19th century, publications focused on child abuse began to appear, describing its impact, especially at the physiological level, as demonstrated in 1860 by the French physician Auguste Ambroise Tardieu (1818–1879), who came to describe quite particular injuries in paediatric cases. Almost a century later, in 1946, the radiologist John Caffev enunciated the first formal concepts on child abuse, when publishing studies on multiple bone fractures in infants, coming to value another relevant detail: the incoherent explanation that parents of abused children can provide (Cunyas Chalco, 2019). In the 1970s, the first conceptual frameworks on child maltreatment emerged, in order to understand, firstly, the functioning of these acts based on the supposed presence of psychiatric disorders in the parents or guardians of the children. As the twentieth century progressed, more subtle theoretical variants, both sociological and socio-environmental (Gil, 1970), proliferated in the search for an understanding of child abuse.

In relation to these parameters, the general aim of this study is to describe the conceptual frameworks on child maltreatment according to the explanatory models of HE proposed by the Pan American Health Organization (PAHO) and the World Health Organization (WHO) by comparatively analysing the different theoretical frameworks (PAHO/WHO, 1996), in addition to identifying relevant insights into concrete forms of intervention in nursing education and practice for the promotion, maintenance or restoration of health in accordance with child maltreatment (Figure 1).

The study will also represent a significant shift in existing research by examining the use of various explanatory models as an efficient tool for nursing practice and ultimately for the various health professions. This study is a very timely contribution to the

Abbreviations: ICT, Information and Communication Technologies; WHO, World Health Organization; PAHO, Pan American Health Organization; HE, Health Education.

international analysis of the teaching of health education, as well as child maltreatment, in Higher Education programmes and specifically in nursing. The University of Castilla-la-Mancha (Toledo, Spain), the University of Reggio Emilia (Italy) and the University of Coimbra (Portugal) form the collaborative network of this research.

Materials and methods

Study design

This research aims to show a detailed, selective and critical study that integrates the essential information from a unitary and overall perspective (Icart et al., 1994). It is an exploratory study of analytical-descriptive approach with a qualitative approach in a multisectoral context, with great utility in education, as well as related fields (Day, 2005) which was developed from January to June 2021.

This narrative review has been carried out using five stages of action taking into account the qualitative data of the various explanatory models to be addressed. The initial stage of a review study is to identify an observed problem in healthcare and propose an objective (Peters et al., 2015); in this case, the overall purpose of this review was to describe publications with social content in relation to child maltreatment and the educational measures to be imparted in the human community to discard them. Therefore, it is intended to provide a better understanding of the phenomenon to be studied, since for nursing the greatest potential is represented in the development of clinical practice, as it allows for the creation and review of scientific evidence (International Council of Nurses, 2014; Peters et al., 2015; Knoester and Plikuhn, 2016).

Search strategy

In order to carry out this review, a series of phases of action were established, bearing in mind the qualitative data of the various explanatory models to be addressed. In the first phase, a bibliographic search was carried out in the following electronic databases: PubMed, Science Direct, CINAHL (Cumulated Index of Nursing and Allied Health Literature), Scopus, Cuiden, as well as Google Scholar (Table 1).

The papers retrieved during the searches were checked against the following inclusion criteria (1) original full-text report published in a peer-reviewed journal; (2) publication period between 1970 and 2021, in order to review the literature in reduced time; (3) manuscripts in Spanish, English and Portuguese language; (4) documentation related to conceptual frameworks of health education in line with child maltreatment, and (5) publications with social content related to child maltreatment and educational measures to be provided in the human community. Exclusion criteria were (1) documentation not aligned with the topic; (2) duplicate material and (3) papers aligned with the study topic, but not associated with the nursing profession and the act of caring. In this phase, 125 articles related to the topic were selected, but 42 that met the established

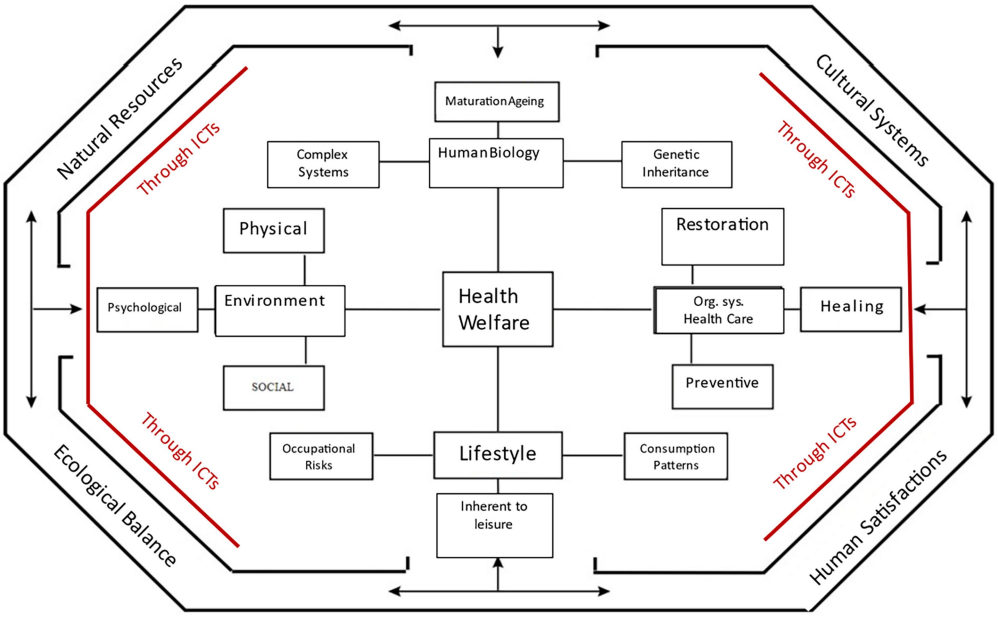

FIGURE 1
Epidemiological model for health field analysis in health promotion, preservation, and recovery. Modified by the author from: Dever (1976), Blum (1981), and Coutino et al. (1991).

Table 1 Search strategy in databases.

Database	Search Strategy	Limits	Filters
PubMed	[(nursing) AND	Title	24 items filtered
Science Direct	(care)] AND	Article	19 items filtered
CINHAL	[(child) OR	English/	17 items filtered
Scopus	(health) AND	Spanish/	12 items filtered
Cuiden	(society) AND	Portuguese	18 items filtered
Google Scholar	(culture)] AND		35 items filtered
	[(education) OR		
	(new technologies)]		

Own elaboration of the authors.

inclusion criteria were finally reviewed and studied in depth (Figure 2).

In a second phase, documentation in paper format was reviewed in the Library of the University of Castilla-La Mancha (Toledo Campus), in the Public Library of Castilla-La Mancha, in the archive of the Faculty of Medicine of the Complutense University of Madrid, as well as in the Municipal Archive of Toledo. The discussion focused on several sub-themes: (1) history of children's rights; (2) history of child abuse; (3) child, family and health and (4) ethical abuse and nursing. A pre-analysis of the material found was carried out. In addition, the reading of books and chapters was carried out, which have been cited throughout the development of the study. There were 20 books, of which 12 books and 5 chapters were studied in depth in order to address the objective of the study.

In the third phase, a manual and/or electronic review was carried out of official documents extracted from the International Council of Nurses and the Coordination of Community Health, the Directorate of Medical Benefits of the Mexican Institute of Social Security, as well as the Ministry of Health, Social Services and Education of the Spanish Autonomous Communities. A total of 8 documents of this type of bibliography were reviewed, but 3 of them were studied in depth.

Data analysis

The bibliography used for this review was subjected to an inferential interpretation by the researchers. An attempt was made to understand the already researched and written reality related to the models of child maltreatment linked to the educational framework of both PAHO and WHO, confronting it with the social reality regarding violence towards infants. This involved the establishment of analysis through integrated categories within child maltreatment models organised into methods: (1) didactic or prescriptive; (2) awareness raising and (3) participatory with a focus on human development. These thematic methods, which are not mutually exclusive, serve as a basis for understanding the unmet needs or demands that constitute a problem for the human population.

After applying the inclusion and exclusion criteria, a total of 56 documents were selected for analysis.

Results

Every human being is immersed in a context or suprasystem that influences, to some extent, his or her health-illness continuum. Social, environmental or physiological factors or aspects influence the thoughts, feelings and actions of the person, independently of the conscious vision of the subject (García, 1998). Likewise, the child's natural and artificial environment, which can influence his or her psychological and affective development, should also be taken into account. Being surrounded by architectural barriers, without free spaces or playgrounds, can aggravate the psyche of the abused infant, interfering with his or her integral well-being, causing emotional damage that can come to symbolize indelible marks for the whole life of the person (Ramírez Calixto and Cedeño Sandoya, 2018). And it has been evidenced that child abuse contributes to a high degree of emotional maladjustment on the part of minors, a fact that leads to the need, on many occasions, for a reevaluation and cognitive-emotional attention (Weissman et al., 2019; Bonet et al., 2020). This is fundamental since an incorrect emotional regulation strategy can lead to psychopathologies (Kim et al., 2021), including self-injurious behaviours (Guérin-Marion et al., 2020). Therefore, in this section, which concerns a common good of human society such as the state of health, nursing care emerges as a public service and an opportunity for the population (Miguélez-Chamorro and Ferrer-Arnedo, 2014). The care provided by nursing staff functions as a frontier or transition between population levels, sectors and health services (Cuevas et al., 2008), always seeking to act as a coach, facilitator, companion or educator (Miguélez-Chamorro and Ferrer-Arnedo, 2014).

Thus, nursing, and more specifically, community nursing, is highly linked to HE, which fosters the consolidation of self-care competencies by the individual and at the family level (SITEAL, 2018; Soto et al., 2018). This includes the basic functions of health promotion and education, disease prevention, care of sick or disabled people, rehabilitation and reintegration of individuals into the social framework. In this regard, the International Council of Nurses in the United States that the responsibilities of nurses include 'promotion of a safe environment, research, participation in health policy formulation and management of health systems and patients, and education' (Shamian, 2014). Therefore, when educating the human community, explanatory models must be taken into account that serve as a basis for shaping the process of action in the face of unmet needs or demands that constitute a problem for the human population.

Within the framework of health education itself, PAHO/WHO offers three methods with different approaches, which are

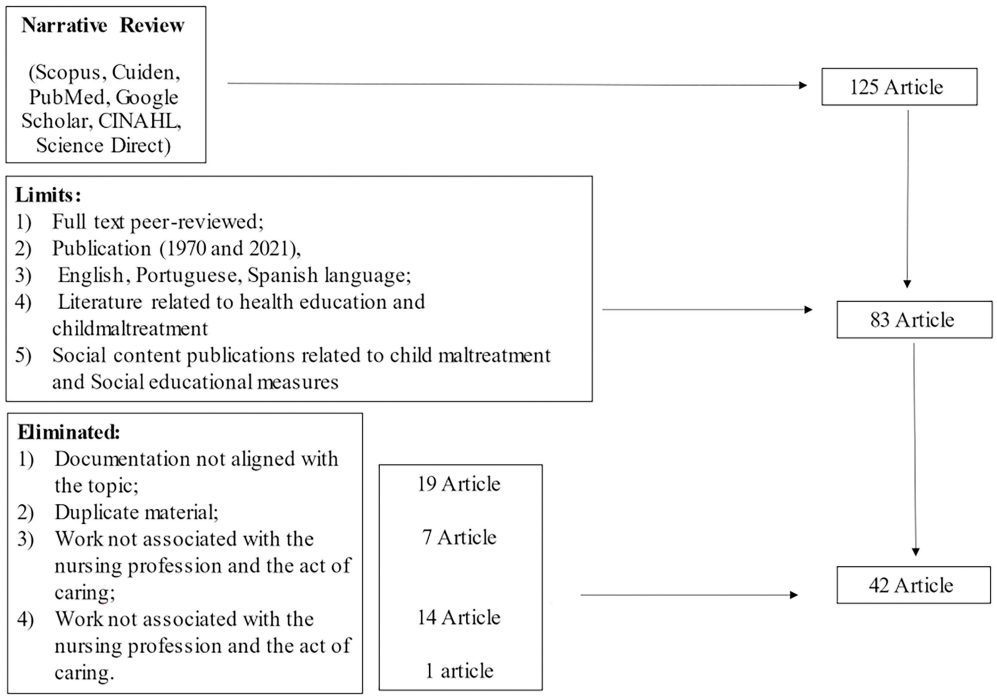

FIGURE 2
Article filtering strategy (Author's own elaboration).

not mutually exclusive (Gil, 1970): (1) the didactic or prescriptive method; (2) the awareness-raising method and (3) the participatory method focused on human development. The prescriptive method, also called the first-generation method, is a model that is framed in the development of an approach aimed at the detailed exposition of goal-oriented contents, without valuing the subject's demand. A dissemination of information is carried out in which a classical pedagogy is applied, generating the sole guilt of the patient, while a prescription or detailed message is elaborated (Fernández Oliva et al., 2004), without feedback to the professional who imparts this model. The awareness-raising (or second generation) method focuses on an integrative pedagogy, in which the subject plays an active and dynamic role, encouraged by the educator. In this case, such analysis is based on the premise of studying multidimensional causes, delving into social, environmental or psychological conditions, thanks to the feedback generated by the people. These kinds of models function as systems that generate self-confidence and progressive independence on the part of individuals, with the ultimate goal of social development (Lois, 2013). As sociologist Everett M. Rogers (1931–2004) put it, such progress would be 'a broadly participatory process of social change, which seeks to expose social and material advances (including equality, freedom, and other valued aspects) to the majority of the population through gaining control over their own environment' (Rogers, 1976). Finally, it is worth mentioning the third-generation models or participatory methods centred on human development (such as the co-orientation model), which present a different perspective on health education in that it is not the health professionals who initiate the educational approach, but the human community that possesses the capacity and self-sufficiency necessary to make its own decisions, thus influencing its management and state of community health. The nursing profession is a participant in this process, not a key figure, as the basic protagonist is the population itself (Figure 3).

These conceptual frameworks have evolved over time, thanks to the changes in the health paradigm offered by speculative contributions such as the theory of health beliefs or the theory of self-efficacy, postulated by Bandura (1986), Mora and Araujo (2008). The same applies to the theoretical analysis of child maltreatment, which is described by the WHO as a computation of the abuse and neglect of children under 18 years of age. It encompasses the various types of physical, psychological or sexual abuse that may threaten or cause harm to the health of children or violate their rights (Arrieta Vergara et al., 2014). Within this scope, it would include what is done (action), omission and what is done inappropriately, i.e., negligence (Doria Martínez and Navarro Chong, 2016). Likewise, at present, the transmission of knowledge, using computer technologies, virtual resources and simulation systems, constitutes one of the great technical-scientific revolutions (Juanes Méndez, 2016), having special relevance in the health sciences, contributing multiple dimensions to the educational process (Ochoa Vásquez, 2009). And, therefore, they can be used as teaching tools on child abuse, both in their theoretical aspects and in the ability to diagnose and prevent

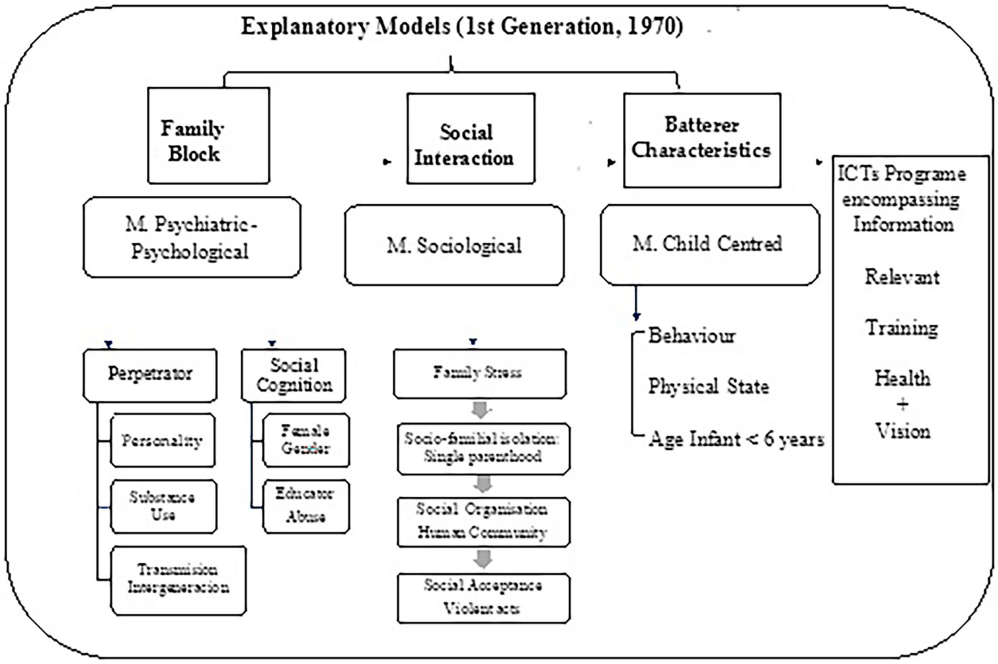

FIGURE 3
First-generation explanatory models. Health education and learning in health sciences converge with the development of new information technologies: a relevant link between training and health care (Author's own elaboration).

possible cases, especially new variants of child abuse such as cyberbullying or sexting. In this sense, it is essential to integrate ICT into the university teaching environment, through computer programmes that systematise the information on the area to be dealt with, in this case, child abuse.

However, this poses a huge challenge for teachers, who have to reinvent themselves and know how to manage these new models of education, channelling information effectively in order to achieve, as effectively or more effectively, the necessary competences in health science subjects. The educational disciplines involved in teaching-learning combine transversal, specific and general competences with informatics fields such as data science, information technology and behavioural informatics (Juanes Méndez, 2016). According to the researcher Pérez López: 'This will be the only way to be able to adequately process the incessant avalanche of information […]; on the other hand, it is also the only way to avoid irrational consumerism, i.e., that which causes the most striking or easy to assimilate to end up being the chosen or most credible thing" (Pérez López, 2006, p. 928).

First-generation models of child maltreatment

From the historical context, the explanatory models of child maltreatment are encompassed in various aspects. The first perspective focuses on the family block, exposing as the aetiology of child abuse an altered family dynamism between the child and the parents or guardians, without reasoning in a more profuse aetiology. The second perspective of these theoretical frameworks studies the social interaction at the origin of child abuse. While the third wave of explanatory models delves into the characteristics of the abuser, delving into the intrapsychic of the perpetrator (Manso, 2006) when looking for the explanation of why maltreatment is generated.

In this way, the first strand flourished in the 1970s, through various theoretical frameworks. On the one hand, it is worth highlighting the psychiatric-psychological model, which tries to explain child abuse from a psychopathological point of view of the parents or legal guardians. Within this framework, different correlations are proposed between child maltreatment and the perpetrator, mainly through the perpetrator's personality, which may be configured by depression, low self-esteem and inability to self-control impulses or anxiety (Zuravin, 1988; Culp et al., 1989; Manso, 2006). Similarly, there are several studies that outline this perspective, stating the use of toxic substances (see drugs) by the legal guardian as a trigger for the act of maltreatment of the paediatric case. Also, it may be an intergenerational transmission, where abused subjects later act as parents who abuse their children (Zuravin, 1988; Milner, 1995). Within the psychiatric-psychological model, social cognition must also be assessed, given the fact that studies suggest the difficulties of reflexivity and emotional recognition that parents, usually mothers, may experience (Kropp and Haynes, 1987), leading to distorted expectations of what is expected of children (Soto et al., 2018),

giving rise to some type of child maltreatment as a rectification or educational measure.

Another model that proliferated in the 1970s, apart from the psychiatric-psychological one, was the sociological model, which not only encompasses psychological aspects, but also social variables. Furthermore, it indicates how family environment conditions and cultural elements are key factors in the triggering of child abuse (Chaffin et al., 1996; Cantarino et al., 2016). This model encompasses four key aspects to be studied: (1) family stress; (2) the social isolation of the family; (3) the social organisation of the human community and (4) the social acceptance of violent acts (Riquelme Pérez, 2012). In relation to the social isolation of the family block, it is necessary to assess whether there is a low socio-economic level (Hillson and Kuiper, 1994). This fact causes a stigma at the level of the human community, influencing the type of social and family interactions (Zuravin, 1989) and fostering the likelihood of abuse or mistreatment of children. This situation occurs as a form of emotional and cognitive relief for the parents, a fact that is even more pronounced in the case of a single-parent family, mainly generated by a separation of the couple (Sack et al., 1985).

The last of the traditional explanatory methods of child maltreatment is child-centred, considering that the child can exhibit certain characteristics that make it aversive for parents or legal guardians (Azar, 1991; Figure 4; Table 2).

Second-generation models of child maltreatment

On the other hand, it was in the 1980s when a new perspective began to proliferate in relation to the causality of child maltreatment, deriving in a different current to that developed in previous years. In this way, the social interaction approach emerged, which conceives that child maltreatment is due to a variety of variables, both parents, the infants and the contextual situations that arise. Therefore, these second-generation models are more complex than first-generation theoretical-explanatory frameworks (Riquelme Pérez, 2012). Within this theoretical current, several frameworks are worth highlighting: firstly, Belsky's ecological model, a system of four interacting levels of interdependent systems, which allows for the linking of parents (their behavioural and psychological characteristics), the family block (microsystem), the human community (exosystem) and culture (macrosystem), taking into account the environments in which the infant interacts. With this theory, Belsky seeks to establish the fact that a specific human society is an organised whole, in which according to the elements that sustain it, these can come to influence the family nuclei, in sensory, perceptual and cognitive aspects such as violence, education or discipline (Riquelme Pérez, 2012).

Another of the second-generation conceptual frameworks to be assessed is the transactional model of Cicchetti and Rizley (1981), a theory focused on the multi-causality of child maltreatment, which is the consequence of an imbalance between enhancing factors (increasing the probability of child maltreatment) and dampening factors (decreasing the risk of child abuse). Enhancers can be of various kinds, such as biological (see physical malformations that strain the parent–child relationship), psychological (presence of parental mental illness), historical (history of abuse) and ecological (inappropriate environment for family harmony). Thus, child maltreatment would be caused when the enhancing factors predominate over the buffering factors (Cicchetti and Rizley, 1981).

A year after the publication of Cicchetti and Rizley's theoretical framework, a new explanatory model appeared that derives from the school of behavioural psychology (Riquelme Pérez, 2012), which acts as an experimental philosophy of analysis of human behaviour (Skinner and Ardilla, 1975). Thus, Vasta's (1982) two-component model posits the existence of two components or forces that will influence the triggering of child maltreatment. These are the use of punishment as a means of disciplining children, and the emotional hyper-reactivity of parents. The linking of these two elements can lead to compulsive acts of violence against children, which are perceived as forms of teaching within the family nucleus (Vasta, 1982). Finally, this theoretical current will end in 1987 with Wolfe's transitional model, which derives from Vasta's postulates, by exposing a three-stage sequencing of child maltreatment, where four components influence, in this case, the evolution of maltreatment, the psychological processes associated with anger, the potentiating factors and the protective factors against maltreatment (Vasta, 1982; Table 3).

Third-generation models of child maltreatment

In the 1990s, a new stream of explanatory models developed, which seek to find the aetiological cause of why child maltreatment is triggered, from a psychological perspective, thus replacing the descriptive and not very explanatory view of the second-generation models (Riquelme Pérez, 2012). This third generation will consist of two main theoretical frameworks, both Milner's theory of social information processing and Hillson and Kuiper's stress and coping theory.

Hillson and Kuiper's (1994) stress and coping theory focuses on how each individual person copes with anxiety, and how anxiety can lead to physical and behavioural impairment. Thus, attention is focused on the possible anxiogenic stimuli that influence the abuser, on the cognitive evaluations that the abuser makes of his or her situation with the child and the way he or she copes with it. Assessing whether the behaviour is positive or maladaptive for the pediatric case can generate a situation that leads to an act of child abuse (Hillson and Kuiper, 1994; Riquelme Pérez, 2012). In turn, Milner's (1995) theory of social information processing exposes the existence of cognitive

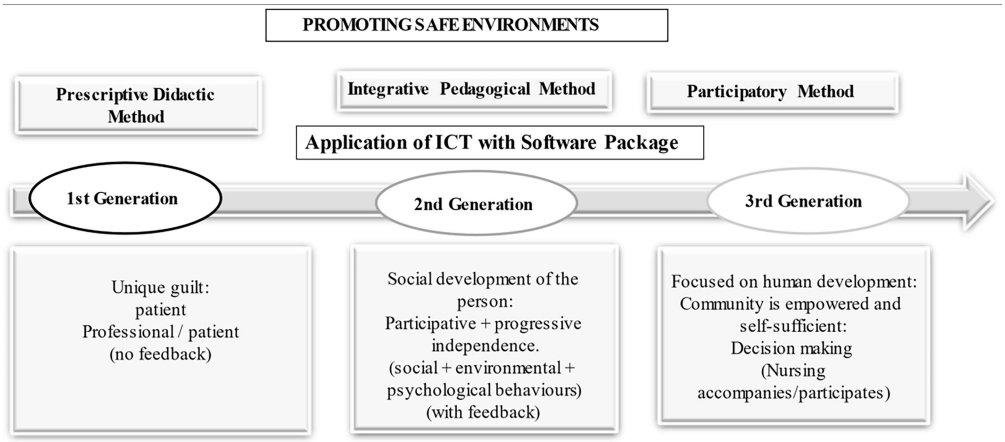

FIGURE 4
Health education method: application of ICT with software package to improve the training of future professionals and health and social care (Author's own elaboration).

errors that influence the parent's thought pattern, causing an altered judgement and a schema of misinterpretation of situations to be present.

Especially in terms of the conception of their children's behaviours, which generates distorted integration of perceptual information that leads to the execution of a response, based on the production of child abuse (Milner, 1995; Riquelme Pérez, 2012).

Discussion

After analysing the history of the explanatory models of health education and the conception of child abuse (according to a possible aetiological cause), a correlation can be seen in terms of the paradigmatic change in the study and explanation of different aspects, such as the human being, its development, health and the existence of affections, in this case, abuse in paediatric cases.

For this reason, a comparative relationship is proposed between the different theoretical frameworks, which allows a relevant vision of the concrete ways of intervening in education and nursing practice, for the promotion, maintenance or restoration of health in cases of child abuse. Thus, taking the three non-exclusive focal methods (Culp et al., 1989) of PAHO/WHO as a basis, the following overview of evolution and theoretical designation is given:

The prescriptive method focused on a transmission of information, in which the sole culpability lies with the patient (based on the professional-subject relationship of Hippocratic medicine; Entralgo, 1970; Gracia, 2002; Guadarrama and Campos, 2020), with the main determinants of illness being biological factors. In this case, neither social interaction nor cultural or economic influence is taken into account, but rather an imposition of factors and values. Traditional explanatory methods of child maltreatment can be accommodated within this theoretical line, because links between child maltreatment and the personality of the maltreater are exposed. See the consumption of toxic substances, altered expectations of what is expected of children (Riquelme Pérez, 2012), and even an intergenerational transmission of the experiences of maltreatment (Milner, 1995). Thus, in this first correlation, the first-generation model of health education encompasses the exposition of the psychiatric-psychological theoretical framework, the sociological model and the one centred on the paediatric case, all of them explanatory models where the prestige and coherence of biomedical science prevails (Moreno et al., 1995; Gómez-Cantarino et al., 2020).

At the same time second-generation models in health education were developed in the 1960s, reflecting a cultural anthropology approach, allowing a deeper understanding of the subjectivity of each subject, thus achieving a more contextualised approach (Moreno et al., 1995). Thus, the intrinsic characteristics of the person and those consolidated by contact with society are valued. From this new line of health education, models based on behaviourist postulates will be forged that allow progress towards new approaches, such as ecological ones (Colom Cañellas, 2004; Hernández-Girón et al., 2012), thanks to the configuration of a precise technology or methodology. When addressing the explanatory models of child maltreatment, it can be seen how the second-generation models of health education are the basis for the consolidation of the theoretical frameworks of social interaction on child maltreatment developed in the 1980s (see Belsky's ecological model or Cicchetti and Rizley's transactional hypothesis).

Similarly, there is a clear transition between second and third-generation models with respect to child abuse, a fact that can be explained by a paradigm shift in health. This would

TABLE 2 Dcumentation included within the scope of child maltreatment.

Author(s)	Type of document/study Year	Purpose	Characteristics
Moreno Manso, J. M. [25]	Article 2006	Child maltreatment is associated with variables: - parents - infants - contextual situations	Main theoretical explanatory models of child maltreatment
Culp, R. et al., [26]	Article 1989	Perpetrator's personality shaped by: - depression - low self-esteem - inability to control impulses - anxiety	Addressing child abuse from a psychopathological point of view of parents or legal guardians
Zuravin, S. [27]	Article 1988	It is related to physical abuse and neglect. In addition to 5 fertility patterns: - family size -Family spacing - age of mother at 1st birth - number of parents - family planning status of the children	Possible connection between child abuse, child neglect and maternal depression.
Milner, J.S. [28]	Article 1995	They are accounted for: - 3 cognitive stages: they are used to mediate parental behaviour - 1 cognitive-behavioural: includes verbal and physical aggression.	Intergenerational transmission of abuse
Chaffin, M.; Kelleher, K.; Hollenberg, J. [30]	Article 1996	Key factors in triggering child abuse: - family environment conditions	This is the Sociological Model, which encompasses psychic aspects and social variables.

Source: Own elaboration of the authors.

TABLE 3 Documentation included within the scope of child maltreatment.

Author(s)	Type of document/ study year	Purpose	Characteristics
Cicchetti, D.; Rizley, R. [36]	Article 1981	Aetiology of intergenerational transmission and sequelae of child maltreatment.	Child maltreatment is caused when enablers predominate over buffers.
Skinner, B. [37]	Book 1974	Explanatory model: behaviourist school	Experimental philosophy of human behaviour analysis
Vasta, R. [38]	Article 1982	The option of using: - punishment: to discipline the child. - infant: punishment to create discipline. - parents: emotional hyper-reactivity.	It posits the existence of components or forces that will influence the triggering of child maltreatment.
Wolfe, D. [39]	Book 1987	A sequence of child maltreatment is presented in which it influences: - evolution of maltreatment - psychological processes - factors that promote maltreatment - protective factors of maltreatment	Infant involvement in psychopathology acts.

Source: Own elaboration of the authors.

justify the existence of Milner's theory of social information processing and the stress and coping postulates of Hillson and Kuiper. Models developed during the 1990s, when the "eco-epidemiological" paradigm was consolidated, which analyses the health problem through multiple determinants, belonging to various spheres, not only biomedical, but also psychological and social (Hernández-Girón et al., 2012). This emerging health paradigm can enable both a specific therapeutic approach (at the individual level) and a preventive approach (at the population level; Hernández-Girón et al., 2012; Hernández et al., 2017). Therefore, the existence of this new vision of understanding a public health problem has made it possible to conceive child maltreatment from a broader and more holistic theoretical perspective (Table 4).

At the same time, it should be noted that there are insufficient elements to determine which of the explanatory model or paradigm is the correct one. This will depend, in part, on the approach to each case of child maltreatment and the competencies displayed by the health professionals, especially those belonging to the nursing discipline when addressing the problem under study (Hernández-Girón et al., 2012). This situation highlights the need to raise awareness and teach higher education students, who are studying nursing, about the various existing explanatory models and the paradigmatic changes in health knowledge that exist, so that the complex reality of each case of child maltreatment can be taken into account (Roudinesco and Plon, 2005). It is here where the use of ICTs as a systematic mechanism of university teaching should be used, facilitating simple, attractive and

TABLE 4 Correlation of health education models and theories of child maltreatment.

Correlation between health education models and theories of child abuse	
Health education models	**Theories of child abuse**
The prescriptive method (First generation model in health education)	First generation models of child maltreatment
	• The psychiatric -psychological theoretical framework • The sociological model • The one centred on the pediatric case
Second generation models in health education	Second generation models of child maltreatment
	• Belsky's ecological model • Cicchetti and Rizley's transactional hypothesis
Third generation models in health education	Third generation models of child maltreatment
	• Milner's theory of social information processing • Hillson and Kuiper's stress and coping theory

dynamic learning that allows the necessary competences to be obtained in this field, and even to promote and generate future specific computer programmes on child abuse within direct user care. Studies carried out (Arredondo, 1993; Hernández-Girón et al., 2012; Priegue Caamaño and Cambeiro Lourido, 2016) reflect the responsibility of education professionals in influencing the future competences of the new generation of professionals. Therefore, this aspect becomes even more important when it comes to health issues. Despite this, there is often a lack of knowledge and adequate university training on child abuse, both within and outside the family (Soto et al., 2018). Although it is true that this situation is usually solved with new future lines of research focused on this panorama, in order to be able to tackle a serious public health problem such as child maltreatment (Gonzalez et al., 2021).

Conclusion

After analysing the general approach of this study, some reflections are raised. From the professional perspective, it is emphasised that teachers must be prepared and responsible for training future generations of nursing professionals to acquire the minimum competences to prevent and deal with a situation of child maltreatment. This can be presented in a theoretical as well as a practical way. The theory provides the basic building blocks that guarantee the implementation or follow-up of a process. This foundation can be corroborated with the Nursing Care Process (NCP), developed by the nurse theorist Linda Hall (1906–1969) in 1955. With this theoretical framework, it is possible to show the correct and precise sequences for action by any nursing professional in the face of a health condition, allowing the work carried out to be evaluated and studied. Despite this, at present, the theoretical efforts of nursing professionals to develop knowledge through theories and models have not been successfully implemented in clinical practice, considering that this is based on the performance of routine procedures. However, such care acts have a clear logic, as they are derived from theoretical postulates.

Thus, through practice in the different rotation devices, both in primary care and specialised care, as well as in secondary education centers, it is a good time to develop the competences acquired on a theoretical level on child abuse, considering this training to be more focused on higher courses within the degree and postgraduate nursing degree.

Likewise, it is exposed that the evolution of the theoretical postulates on child abuse is correlated with the educational theoretical methods proposed by the WHO, which establish different perspectives of teaching and awareness of the population on multiple public health problems, bearing in mind cultural patterns that influence the sense, evolution and thought of human society. This demonstrates the need for a transdisciplinary approach to child maltreatment, where there is no one explanatory model more suitable than another, but the choice of the health education paradigm and, within this, the most recommendable child abuse theory will depend on each situation. It is also important to highlight the importance of valuing the use of information and communication technologies (ICT) in this field, due to their high capacity to manage and systematise information, making them a relevant tool for the correct training of future health professionals, especially in the case of child abuse, as it is a public health problem. In the words of researchers Nuria Fabrellas and Jordi Galimany 'Health professionals themselves should promote and consume the use of these applications, as we are witnessing a democratisation of health information that can facilitate health promotion and disease prevention' (Fabrellas Padres and Galimany Masclans, 2019, p. 7).

Author contributions

SG-C, AC-O, and JR-M contributed to the conception and design of the study. SG-C, AC-O, JR-M, CG, and MU-G performed the data collection, organisation, and analysis. SG-C and VM-P wrote the first draft of the manuscript and sections of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

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EDITED BY
Benito Yáñez-Araque,
University of Castilla-La Mancha, Spain

REVIEWED BY
Andreia de Bem Machado,
Federal University of Santa Catarina, Brazil
Lassaad Lakhal,
University of Sousse, Tunisia

*CORRESPONDENCE
Said Khalfa Mokhtar Brika
sbrika@ub.edu.sa

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The impacts of total quality management practices in Algerian higher education institutions

Fethia Yahiaoui[1], Khalil Chergui[1], Nesreddine Aissaoui[1], Said Khalfa Mokhtar Brika[2]*, Imane Ahmed Lamari[2], Adam Ahmed Musa[2,3] and Mohmmad Almezher[2,3]

[1]University of Oum El Bouaghi, Oum El Bouaghi, Algeria, [2]University of Bisha, Bisha, Saudi Arabia, [3]Department of Management Administration, Faculty of Economics, White Nile University, Kosti, Sudan

Algerian universities rely on total quality management. TQM is one of the most successful strategic options for improving the quality of higher education. In addition, achieving academic accreditation and progress in international rankings. The study aims to address relevant contemporary issues by examining the impact of total quality management on the quality of higher education. The data were analyzed using a mixed-method approach; the study was done as a survey, with data collected *via* questionnaires issued to 610 students. The questionnaire included Likert scale items that were quantitatively evaluated and modeled using structural equation modeling (SEM) using Amos to accomplish the path analysis of the research model. Furthermore, qualitative data were acquired through interviews with 24 professors who are members of the Quality Cells, and qualitative data were evaluated using content analysis with NVivo. The study findings revealed that TQM has a direct and significant impact on the quality of graduates, scientific research, and community service in Algerian universities. The main results have been presented, and recommendations for future research are made.

KEYWORDS

quality, quality of higher education, TQM, mixed-method approach, Algerian universities

Introduction

Since "quality gurus" such as Walter Shewhart, Edwards Deming, Joseph Juran, Philip Crosby, Armand Feigenbaum, Kaoru Ishikawa, and others underlined the critical role of Total Quality Management and its importance in obtaining various organizational benefits. Several researchers have expressed an interest in writing about it and its consequences. Several researchers consider TQM as a source for improving performance (Pike and Barnes, 1995; Reed et al., 1996; Kumar et al., 2009; García-Bernal and Ramírez-Alesón, 2015; Anil and Satish, 2019). TQM is viewed as a source of competitive advantage (Powell, 1995; Reed et al., 2000; Douglas and Judge, 2001; El Shenawy et al., 2007; Ferdousi et al., 2018). It is also regarded as a means of enhancing financial performance and achieving profitability (Hansson and Eriksson, 2002; Selladurai, 2002; Wayhan and Balderson, 2007;

Milovanovic, 2014). It also served as a source of customer satisfaction (Forza and Filippini, 1998; Sit et al., 2009; Ooi et al., 2011; Sheikholeslam and Emamian, 2016). Many researchers see it as a means of achieving social responsibility (Ghobadian et al., 2007; Aguilar and Bernardo, 2013; Benavides-Velasco et al., 2014; Jalilvand et al., 2018; Abbas, 2020).

On this basis, research into total quality management practices and their applications in various fields and sectors began, including TQM in small and medium enterprises (Ghobadian and Gallear, 1996; Adriana Tisca et al., 2015; Hilman et al., 2020), TQM in high-technology companies (Price and Chen, 1993; Yang, 2006), and Total quality management in service institutions, such as hotels, hospitals, schools, public administrations … etc. (Milakovich, 1991; Martin, 1993; Bradley, 1994; Short, 1995; Sureshchandar et al., 2001; Bon and Mustafa, 2013).

For several years great effort has been devoted to the study of TQM and its core values, tools, methods, practices, and impacts in the educational sector (Vlašić et al., 2009; Sallis, 2014; Mukhopadhyay, 2020). Including investigations that focused on TQM in higher education, this problem has been researched in several ways. First, TQM practices in universities and higher education institutions (Abdulameer et al., 2014; Ahmed and Ali, 2016), second, TQM implementation in higher education (Taylor and Hill, 1992; Anderson, 1995; Sirvanci, 2004; Meirovich and Romar, 2006; Venkatraman, 2007), and third, TQM benefits, results, and impacts in higher education (Shahdadnejad and Alroaia, 2013; Aminbeidokhti et al., 2016; Psomas and Antony, 2017; Ullah et al., 2018; Padró et al., 2020).

Based on how the quality approach was applied by various quality gurus to this particular context of research, Walter Shewhart began to focus on controlling processes, using a statistical method to make quality relevant not only for the end product (graduate students) but also for the teaching and learning process that produced them (Shewhart and Deming, 1986). As for Edwards Deming, one of the well-known tools that proved effective in improving the quality of services provided by higher education institutions was the PDCA cycle (plan, do, check, and act; Deming, 1991). According to Joseph Juran, the use of the Juran Trilogy (quality planning, quality control, and quality improvement) has been shown beneficial in various contexts to evaluate and improve the quality of services delivered in higher education (Juran, 2005; Sok and Taib, 2012). Philip Crosby's contributions were notable for 14 quality management points and the concept of zero defects to achieve high-quality levels in higher education institutions (Crosby, 2005; Farooq et al., 2007). Armand Feigenbaum proposed Total quality control as a system for integrating the quality development, quality maintenance, and quality improvement efforts of various groups in higher education institutions to control quality costs (prevention costs, appraisal costs, internal failure costs, and external failure costs) and provide complete customer satisfaction (Feigenbaum, 1991). Ishikawa is well-known for proposing several practical tools for quality improvement, such as the Ishikawa fishbone diagram, which aims to improve quality by identifying the primary and secondary causes of a specific quality problem (Ishikawa and Loftus, 1990).

In Algerian higher education institutions, several academics have studied TQM (Khelifa et al., 2013; Barka and Ilhem, 2016; Keffane et al., 2020; Belimane and Chahed, 2021). They focused on implementing TQM principles in Algerian higher education while ignoring TQM's impact at various levels. This is what constitutes a research gap for previous research that must be addressed by the study, as the various effects of applying total quality management principles in higher education must be identified and measured to improve the quality of students and graduates, the quality of scientific research, the quality of community services, and so on. Detecting the effects of the TQM application using mixed methods (qualitative and quantitative approaches).

Accordingly, the problem of the study is to reveal the impacts of applying Total Quality Management practices in Algerian higher education institutions to improve the quality on three levels: quality of graduates, quality of scientific research, and quality of community service. Using mixed methods from the customer's or student's perspective is advantageous (quantitative and qualitative).

Theoretical background

In higher education, Total Quality Management is defined as a management philosophy, a management method, an integrated system, a continuous improvement approach, and a change approach for achieving excellence. This is what Hansson and Klefsjö (2003) referred to as an integrated system, which involves the adoption of a set of core values, techniques, and tools, where they believed that TQM's core values were the foundation for their application's success. Theoretical literature refers to these core values as principles (Morrow, 1997; Helms et al., 2001; Mar Fuentes-Fuentes et al., 2004; Aguilar and Bernardo, 2013). It is also referred to as a series of practices (Ooi et al., 2011; Zwain et al., 2014; Ahmed and Ali, 2016; Khan et al., 2019). However, most researchers agree on their nature and number, as shown in Table 1.

TQM, as well as the eight practices listed in Table 1, interact with internal and external quality assurance as to the foundation and process of attaining this, allowing the quality of higher education to be achieved (Bogue, 1998; Welsh and Dey, 2002; Moldovan, 2012; Asif and Raouf, 2013; Tight, 2020). In higher education, there are five major approaches to quality that can be identified: exceptional, perfection, fitness for purpose, value for money, and transformative (Harvey et al., 1993; Harvey and Williams, 2010). Higher education quality, according to Robert Birnbaum, is a multidimensional notion with three basic dimensions: the individual dimension (higher education contributes the formation of human competencies through the educational service directed to students), the eligibility dimension

TABLE 1 TQM practices in higher education.

Practices	Ünal, 2001	Sabihaini et al., 2010	Kysilka and Medinschi, 2011	Zakuan et al., 2012	Abdulameer et al., 2014	Ahmed and Ali, 2016	Padró et al., 2020
Customer focus	√	√	√	√	√	√	√
Management commitment	√	√	√	√	√	√	√
Total employee involvement	√	√	√	√	√	√	√
Process approach	–	–	√	–	√	√	–
A systematic approach to management	–	–	√	–	√	√	–
Continuous improvement	√	–	√	√	√	√	√
Fact-based decision-making	√	√	√	√	√	√	√
Mutually beneficial supplier relations	–	–	√	–	√	√	√

TABLE 2 Quality dimensions in higher education.

Dimensions	Cave, 1997	Patrick and Stanley, 1998	Kwan and Ng, 1999	Gibbs, 2010	Ullah et al., 2011	Florida and Quinto, 2015	Yeung, 2018
Quality of graduates	√	√	√	√	√	√	√
Quality of scientific research	√	√	√	√	√	√	√
Quality of community service	√	–	√	√	–	√	√

(higher education institutions must meet educational and international standards based on academic experts' assessments), and the social dimension (degree of satisfying the needs of the various actors in the society; Papadimitriou, 2011).

Quality of higher education is related to the extent to which university activities (academic, administrative, and community) achieve their goals and meet the quality standards that are expected of them, as measured by a set of pre-defined characteristics known as dimensions, indicators, and quality standards. These dimensions are primarily represented in Table 2.

Total quality management is viewed in the theoretical literature as an integrated set of dimensions that are applied as a single system and are not isolated from one another (Hansson and Klefsjö, 2003). As for the quality of higher education, each dimension is measured separately, and the partial correlations between the study variables might be imagined as follows.

TQM and quality of graduates

Many trends have suggested that TQM has an impact on increasing the quality of students from higher education institutions. According to many researchers, TQM is thought to have direct effects on improving graduate quality and indirect effects through improving educational process quality (Dahlgaard et al., 1995; De Jager and Nieuwenhuis, 2005; Dahil and Karabulut, 2013).

Willis and Taylor (1999), for one, emphasized that total quality management is built on focusing on the customer and studying his needs, which are then converted into professional standards of employers that enable graduates to work and achieve excellence in a highly competitive business environment. Sakthivel et al. (2005) found that the five TQM components (Top management commitment, Course delivery, Campus facilities, Courtesy, and Customer feedback and improvement) have an impact on the quality of educational service and students' academic performance satisfaction. According to Dahil and Karabulut (2013), TQM is a process that develops the educational system and the training of qualified personnel who can match the public's expectations. In his studies in Spanish universities using a graduate employability survey, Martínez-Gómez et al. emphasized that TQM training and knowledge help graduates to have acquired the competence needed to perform their job successfully (Martínez-Gómez et al., 2018, 2020). Furthermore, Abbas et al. (2021), highlighted QMS as a key component in improving students' employability and industry acceptance. In Algerian universities

(Khelifa et al., 2013; Keffane et al., 2020) emphasized the existence of several effects of total quality management, including improving the quality of graduates.

> *H1*: There is a direct and significant impact of TQM on the Quality of graduates in Algerian universities.

TQM and quality of scientific research

According to Hemlin (1993), scientific quality is measured by quality indicators (citations, awards, and peer review), the scientist's research effort, the researcher himself/herself (knowledge, skills, and abilities), the research environment, the scientific effect, an institution's research policy and organization, and finally financing. Anninos (2007) indicated that high-quality scientific research is easier than achieving high-quality instruction since the quantitative and qualitative indicators are unambiguous, and quality management systems aid in reaching research excellence. Previous scholars affirmed that the quality of scientific research is impacted in a variety of different forms by total quality management (direct and indirect; Black, 1995; Kanji et al., 1999; Sallis, 2014).

For his part, Jusoh et al. (2008) stated that the use of TQM components is critical in higher education, research and development, and technology transfer, particularly because it is the foundation for the Malaysian economy's development. Some believe that whole quality management adds to academic success, including both teaching and scientific research (Mashagba, 2014; Zwain et al., 2017). In addition, Lanati (2019) mentioned in detail in his book "Quality Management in Scientific Research—Challenging Irreproducibility of Scientific" quality tools for the scientific research (Pareto Chart, Ishikawa, Control Charts, Flow Chart, Decision-Making and Problem Solving Tools, Knowledge Management, and Team Work) and quality methods for the scientific research (Project Management, Failure Mode and Effect Analysis, Design of Experiment, Lean Management and Six Sigma). In Algerian universities, Khelifa et al. (2013), Barka and Ilhem (2016), Keffane et al. (2020) and Belimane and Chahed (2021)pointed out that there are different effects of total quality management in higher education institutions, including improving the quality and output of scientific research.

> *H2*: There is a direct and significant impact of TQM on the Quality of scientific research in Algerian universities.

TQM and quality of community service

Many studies have established that total quality management provides a role in achieving social responsibility and that there is an integrative relationship between the two in various industries (Ghobadian et al., 2007; Aguilar and Bernardo, 2013; Benavides-Velasco et al., 2014; Jalilvand et al., 2018; Abbas, 2020). In the case of higher education, there is a potential impact on achieving high-quality community services as a social responsibility factor. Many researchers emphasized that total quality management has many effects in higher education institutions, allowing it to influence society and achieve its societal commitments, what is known as quality of community service (Barnett, 1992; Couch, 1997; Kanji et al., 1999; Koch, 2003; Sahney et al., 2004; Sallis, 2014). According to Khoja et al. (2017), the assurance of the quality of community services in Libyan higher education and emerging countries is related to the necessity to connect the aspects of overall quality management with the dimensions of completion in the sustainable quality management (SQM) model. Yeung (2018) identified three levels of sustainable development in higher education: organizational stakeholder participation, educational goals, and community need realization; teacher awareness of environmentally friendly issues, competency-based concepts, and providing real-world exposure to learners; and learner role definition. To achieve these levels, he emphasized the importance of facilitating effective integration of the ISO 9001 quality management system (QMS), ISO 26000 guidelines for corporate social responsibility (CSR), and program accreditation requirements. Banerjea (2018) emphasized that total quality management has a strong ethical dimension, calling for the importance of taking into account the interests of stakeholders, as it is considered a foundation and a catalyst for effective corporate social responsibility in the higher education sector in his study to explore the importance of TQM and CSR to promote education and various corporate initiatives in community. Castillo (2020) reaffirmed the necessity to develop and implement TQM concepts to all aspects of higher education academic units, including teaching, research, community services, and administrative support. Furthermore, Nogueira emphasized in his different studies that TQM and CSR are two increasingly significant dimensions in creating a sustainable and hopeful future for all stakeholders, and that they are important dimensions in achieving a sustainable and promising future for all stakeholders (among others, students and workers employers, and society in general; Nogueiro et al., 2011, 2017, 2022). In Algerian universities, Khelifa et al. (2013) and Keffane et al. (2020) emphasized the existence of numerous effects of total quality management, including improving the quality of community service.

> *H3*: There is a direct and significant impact of TQM on the Quality of community service in Algerian universities.

The study's research model might be depicted as follows, based on the links between total quality management and higher education quality.

Materials and methods

Data collection

Quantitative data and sample selection

The purpose of this study was to determine the impact of TQM on higher education quality in Algerian universities.

The research was carried out as a survey, with data collected using a standardized questionnaire delivered to students at all levels. According to the Yamane (1967) formula, the first sample consisted of 610 students: $n = N/1 + Nd2 = 1{,}777{,}304/1 + (1{,}777{,}304*0.052) = 400$ (Adam, 2020). Because of the projected difficulty in getting lists of all Algerian students, 610 questionnaires were gathered using a snowball sample (non-probability sample) related to network sampling (Handcock and Gile, 2011).

The questionnaire included constructs that would be tested to do quantitative analysis. The following is a five-point Likert scale that was used to express construct measurement items: 1 means severely disagree, 2 means disagree, 3 means medium agree, 4 means agree, and 5 means strongly agree. In addition to demographic data, the questionnaire included two major constructs: TQM (continuous improvement, customer focus, fact-based decision-making, management commitment, mutually beneficial supplier relationships, process approach, systematic approach to management) with eight dimensions, and quality of higher education with three dimensions (quality of graduates, quality of scientific research, and quality of community service).

Cronbach's alpha and Guttman split-half were used to calculate reliability and validity, which was done using SPSS software (version 25). The validity and reliability coefficients of the questionnaire constructs are shown in Table 3.

Table 3 provides the summary statistics for Validity and Reliability; it shows that the reliability coefficients (Cronbach's Alpha) are 0.994 for TQM and 0.992 for quality of higher education, which are within the acceptable limit as per Bland and Altman (1997). It presents also that the Validity coefficients (Guttman split-half) are 0.990 for TQM and 0.965 for quality of higher education, which are within the allowed range according to Jackson (1979). This indicates that the questionnaire of this study is suitable for conducting research and drawing conclusions.

Qualitative data

In management sciences, the interview is considered an effective way to collect qualitative data, and in our study, it was used by organizing it with professors who specialize in the subject, and 24 professors are members of the Quality Cells, which monitor issues of higher education quality and quality management in Algerian universities. This is done to find a study model test from the perspective of specialized academics, not merely students.

Methods and analysis approaches

Quantitative methods

We have used structural equation modeling (SEM) through IBM SPSS Amos 25 to assess the relationships in the research framework and test the hypothesis. Nachtigall et al. (2003) indicate that the comparison of the model to empirical data is the main feature of SEM. This comparison generates so-called fit statistics, which evaluate the model's fit with the data. Using this method or what is known as covariance-based structural equation modeling (CB-SEM) requires three conditions (Lowry and Gaskin, 2014). Suitable for confirmatory studies and the model must be precisely delimited between the variables, appropriate for large samples (the sample in this study was 610), requires a normal distribution of the data shown in Table 4.

A significant divergence from normality, according to West et al. (1995), is defined as an absolute skewness value > 2 and an absolute kurtosis (proper) value > 7. Table 4 shows that all of the research variables' absolute values are less than 2 for skewness and less than 7 for kurtosis, indicating that the data follow a normal distribution.

Qualitative methods

The use of qualitative methods in addition to quantitative methods, referred to as the mixed method, is due to the

TABLE 3 Validity and reliability statistics.

Constructs	Cronbach's alpha	Guttman split-half	N of items	Number of cases
Customer focus	0.953	0.933	4	610
Management commitment	0.961	0.985	4	610
Total employee involvement	0.941	0.945	4	610
Process approach	0.965	0.945	4	610
Systematic approach to management	0.971	0.970	4	610
Continuous improvement	0.963	0.950	4	610
Fact-based decision-making	0.957	0.941	4	610
Mutually beneficial supplier relations	0.943	0.949	4	610
TQM	0.994	0.990	32	610
Quality of graduates	0.977	0.989	10	610
Quality of scientific research	0.977	0.975	10	610
Quality of community service	0.991	0.993	10	610
Quality of higher education	0.992	0.965	30	610

TABLE 4 Tests of normality.

Constructs	Skewness	Kurtosis
Customer focus	1.508	1.48
Management commitment	1.094	0.047
Total employee involvement	1.547	1.624
Process approach	1.24	0.819
A systematic approach to management	1.357	1.032
Continuous improvement	1.34	1.057
Fact-based decision-making	1.296	0.918
Mutually beneficial supplier relations	1.196	0.58
TQM	1.341	1.084
Quality of graduates	0.968	−0.106
Quality of scientific research	1.232	0.671
Quality of community service	0.739	−0.852
Quality of higher education	0.946	−0.143

importance of the qualitative approach in compensating for the shortcomings of quantitative methods. Whereas these methods rely primarily on analyzing the opinions of specialists (in our study, they were represented by 24 professors who are members of the Quality Cell) who answer the subject in an accurate and extensive manner (*via* the open questions of the interview guide), allowing a good understanding of the topic and confirmation of the quantitative analysis results, and this emphasizes the importance and benefits of qualitative methods using NVivo (Madey, 1982; Henwood and Pidgeon, 1992; Edwards-Jones, 2014; Almalki, 2016; Jackson and Bazeley, 2019).

NVivo is a software program that can be used to save, manage, and analyze qualitative data and open-ended questions (Edwards-Jones, 2014). Visualization techniques (thematic analysis, cluster analysis and cognitive mapping were used to link two variables: TQM and quality of higher education, to confirm the study model qualitatively, and test the degree of its agreement) and thought experiments can also help to clarify what might be useful questions (Jackson and Bazeley, 2019).

Results

The statistics and SEM findings are presented in this section to ensure hypothesis testing and the study model.

Descriptive statistics

Table 5 provides a summary of the descriptive statistics for the study sample.

Table 5 summarizes the demographic characteristics of the study sample, revealing that the majority of respondents are male (63.4%), less than 30 years (36.5%), and most of them are undergraduate students (36.7% for bachelor's degree and 32.8% for master degree), the study in different disciplines, the most important are Economic sciences (32.5%) and Literature and languages (19%). This explains a large number of undergraduate students in Algerian universities compared to postgraduate students, as well as the nature of the study sample (Bouchikhi and Zine, 2017). These characteristics, in turn, affect the students' answers regarding the study variables presented in Table 6.

Table 6 shows the descriptive statistics for the study variables. The majority of respondents chose the option of weak commitment to apply all TQM principles (mean = 1.9217), as well as the option of weak attainment of higher education quality standards (mean = 2.0452), as indicated by the small dispersion of the two variables based on the standard deviation. This explains several things, including Algerian universities' tardiness in implementing total quality management principles and their commitment to internal quality assurance and self-evaluation processes, as well as their ranking in the international classification of universities for higher education quality (El Hassan, 2013; Guessoum, 2019).

Correlation matrix

Table 7 shows the correlation matrix of study variables and constructs.

Table 7 shows that both TQM principles and Quality of Higher Education constructs have a significant positive correlation, with all correlation coefficients being strong (greater than 0.8 and significant at the 0.01 level). This is explained by three major factors: first, the respondents' answers were similar in terms of total quality management principles and higher education quality; second, the positive impact of quality assurance and self-assessment efforts in Algerian universities on higher education quality; and third, despite the delay in implementing total quality management and committing to quality standards, Algerian universities are committed to quality (El Hassan, 2013; Badran et al., 2019; Guessoum, 2019).

SEM results

The path analysis model for confirmatory factor analysis was used to assess the study's hypotheses and model, as it is considered an effective technique for doing so, as stated by Stage et al. (2004). The path analysis model's outputs are shown in Figure 1.

According to Browne and Cudeck (1992), the path model's fit indices have been achieved; therefore, the relative Chi-square value is less than 5 (3.373), signifying that the study's suggested model is consistent with the real data. The comparative fit index (1.000) and the Tucker Lewis index (0.997) are all very close to one, indicating that the study's hypothetical model is far from zero (which assumes no association between the study variables), as well as a value of RMSEA less than 0.08 (0.062). All of this leads us to accept both the Research framework (Figure 2) and the hypotheses provided in Table 8.

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TABLE 5 Descriptive statistics of the study sample.

Variables	Categories	Frequency	Percent	Valid percent	Cumulative percent
Gender	Male	387	63.4	63.4	63.4
	Female	223	36.6	36.6	100.0
Age	Less than 30 years	222	36.4	36.4	36.4
	30–40 years	211	34.6	34.6	71.0
	40–50 years	119	19.5	19.5	90.5
	More than 50 years	58	9.5	9.5	100.0
Edu. Level	Bachelor	224	36.7	36.7	36.7
	Master	200	32.8	32.8	69.5
	Doctorate	186	30.5	30.5	100.0
Specialty	Economic sciences	198	32.5	32.5	32.5
	Social and human sciences	112	18.4	18.4	50.8
	Law and political sciences	84	13.8	13.8	64.6
	Literature and languages	116	19.0	19.0	83.6
	others	100	16.4	16.4	100.0
	Total	610	100.0	100.0	

Table 8 shows that total quality management has a significant, positive, and large impact on improving the quality of higher education. At the first level, total quality management has a 98.9% impact on improving the quality of graduates and improving the quality of community service, and at the second level, total quality management has a 97.4% impact on improving the quality of scientific research. At the level of significance $p = 0.01$, this leads us to reject the null hypotheses and accept the alternative hypotheses (H1, H2, and H3).

Qualitative results

According to Clarke and Braun (2018), thematic analysis is not just a way of describing and reducing data; it is also a way of interpreting, describing, and summarizing the levels of discourse (codes or study variables) to check the validity of hypotheses. The following tendencies emerged from respondents' assessments on Algerian universities' TQM experience, giving to NVivo12 outputs:

From the thematic analysis (Figure 3), several implications can be reached. First, the respondents' discussions were equally focused on the variables and dimensions of TQM, as they believe they are all crucially significant. Second, the interviewees' discourse was similarly focused on the variables and dimensions of higher education quality, since they believe they are all equally important. Finally, there is a gap in the respondents' discourse because their focus was on TQM rather than the quality of higher education, that is, because the implementation of TQM principles is the base for obtaining quality in Algerian higher education supported by Khelifa et al. (2013) and Keffane et al. (2020).

Cognitive mapping, according to Eden, Jones, and Sims, is a modeling technique that tries to depict ideas, beliefs, values, and attitudes, as well as their links to one another, in a form that can be studied and analyzed (Northcott, 1996). According to this approach, Figure 4 shows the relationship between the study variables based on the cluster analysis results.

Figure 4 of the cluster analysis shows that there are three levels of relationships between the study variables: first, the relationship of total quality management with its dimensions, second, the relationship of higher education quality with its dimensions, and finally, the relationship of total quality management with higher education quality. The following table, based on Pearson's coefficient, shows the relationship between independent and dependent variables in the study model.

Table 9 shows that there is a moderately positive relationship between all dimensions of TQM and all dimensions of higher education quality, with all Pearson's correlation coefficients limited between 0.33 and 0.66. This is in line with the findings of quantitative analysis and path analysis, which all demonstrated the hypothesis' validity (H1, H2, and H3).

Discussion and implications

This paper aims to look at the impact of TQM on higher education quality from three perspectives (quality of graduates, quality of scientific research, and quality of community service). The study employed a mixed approach, with quantitative data from 610 questionnaires distributed to Algerian university students being analyzed *via* path analysis, and qualitative data from a structured interview with 24 professors who are members of the quality cells being analyzed *via* NVivo.

Our method is unique in that we used mixed methods to investigate the impact of TQM on three levels (quality of graduates, quality of scientific research, and quality of community service). There is a direct and significant impact of TQM on the quality of graduates in Algerian universities, a direct and significant impact of TQM on the quality of scientific research in Algerian universities, and a direct and significant impact of TQM on the quality of community service in Algerian universities,

TABLE 6 Descriptive statistics of study variables.

Study variables	Minimum	Maximum	Mean	Std. deviation
Customer focus	1.00	5.50	1.8561	1.18015
Management commitment	1.00	5.00	1.9877	1.28096
Total employee involvement	1.00	5.50	1.8639	1.15840
Process approach	1.00	5.00	1.9398	1.19427
Systematic approach to management	1.00	5.00	1.9135	1.19951
Continuous improvement	1.00	5.00	1.9066	1.18014
Fact-based decision-making	1.00	5.00	1.9266	1.20244
Mutually beneficial supplier relations	1.00	5.00	1.9791	1.21256
TQM	1.00	5.13	1.9217	1.17680
Quality of graduates	1.00	5.00	2.0546	1.26201
Quality of scientific research	1.00	5.00	1.9172	1.18375
Quality of community service	1.00	5.00	2.1638	1.40244
Quality of higher education	1.00	5.00	2.0452	1.25184

TABLE 7 Correlation matrix.

Variables and constructs		Customer focus	Management commitment	Total employee involvement	Process approach	Systematic approach management	Continuous improvement	Fact-based decision-making	Mutually beneficial supplier relations	TQM
Quality of graduates	R	0.896**	0.881**	0.928**	0.910**	0.888**	0.907**	0.891**	0.913**	0.920**
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Quality of scientific research	R	0.950**	0.926**	0.944**	0.968**	0.964**	0.973**	0.961**	0.970**	0.977**
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Quality of community service	R	0.809**	0.785**	0.808**	0.861**	0.864**	0.862**	0.857**	0.877**	0.858**
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Quality higher education	R	0.903**	0.881**	0.911**	0.932**	0.925**	0.934**	0.922**	0.940**	0.937**
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

**Correlation is significant at the 0.01 level (2-tailed).

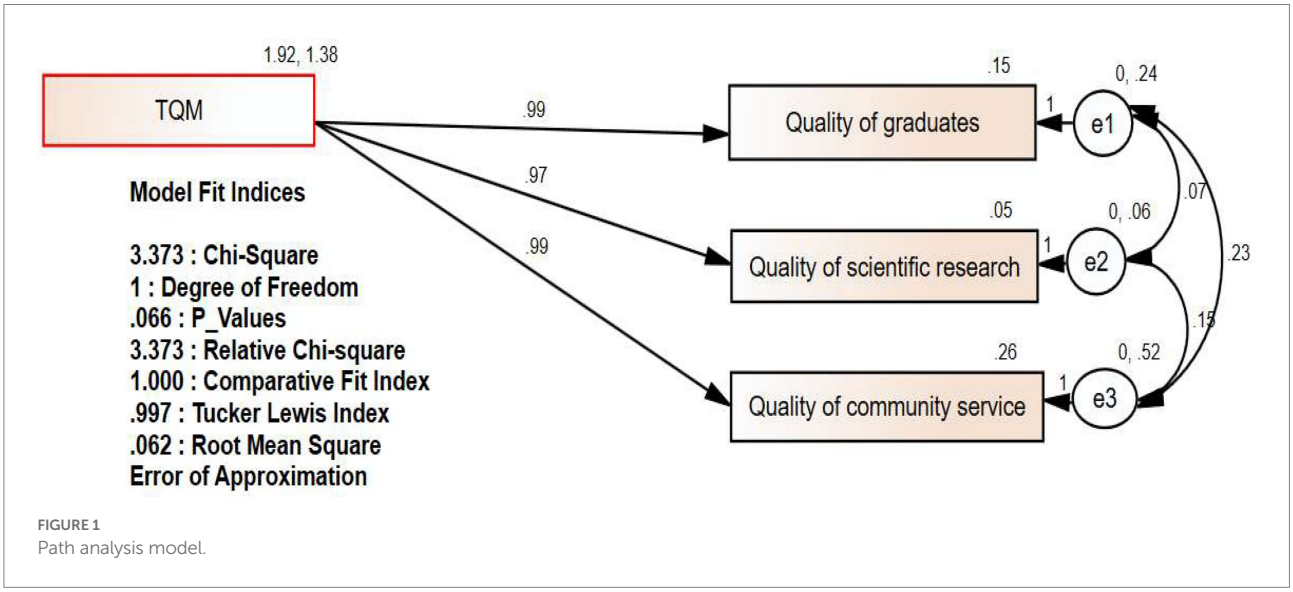

FIGURE 1
Path analysis model.

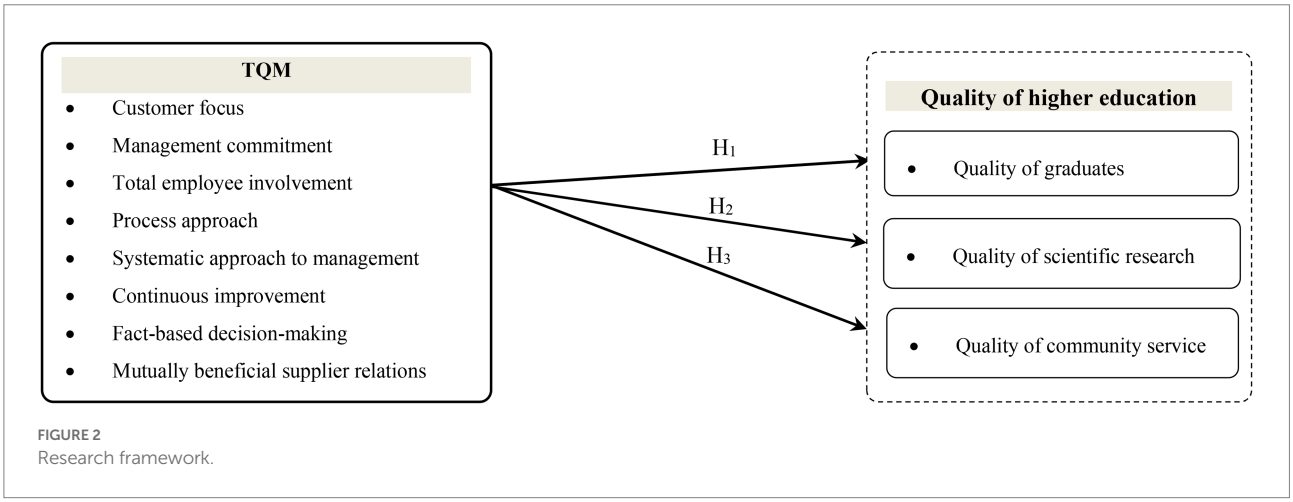

FIGURE 2
Research framework.

TABLE 8 Direct effects in the path analysis model.

Effect type	Path	Estimate	S.E.	C.R.	*p*-Value	Hypothesis	Results
Direct	TQM → Quality of graduates	0.989	0.017	58.174	***	H_1	Supported at 0.01
	TQM → Quality of community service	0.989	0.017	58.174	***	H_2	Supported at 0.01
	TQM → Quality of scientific research	0.974	0.007	133.384	***	H_3	Supported at 0.01

***Supported at 0.01.

among other findings. The qualitative and quantitative results were both in agreement.

First, regarding the impact of TQM on the quality of graduates, which was found to be significant at 0.01 with a path coefficient estimated at 0.989, it was found that the qualitative correlation coefficient was 0.399305. These results are broadly consistent with several previous studies (Willis and Taylor, 1999; Sakthivel et al., 2005; Lin et al., 2012; Dahil and Karabulut, 2013; Martínez-Gómez et al., 2018, 2020). While it differs from some studies that acknowledge that the effect is weak (Koch, 2003). Second, the effect of TQM on the quality of scientific research was determined to be significant at 0.01 with a path coefficient of 0.974, and the qualitative correlation coefficient was found to be 0.399305. These findings are in line with those of several earlier research (Anninos, 2007; Jusoh et al., 2008; Mashagba, 2014; Zwain et al., 2017; Lanati, 2019). These results differ from some studies, Koch (2003) emphasized the reasons for the weak impact of TQM in higher education. Third, with a path coefficient of 0.0.989 and a qualitative correlation coefficient of 0.390094, the influence of TQM on the quality of community service was assessed to be significant at 0.01. These findings are consistent with those of previous studies (Nogueiro et al., 2011, 2017, 2022; Khoja et al., 2017; Banerjea, 2018; Yeung, 2018; Castillo, 2020), while these results differ from Koch (2003) which confirmed that the effect is small and identified the reasons for this.

Finally, all these results confirm the existence of a significant role of total quality management in improving the quality of higher education in Algerian universities, both quantitatively and qualitatively. This has been discussed and confirmed in several similar studies (Khelifa et al., 2013; Mashagba, 2014; Zwain et al., 2014, 2017; Barka and Ilhem, 2016; Psomas and Antony, 2017; Khan et al., 2019; Keffane et al., 2020; Belimane and Chahed, 2021), while Koch (2003) study remains, which always confirms that this effect is weak.

Accordingly, the study gave an addition compared to previous studies, especially those that were completed in Algerian universities. It demonstrated the existence of direct and significant effects of total quality management in improving the quality of graduates, the quality of scientific research, and the quality of community service, using quantitative methods (path analysis) and qualitative methods (content analysis). This is what the directors of Algerian higher education institutions are looking for, that is, the importance, advantages, and effects of the application of total quality management before looking for how to apply it, those indicated by Khelifa et al. (2013) Barka and Ilhem (2016), Keffane et al. (2020), and Belimane and Chahed (2021).

At least four limitations apply to the conclusions of this study. First, the study did not assess the influence of TQM on higher education quality, comparing universities, academic environments, and students, as well as the variations resulting from changes in professors' perspectives. This may necessitate a meta-study that compiles the findings of various research conducted in various settings. Second, one outstanding question

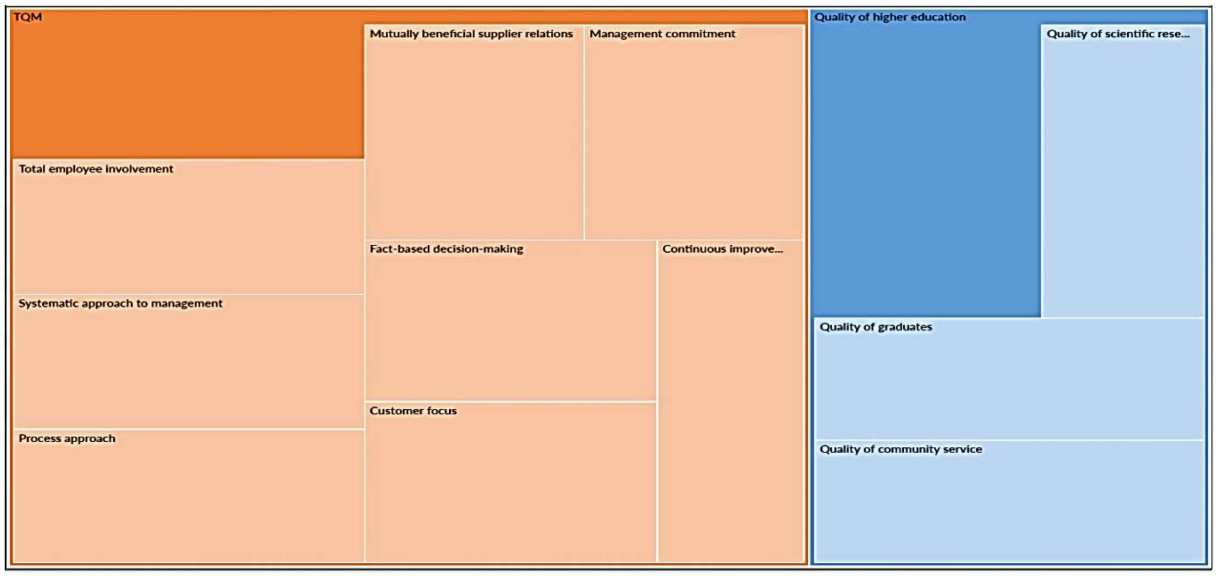

FIGURE 3
Matrix query of thematic analysis.

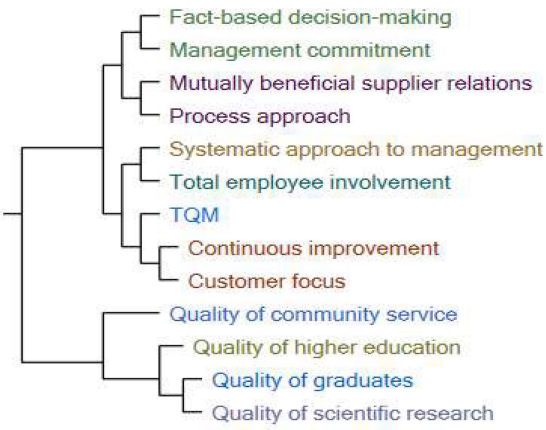

FIGURE 4
Cluster analysis of study variables.

is whether the quality of higher education is influenced by other variables such as student and faculty levels, curricula and programs, the administrative system, and so on. This may require another empirical investigation. Third, the most significant limitation is that, as a result of the Corona epidemic, the quality of higher education has altered, with universities becoming increasingly reliant on e-learning, and we must discuss the quality and value of this system. Finally, we may need data from a bigger sample and may need to utilize other statistical approaches, such as analysis of variance, to quantify the impact between the research variables. Future research trends are being evaluated as a result of these limitations.

Conclusion

The main objective of this study was to investigate the impact of TQM on higher education quality in Algerian universities by examining three sub-problems (impact of TQM on quality of graduates, impact of TQM on quality of scientific research, and impact of TQM on quality of community service) using a quantitative analysis of 610 questionnaires distributed to Algerian university students and qualitative analysis of 24 structured interviews with professors' members of the quality cells.

To summarize the quantitative findings, the correlation matrix shows that TQM and its dimensions (continuous improvement, customer focus, fact-based decision-making, management commitment, mutually beneficial supplier relationships, process approach, and systematic approach to management) have a positive significant correlation with higher quality. TQM has a direct and considerable impact on the quality of graduates, scientific research, and community service at Algerian universities, according to the SEM results or path analysis model.

The qualitative findings reveal three levels of relationships between the study variables: first, the relationship between total quality management and its dimensions, second, the relationship between higher education quality and its dimensions, and third, the relationship between total quality management and higher education quality.

The study's findings can benefit university administrators, leaders, and policymakers in the Ministry of Higher Education and Scientific Research on several levels. The first is to go from the stage of self-assessment to the stage of establishing a quality

TABLE 9 Pearson's correlation coefficient.

Code A	Code B	Pearson's correlation coefficient
Continuous improvement	Quality of graduates	0.399305
Customer focus	Quality of graduates	0.399305
Fact-based decision-making	Quality of graduates	0.399305
Management commitment	Quality of graduates	0.399305
Mutually beneficial supplier relations	Quality of graduates	0.399305
Process approach	Quality of graduates	0.399305
A systematic approach to management	Quality of graduates	0.399305
Total employee involvement	Quality of graduates	0.399305
TQM	Quality of graduates	0.399305
Continuous improvement	Quality of scientific research	0.399305
Customer focus	Quality of scientific research	0.399305
Fact-based decision-making	Quality of scientific research	0.399305
Management commitment	Quality of scientific research	0.399305
Mutually beneficial supplier relations	Quality of scientific research	0.399305
Process approach	Quality of scientific research	0.399305
A systematic approach to management	Quality of scientific research	0.399305
Total employee involvement	Quality of scientific research	0.399305
TQM	Quality of scientific research	0.399305
Continuous improvement	Quality of community service	0.390094
Customer focus	Quality of community service	0.390094
Fact-based decision-making	Quality of community service	0.390094
Management commitment	Quality of community service	0.390094
Mutually beneficial supplier relations	Quality of community service	0.390094
Process approach	Quality of community service	0.390094
A systematic approach to management	Quality of community service	0.390094
Total employee involvement	Quality of community service	0.390094
TQM	Quality of community service	0.390094
Continuous improvement	Quality of higher education	0.337994
Customer focus	Quality of higher education	0.337994
Fact-based decision-making	Quality of higher education	0.337994
Management commitment	Quality of higher education	0.337994
Mutually beneficial supplier relations	Quality of higher education	0.337994
Process approach	Quality of higher education	0.337994
A systematic approach to management	Quality of higher education	0.337994
Total employee involvement	Quality of higher education	0.337994
TQM	Quality of higher education	0.337994

management system. Second, achieving institutional and programmatic academic accreditation is a priority. Third, a comprehensive quality management approach for use in Algerian universities is being developed. Fourth, working on creating policies to help universities advance in their international classification. Fifth, policy-makers and directors of higher education institutions in Algeria must work on preparing clear strategies to adopt and apply the principles of total quality management and establish a quality management system to improve the quality of higher education (improving the quality of graduates, improving the quality of scientific research, and improving the quality of community service) by relying on an integrated quality system in which all stakeholders participate (professors, administrators, students, workers, and external community), which allows the classification of Algerian universities in the first ranks in the international classifications of universities.

Work on the remaining challenges is continuing and will be published in future studies, based on the positive discoveries presented in this paper. The next stage of our research will be a meta-analysis of the impact of TQM on higher education quality. Other issues to be addressed include the disparities in impacts between universities, the impact of other variables such as student and faculty levels, curricula and programs, and the administrative system on higher education quality.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

Study design, data collection and analysis, and manuscript editing and writing were all conducted by FY, KC and SB. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY
Con Stough,
Swinburne University of Technology,
Australia

REVIEWED BY
Siti Mistima Maat,
Universiti Kebangsaan Malaysia,
Malaysia
Teresa Pozo-Rico,
University of Alicante,
Spain

*CORRESPONDENCE
Benito Yáñez-Araque
benito.yanez@uclm.es

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Cooperative work and neuroeducation in mathematics education of future teachers: A good combination?

Marcos Procopio[1], Leandra Fernandes Procopio[2], Benito Yáñez-Araque[3]* and Raquel Fernández-Cézar[1]

[1]Mathematics Department, Faculty of Education of Toledo, University of Castilla-La Mancha, Toledo, Spain, [2]Pedagogy Department, Faculty of Teacher Training and Education, Autonomous University of Madrid, Madrid, Spain, [3]Department of Business Administration, Faculty of Law and Social Science, University of Castilla-La Mancha, Toledo, Spain

In order to respond to the new approaches in higher education, this paper presents the didactic experience of the implementation of a methodological approach based on cooperative learning and the literature review on neuroeducation in 53 students enrolled in the 3rd year of the degree in Early Childhood Education in the subject of Development of Logical-Mathematical Thinking and its Didactics II. The application of cooperative learning in combination with the literature review on neuroeducation aimed to teach future teachers how they should act with their future pupils (aged 3 to 6years) with special educational support needs (SEN) at school. The design of the proposal to be used was also adjusted to the didactic resources available. The represented contents worked on were magnitudes, time, length, weight, and geometry. The data collected were the activities of the teacher training students (didactic proposals) adapted to the early childhood development stage. They were to be created, so that the main objective was that the undergraduate students would be able to solve the exercises as children would. The students were even challenged to make an exhibition in which they had to act as teachers and their classmates would be the children with SEN. The proposals were evaluated according to a rubric, with an emphasis on the students' teachers' awareness of students with SEN. To conclude, the degree of satisfaction of the student teachers with this methodology was high. This shows that learning neuroeducation and cooperative work makes future teachers know how to teach mathematics also to students with SEN.

KEYWORDS

cooperative learning, mathematics education, inclusive education, teaching, neuroeducation, future teachers, early childhood education

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Introduction

The change that society has undergone throughout its history does not only involve the structures that represent the environment in which man has chosen to live. This change has been accompanied by a constant restructuring of the intellectual formation of its members in all areas, especially education or employment, by providing training programs to cultivate talent (Yáñez-Araque et al., 2021; Ruiz-Palomino et al., 2022). But for this change to continue to flow in an increasingly intense way, it is necessary to be concerned with the training of those who will educate future generations. Specifically, this work will deal with part of these people, the future teachers of early childhood education.

One of the concerns in the training of future teachers is precisely the difficulties they have with mathematics (Pañellas, 2016), given that some of them show these difficulties when they are students in their pre-university stages. Therefore, it is necessary to work with them to demystify the subject, alleviate their fears and give them didactic tools so that they can work with them, especially with children with special educational needs (SEN). In this sense, especially because teaching today involves challenges that go beyond how to educate. It is interesting to bring teachers closer to the findings of neuroeducation. These findings can help them to understand how mathematics learning in general develops in the brain, and to develop their proposals with an inclusive vision for all their students.

Teaching in accordance with the use of student-centered methodologies in their own training and skills that are known as innovative/active methodologies with the aim of making it possible to introduce logical-mathematical thinking to children with SEN requires at least an understanding of what neuroscience offers as an aid. Therefore, the low performance in Mathematics subjects (Dove and Dove, 2015) in Early Childhood Education teachers is not only justified by the lack of attraction they may feel toward mathematics, but in the lack of knowledge of how the cognitive process occurs and the limited experience with this subject provided by the didactic approach used. These are some of the justifications that may cause these teachers not to transmit accessible and sometimes understandable mathematics. Although some active methodologies such as flipped classroom (Dove and Dove, 2015) and cooperative learning (Swift, 2012) have been used with prospective early childhood teachers, there are no clear conclusions about the effect on their performance. Although in these previous works prospective teachers were taught with some active methodologies, they were not challenged to teach their peers as is they were children, playing the university students the teacher and pupils roles, which is the novelty of the present paper.

With all this in mind, the objective of this work is to develop teaching skills in mathematics education with a focus on cooperative work and neuroeducation literature research.

Theoretical framework

Throughout the history of mankind, the teaching-learning process has undergone several significant changes that have evolved along with the needs of society. Thus, the teaching of mathematics has evolved in a way that is as intense as the transformation of everything that society has built. Both teaching and learning ceased to be accessible only to a select group, to become generalized learning and, moreover, essential for all components of society (Vegas and Ricardo, 2006).

With this evolution came the concern for certain members of society who were initially not considered in this teaching-learning process: people with SEN. Consequently, the training of future teachers has also had to evolve for them to be able to act in a scenario in which their students are diverse. Therefore, for mathematics teaching to be developed in an inclusive way, both for students with and without SEN, it is necessary for the training of future teachers to include new experiences involving appropriate methodologies for this, as well as knowledge of neuroscience in relation to the learning of mathematics.

To do so, it must be understood that the teaching of mathematics involves some problems, three of which can be highlighted: The first is the type of methodology used in the training of future teachers, which should enable them to familiarize themselves with the subject in an enjoyable way, so that they can pass it on to their pupils with an emotion of enjoyment. The second is whether they are taught how to teach it and make it accessible to an increasingly diverse student body. The third, but no less important, is that mathematical knowledge brings into play contents and procedures that involve: memory, attention, as well as very complex mental procedures such as organizing ideas, comparing, analyzing, reasoning, making decisions, following a structure, and complying with rules (Radford, 2006; Radford and André, 2009).

Regarding the first point, among the methodologies that can be used with the aim of making future teachers have a positive experience with mathematics, is cooperative learning (Placencia, 2015), which, due to its characteristics, seems to be a more conducive methodology to start with. As early as 1991, the National Council of Teachers of Mathematics (NCTM) noted experiences in which it was successfully developed in mathematics teaching and learning (Davidson and Kroll, 1991).

But before we start using cooperative learning, we should at least be aware of its characteristics, as it is often confused with group work (Domingo, 2008). However, it is important to clarify that they are two completely different ways of working with learners. Cooperative learning has several characteristics that differentiate it from group work (Johnson et al., 1999), for example, the communication between the components is based on trust, mutual support, and reciprocal support where it is verified that the members come to understand that all will succeed due to the synergistic nature of the task. Therefore, cooperative learning develops competences and skills such as communication, listening, decision-making and leadership. Group work does not involve the number of procedures of cooperative learning, moreover,

cooperative learning is more than the development of working together with peers at university. According to Díaz-Aguado (2015), cooperative learning leads to the development of learning, not being a mere group collaboration.

As the name itself indicates, the first thing to consider is the collaboration that must exist between the components of the group. Since the success of the group depends directly on the contributions that each one can make and implies the social recognition of all the components (García et al., 2001, p. 38). It also depends on how one's own work and that of others is organized. This leads to the development of new competences and skills such as the ability to relate to peers and to manage these relationships. Another relevant feature to bear in mind, is that cooperative learning, does not promote competition between the groups that are formed, or even between the components of the group. This builds positive interdependence (Herrada and Baños, 2018). The idea is that success does not belong only to one component, but that if one is successful, it means that all will be successful.

In contrast to competitive methodologies, through cooperative learning, students develop skills such as solidarity among group members. Each person becomes responsible for presenting new proposals to the group, which leads to another skill, which is that learning is obtained from living together with others (Pegalajar Palomino and Colmenero Ruiz, 2013).

On the other hand, working mathematics with students who have special needs requires that the training of future teachers goes to another level. It is necessary to know how they learn to be able to teach (Fernández Bravo, 2010; NAYEC and NCTM, 2013; Hernández-Perlines et al., 2016), as well as to know how the brain can retain knowledge. This implies that knowing certain bases of neuroscience, one of which is neuroeducation, is fundamental for future teachers to contemplate the teaching of logical-mathematical thinking in an inclusive way, making it suitable for their diverse students, including students with SEN.

Students with SEN do not only include children with learning difficulties, physical or intellectual disabilities, but also those with high abilities, whether academic, sporting, or artistic. With all of them it is necessary to use special methods and resources that contribute to their development (Fernandes Procopio et al., 2022), and it is necessary for future teachers to be aware of this, given that one of the problems pointed out in the lack of success in mathematics is inadequate teaching (Fernández Bravo, 2010). Considering the approach from the knowledge of the functioning of the learner's brain, which is explained from neuroscience, would allow teaching to be adapted to all learners, and this includes learners with SEN.

Therefore, both the choice of methodologies to be used to teach future teachers and the knowledge of how learning is supported by neuroscience. This can give them the ability to understand that "special education pupils go through the same difficulties as children in mainstream education, but the difference lies in the fact that their cognitive processes of memory, attention and language are more marked, at least in terms of probabilistic thinking" (López-Mojica, 2013, p. 172).

As much as this work points to innovative methodologies, it is not a defense that learning can be measured by the novelty of the techniques and resources used, but neither can it deny the support that methodologies such as cooperative learning bring to the teaching-learning process of future teachers.

Neuroscience, coupled with new methods of brain research, can generate benefits for education (Ocampo, 2019). This research allows us to understand how the brain learns in a deeper way, which allows us to expand its potential (Roig, 2017). From the application of the neuroscience of learning to education arises neuroeducation which, unlike neuroscience, is concerned with understanding how the brain interacts in the acquisition of knowledge in the teaching-learning process. In other words, neuroeducation focuses on working memory, executive functions and the contribution of strategies that influence the teaching-learning process. For Días (2021) it is essential that teachers, in addition to knowing the neurobiological bases of learning such as memory, emotions and attention, understand how the brain works, as well as its correspondence with learning. In this way, the use of active methodologies that promote in students the development of autonomy, intelligence, and the use of technologies, contribute to improving learning conditions. These include cooperative/collaborative learning (Gonzáles and Abad, 2020).

Thanks to neuroeducation, it is possible to understand the interaction that takes place in the brain now of learning. This makes it possible, for the future teacher, to know what types of methodologies he/she could use to make the learning of his/her students more effective. In this way, neuroeducation and cooperative learning can be used as a tool to support mathematics education.

Methodology

The participants were 53 students, 51 of whom attended the classes regularly, all of them female, students of the 3rd year of the degree in Early Childhood Education and enrolled in the subject Development of Logical-Mathematical Thinking and its Didactics II, in a Spanish university.

The students were chosen for two reasons: first, because they are enrolled in a subject that represents the key point for them, where they always encounter the difficulties of how to teach mathematics and how to know if their students are learning. And second, to help them decide which methodological path they should follow as future teachers in mathematics classes.

As a procedure, it was decided to work with the 10 existing base groups so that they could satisfactorily and adequately develop the contents and objectives of the subject. At the end of each theoretical block, they were asked to develop a teaching plan related to a content, and to implement it with the didactic resources available in the Didactics laboratory. These resources were Cuisenaire rods, hydrostatic balance, among others. Each of the blocks were named in a way that represented all the content worked on during the 4-month period, as shown in Table 1.

TABLE 1 Distribution of the blocks in the subject Development of Logical-Mathematical Thinking and its Didactics II.

Blocks
The construction of magnitude in children:
1. Measurement
2. Length
3. Mass
4. Time
5. Extensive additive
6. Intensive or non-additive
Geometry:
7. Similar spaces
8. The construction and structuring of space
9. Spatial and plane shapes
10. Van Hiele adaptation to early childhood education

TABLE 2 Didactic guide used for the development of the internships.

Title
It should be creative and motivate students to want to take part in projects
Introduction
Justification of the proposal
Theoretical framework
The theoretical framework may contain both old and mainly recent authors
Objectives
Programming objectives
Contents
Contents of the program
Recipient
It will indicate the learners targeted and describe the difficulties that may be encountered in classes for them.
Didactic proposed
This should contain all the activities you intend to develop in class in an explained way and how you will work with the students.
Curricular adaptations for SEN
Teaching strategies
Here you should explain how you are going to develop what you set out to do in your class and list how you are going to do it.
Bibliography

The blocks were structured, in such a way that one or more of the contents, presented in the teaching guide could be worked on in each, i.e., in block 1 all the contents related to measurements were worked on. To carry out the work, a structure was proposed that was analyzed and modified by the participants until the one shown in Table 2 was reached. The aim was for the work guide to be a living document that could be adapted to the needs of each practice and students' group.

As a third prompt, they were to investigate what neuroeducation has to say about how pupils with special needs learn mathematics in their early childhood class.

Ten practices were proposed, one for each group, in which the future teachers had to prepare activities adapted to the ages of the chosen pupils (between 3 and 6 years old), as well as propose curricular adaptations for pupils with SEN. The contents were: magnitudes, time, length, weight, and geometry. All the practices were followed by group tutorials with the aim of checking the degree of scope and adaptation of the approaches to the ages of the infant education pupils. This ensured the degree of theoretical learning of mathematics by the future teachers.

The evaluation of the didactic proposals was carried out according to the criteria presented in Figure 1.

Results

Table 3 shows the practices carried out during the course in the subject Development of Logical-Mathematical Thinking and its Didactics II, aimed at students with special educational needs.

Of the 10 groups that carried out the research, three stood out for the way they implemented neuroeducation knowledge in their classes. Table 3 presents the 10 practices, from which the three highest scoring practices were selected. These three practices correspond to the three groups that were most successful in developing and presenting their lessons using neuroeducation, as proposed in the written document prepared for each practice. These three groups made use of neuroeducation as an attempt to find new directions for the development of students with SEN.

In the first practice, Mathematics, the prospective teachers developed a lesson in which they had to point out the fundamentals of neuropedagogy and the methodology they were going to use to teach the magnitude of length. The lessons were conducted in an inclusive way, although with the great challenge of integrating students with SEN into the group. For Sales et al. (2015) it is worth mentioning that pupils with SEN are different from those with learning difficulties, given that the origin of the difficulties for the former is neurological. In terms of treatment, learning difficulties can be treated more easily, while students diagnosed with SEN require specific methodologies, depending on the degree of difficulty diagnosed, for the results of their treatment to be satisfactory. Autism spectrum disorder is a group of neurodevelopmental disorders that have in common both clinical expressions and the following characteristics: difficulties in reciprocal social interaction, difficulties in comprehension, expression and verbal communication and repetitive, restricted, and stereotyped behaviors (Artigás Pallarés and Narbona, 2011; Salvadó et al., 2012; Lozano et al., 2013).

To bring the activity closer to these students, one of the activities proposed was an assembly, in which both moments in which the student with special educational needs could remain in the group and moments in which they could not, according to their will, were proposed, offering them the materials they were working with so that they could familiarize themselves with the group or individually, respectively. Inclusive skills approaches and activities that aim to teach, using appropriate methodologies and

DEVELOPMENT OF LOGICAL-MATHEMATICAL THINKING AND ITS TEACHING II
GROUP ASSESSMENT TEMPLATE

Name of the students: _____ **Group:** _____

Qualification criteria

Groups	Creativity (Max. 1,0 point)	Originality (Max. 1,0 point)	Leadership and control (Max. 1,0 point)	Clear presentation (Max. 1,0 point)	Preparation of material (Max. 2,0 points)	Adequacy of contents (Max. 1,5 points)	Adequacy of Neuroeducation (Max. 1,5 points)	Organization/ Planning (Max. 1,0 point)	Overall evaluation of the group* (Max. 10,0 points)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

* Qualitative observations that you want to add to the evaluation: _____

FIGURE 1
Group evaluation rubric.

TABLE 3 Lessons developed for children with special educational needs.

Practice	SEN	Topic	Score
Learning with Pinochio	Intellectual disability	Measurements	6,4
Hansel and Gretel: lighter or heavier	Autism spectrum disorder (ASD)	Mass	6,5
Nemo and the geometry of the ocean	Attention deficit hyperactivity disorder (ADHD)	Geometry	7,0
Dora the explorer and the geometric jungle	Attention deficit disorder	Geometry	6,8
Alice in the land of clocks	Dyscalculia	Time	7,2
Turbo and the race of the champion	High abilities	Length	7,1
Tadeo Jones and the geometric treasure	Intellectual disability	Spatial and plane figures	6,7
Matheolympics	ASD: Autistic spectrum disorder	Magnitude length	9,5
Dancing with numbers and geometric figures	ADHD: Attention deficit and hyperactivity disorder	Geometric figures	9,1
The flea market	High abilities	Numbers	9,3

understanding children's brain development, promote learning. Studies such as that of Garnica et al. (2013) indicate that these pupils can develop an understanding of notions of length.

The next group worked with numbers and geometric figures. It could be observed that they not only sought to work on mathematical concepts, but also to apply them in different situations and everyday activities, as well as to develop intuition and social values through their experiences. They used these strategies to attract the attention of students with ADHD in a different way. According to Miranda et al. (2012) the difficulties presented by students with ADHD are related to impulsivity, restlessness, or inattention with respect to mathematical ability.

On the other hand, the future teachers also chose geometry because of its proximity to reality from an early age, thus keeping the attention of pupils with ADHD, as this part of mathematics is related to space and can be found in most of the materials around them, allowing them to work with exploration and observation of the environment, and facilitating the development of logical-mathematical thinking, in this case spatial.

However, the future teachers, expressed in their presentation and demonstrated with the activities that they considered of vital importance for working on mathematics with children with ADHD (although it is fundamental for all types of pupils), that mathematics will allow them to obtain an integral development, because in addition to working on mathematical concepts, other knowledge belonging to other contexts can be acquired. For example, the activities designed by this group in this study were aimed at working on mathematics, but also on other aspects, such as attention, socialization, respect, emotions, etc. This is in line with various authors (Yoo et al., 2014; Molina and Martínez-González, 2015; Johnstone et al., 2017) who work with neuroscience and report that improvements are found in the cognitive and emotional processes of students with ADHD.

In the last practice presented in this text, the future teachers chose to work with numbers, titling their exhibition The flea market. They sought to develop the concepts of number and simple addition and subtraction operations with students with High Abilities. They opted for classes with diversity, considering that children with high abilities get along better if they work in groups with other pupils and in a playful way. In this type of activity, the proposal is that the other children develop empathy as well as mathematics, and those with special educational needs reinforce their companionship by helping their peers, which would be a kind of motivation for the highly able pupils.

For Olszewski-Kubilius and Carenbach (2012), when highly able students understand that their success depends on hard work in school, they will do it. This implies that if teachers provide challenging lessons to these students, this will motivate them to continue. Motivation is an aspect of learning that has been explained from neuroscience, as well as its applications in education (Herce-Palomares and Abellán-Civera, 2018). Furthermore, these authors recognize that high abilities do not guarantee academic success or success in adulthood (Herce-Palomares and Abellán-Civera, 2018).

Discussion

The teacher's task always follows the same direction: to reflect on the objectives, contents, competencies, skills, and the material to be used in the classroom. However, the future teacher needs to go beyond what is known as the teaching task, he/she needs to value the interaction that the brain develops now of learning. This is what some authors defend, such as Poma and Castillo (2022), who go so far as to affirm that neuroeducational principles and factors are indispensable in the teaching-learning process of mathematics. If we add that the group of students present SEN, the knowledge of these neuroeducational principles becomes even more necessary.

The results obtained indicate that in practice with students with Autistic Spectrum Disorder (ASD), they can benefit from learning based on observation and methodologies for inclusion to occur (Torres, 2016). Students with ASD are also able to learn from their already lived experiences, applying neuroeducation and active methodologies. With the support of neuroeducation it is possible to adapt the organization of spaces that enable the development of skills and abilities to learn with the use of games, flavors, sounds, colors, and shapes, i.e., from sensory perception.

Regarding students with attention deficit hyperactivity disorder (ADHD), considered the most common neurobiological disorder (Rodillo, 2015), the future teachers developed a practice with their own didactic material that enables the teaching-learning process in these students. Factors such as involvement and goals achieved can generate well-being and attitudes that lead to the development of a positive psychology in people with ADHD (Newark et al., 2012). Among the elements for developing well-being are cooperative work, task involvement, meaning and goals (Seligman, 2019). In line with these elements, the future teachers chose geometry because of its proximity to objects close to the everyday life of students with ADHD and thus to work mathematics on aspects of attention, socialization, respect, emotions, and interaction.

Finally, the range of students with SEN also includes those with high abilities. These are characterized by intelligence, creativity, and motivation with the task, in addition to the emotion that is present in high learning abilities. From the perspective of neuroeducation, students in general may present learning problems that may be generated by a lack of motivation and interest (Días, 2021). Therefore, it is necessary for future teachers to know that students with high abilities develop a different cognitive processing, which involves acting and intervening on their attention and motivation, associating them with emotional principles that must be considered in the school context (Luque et al., 2016). In practice, future teachers used elements of neuroeducation to work with students with high abilities. Activities were proposed to reinforce motivation, interest, and their abilities such as creativity and intelligence, through cooperative work. Through the development of group, individual or paired projects, these students addressed the needs of their highly able pupils. In addition, the future teachers considered the emotional processes of students with high abilities, such as the small changes that can make personal adjustments that influence the improvement of the academic performance of these students (Rivera et al., 2014).

Conclusion

The main contributions of this exploratory educational experience, carried out with future female early childhood education teachers, is the evidence that cooperative learning, in combination with neuroeducation research, makes these students prepare their own teaching materials with SEN awareness. By using cooperative learning, we have been able to provide the future teachers with a practical contact with mathematics, as well as the awareness that the students they will encounter in their classrooms will be diverse and their success as teachers involves learning from all of them. Therefore, their own research will be necessary to promote the learning of mathematics in all of them. In addition, this approach has allowed us to provide them with knowledge of neuroscience and they have been able to apply all of this to their teaching proposals for dealing with pupils with special educational needs.

The much talked about quality education that we all desire must be addressed from the initial training of teachers and must be approached from an inclusive perspective. This is one of the greatest challenges we have in teacher training, to train teachers capable of changing and modifying content, approaches, structures, and strategies, with a common approach that includes all children of the corresponding age and with the conviction that it is the responsibility of the general system to educate all children (Right to Education Initiative, 2019).

In mathematics, we have seen a significant qualitative leap in the motivation, interest, creativity and learning of future teachers. In addition to understanding the development of children's logical-mathematical thinking, they have been able to understand that all children have the right to learn and can do so if, as teachers, we provide them with an experience appropriate to their level and educational needs.

Finally, it is important to implement methods in Mathematics Education that focus on cooperation, manipulation and adaptation of teaching materials and resources, making them inclusive and accessible to all students. There are no limits to learning, what there are barriers, and this is what future teachers must consider when teaching mathematics. From this perspective, their teaching role should be oriented toward reducing barriers to learning, offering inclusive educational proposals around mathematics and adequate support for their needs. This is what we want to call here the teacher's awareness in welcoming diversity.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

This research project has been granted full approval by the Social Research Ethics Committee of the University of Castilla-La Mancha under reference CEIS--634122-B5K2. The patients/participants provided their written informed consent to participate in this study.

Author contributions

MP, LFP, BY-A, and RF-C: conceptualization, validation, formal analysis, investigation, and visualization. MP and LFP: methodology and writing—original draft preparation. MP: resources. LFP: data curation. BY-A and RF-C: writing—review and editing, supervision, and project administration. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY
Benito Yáñez-Araque,
University of Castilla-La Mancha, Spain

REVIEWED BY
Ali Saleh Alshebami,
King Faisal University, Saudi Arabia
Muhammad Yaseen Alias Sharjeel Bhutto,
Shandong Jianzhu University, China

*CORRESPONDENCE
Miao Shi
✉ miao.shi@lpunetwork.edu.ph

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Adjustment of self-initiated and organizational expatriates: The moderating role of cross-cultural training

Muhammad Noman[1], Muhammad Safdar Sial[2], Sarminah Samad[3], Rita Yi Man Li[4] and Miao Shi[5]*

[1]School of Journalism and Communication, Wuhan University, Wuhan, China, [2]Department of Management Sciences, COMSATS University Islamabad (CUI), Islamabad, Pakistan, [3]Department of Business Administration, College of Business and Administration, Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia, [4]Sustainable Real Estate Research Center, Department of Economics and Finance, Hong Kong Shue Yan University, Hong Kong, Hong Kong SAR, China, [5]School of Management, Pass College of Chongqing Technology and Business University, Chongqing, China

Globalization and the international labor movement made the ability to work anywhere globally. These individuals are usually organizational expatriates (OEs) deployed to overseas assignments by their employers or self-initiated expatriates (SIEs) who choose to relocate and work in a foreign country. Therefore, this study examines and contrasts the variations in cross-cultural adjustment (CCA) between Chinese SIEs and OEs in Pakistan. Furthermore, it aims to understand how cross-cultural training (CCT) influences the adaptation of Chinese SIEs and OEs. Data were obtained from 35 Chinese expatriates with 17 SIEs and 18 OEs employing a qualitative technique and were analyzed *via* thematic analysis in MAXQDA 20. According to the study, both SIEs and OEs face distinct hurdles to their CCA in Pakistan, including cultural taboos, language obstacles, and work variations. While numerous aspects that will favorably affect their CCA, including the accessibility of necessities, the friendliness of the Pakistani people, and the brethren relations between Pakistan and China, assist them in making a smooth transition to life in Pakistan. Furthermore, the results indicate that the mediating role of pre-departure CCT and the host country mentors' support and facilitations acquired through online resources contribute to both Chinese SIEs and OEs' CCA in Pakistan.

KEYWORDS

cross-cultural adjustment, self-initiated expatriates, organizational expatriates, cross-cultural training, Pakistan

1. Introduction

Globalization has ushered social, economic, cultural, technological, and educational variations (Altman and Shortland, 2008). Consequently, many global corporations can now establish operations overseas to compete in the international economy (Srivastava and Pandey, 2012). In recent years, China has increased its involvement in several nations worldwide (Buckley et al., 2018; Jackson and Horwitz, 2018). As a result, many Chinese expatriates have relocated worldwide (Zhang and Fan, 2014; Cooke et al., 2017). China launched several significant international investments, including the Belt and Road Initiative (BRI; Huang, 2016), in 2013. The span of this venture extends from China through South East Asia, East Africa, West Asia, Greece, Venice, and finally, Rotterdam (Ahmad, 2016), emphasizing spatial connection and economic growth. In recent years, the mobility of more than 30 million Chinese expatriates throughout the globe (Textor, 2021) has sparked a greater interest in Chinese expatriates (Charoensukmongkol, 2021; Guang and Charoensukmongkol, 2022). Several studies have analyzed the difficulties faced by Chinese expatriates in Settings (Bader and Schuster, 2015; Abugre, 2018). As a component of the Belt and Road Initiative (BRI), the China-Pakistan Economic Corridor (CPEC; Syed, 2018; Bari et al., 2019) was recently launched, providing a rare chance to study Chinese expatriates' adaptation to a hitherto unexplored context: Pakistan. Since the inception of the (BRI), many Chinese companies and expatriates have relocated to Pakistan, adapted to Pakistan's work and non-work sectors (Zhang and Fan, 2014).

The extant research on expatriate CCA has concentrated chiefly on Western expatriates (Olsen and Martins, 2009; Harrison and Michailova, 2012; Makkonen, 2016). To have a thorough knowledge of expatriate CCA, it is essential to recognize that expatriates face several psychological, behavioral, and somatic obstacles while relocating to a new distant nation (Firth et al., 2014; Maertz et al., 2016). In addition, there are substantial disparities between Western and Asian environments (Chuang et al., 2015; Tahir, 2018), which uniquely impact expatriates' adjustment process. Nevertheless, research on expatriate CCA has concentrated chiefly on Western expatriates (Olsen and Martins, 2009; Harrison and Michailova, 2012; Makkonen, 2016). Asian expatriate CCA obstacles have received little attention (Ang and Tan, 2016; Nadeem and Mumtaz, 2018; Noman et al., 2020). When someone relocates to another country to work for one of the firm branches, they are referred to as expatriates (Guo et al., 2016). Expatriates with appropriate employment assets enjoy the benefits of foreign professional mobility and experience a smoother transition to living and working in the host nation (Dimitrova et al., 2020). The two main categories used to describe expatriates by scholars are "self-initiated expatriates" (SIEs) and "organizational expatriates" (OEs; Jokinen et al., 2008). Independent movers are known as self-initiated expatriates (SIEs). Their ambition is to find employment in a foreign country, and they are taking the necessary steps to make that happen (Linder, 2018).

In contrast, organizational expatriates (OEs) are those transferred overseas by their employers (Linder, 2018). Many scholars concluded that SIEs move overseas for individual reasons such as self-improvement, whereas OEs go foreign mainly to achieve professional or organizational objectives (Suutari and Brewster, 2000; Peltokorpi, 2008). Consequently, firms rely on expatriates who can handle assignments in other countries to sustain and improve their competitiveness (Dowling and Welch, 2005). According to Koo Moon et al. (2012), effective expatriate CCA is one of the critical foundations of an organization's success. Through CCT, expatriates must get adequate knowledge, comprehension, and awareness of the acceptable norms and behaviors of the host country to improve their abilities (Wang and Tran, 2012). It also helps expatriates tackle intercultural settings (Littrell and Salas, 2005). Further, CCT is a set of formal guidelines designed to help workers improve their social and professional interactions with coworkers from diverse cultural backgrounds (Brislin and Yoshida, 1994). It fosters an expatriate's cross-cultural understanding, allowing them to effectively interact with others from distinct cultural environments (Wang and Tran, 2012). The effective CCT may enable expatriates to become acquainted with the host nation's culture, legislation, rules, working atmosphere, and other aspects. Thus, it aids their cross-cultural adaptation while operating overseas.

The studies on OEs have emphasized intercultural adjustment and various employment aspects, including work effectiveness and engagement (Hechanova et al., 2003; Bhaskar-Shrinivas et al., 2005). On the contrary, existing studies on SIEs have focused on motivational and professional life elements of self-directed international encounters (Richardson and Mallon, 2005; Al Ariss and Syed, 2011; Selmer and Lauring, 2011a). SIE scholars have given less consideration to CCA and employment aspects (Selmer and Lauring, 2011b; Froese et al., 2012), despite offering crucial information about the possibly more extensive expatriate community than OEs (Myers and Pringle, 2005). It's also worth noting that scholars have conducted few studies comparing SIEs and OEs. These studies demonstrate that individual and employment variables, CCA, and work engagement vary amongst SIEs and OEs (Doherty et al., 2011; Froese and Peltokorpi, 2011). Moreover, little is understood about why there are disparities in critical expatriate consequences such as CCA and work satisfaction between SIEs and OEs. This study looks into these discrepancies between SIEs and OEs, the underlying causes of variations in CCA, and work satisfaction between SIEs and OEs.

The research significantly advances two crucial areas of the literature. First, the research investigates the distinctions between SIEs and OEs and their CCA in Pakistan's diverse cultural atmospheres. Furthermore, the study's sample consists of Chinese OEs and SIEs, working in Pakistan. By investigating the adjustment issues faced by Asian expatriates in an Asian context, this sample contributes to the international business literature. Due to their growing global presence, Chinese expatriates' adjustment difficulties are also valuable. Second, research indicates that one of the essential elements of an overseas task is the ability

to adapt to different cultures. Therefore, CCT plays a crucial role. The main goals of CCT techniques are to reduce culture shock and increase awareness of cultural diversity among expatriate workers while also assisting them in comprehending the value of culture (Eschbach et al., 2001). However, there is no previous research on this topic in Pakistan. The present study to close this research gap and advance our understanding of this topic. The results of this study may aid Multi-national corporations in creating appropriate CCT programmes that assist expatriates and their families in adjusting to the distinctive socio-cultural atmosphere of Pakistan. It may also encourage other research investigations on this critical topic. This study aims to examine the elements that influence Chinese SIEs and OEs' CCA and, particularly, to determine the differences between the SIEs and OEs' CCA process in Pakistan. Further, the study is interested in finding the degree of CCT that will help facilitate the Chinese SIEs and OEs; for instance, the moderating role of CCT in SIEs and OEs' CCA.

This paper has been four sections. The first section includes a brief review of the main literature, while the second section discusses the methodology, including details about the interviews with Chinese expatriates and how the data were analyzed. The third section is the study findings. The fourth section presents the discussion of the study results. The final section provides a conclusion, practical implications, future research directions, and limitations of the study.

2. Literature review

2.1. Defining the term "SIEs" and "OEs"

When individuals leave their national borders to live and work temporarily in another nation, this process is known as expatriation (Richardson and McKenna, 2006; Rose et al., 2010). According to Suutari et al. (2018), the word "ex-pat" originates from the Latin term "ex-Patria," which means "away from one's nation." It describes someone leaving their country searching for better employment and living opportunities. So, an expatriate is a person who plans to live and work for a specific amount of time in a foreign nation or culture (Holopainen and Björkman, 2005).

There are two types of expatriates looking for work abroad: organizational expatriates (OEs) and self-initiated expatriates (SIEs; Howe-Walsh and Schyns, 2010). When a parent company sends a highly qualified employee to work in a foreign subsidiary for a set length of time (often three to 5 years), these workers are known as "OEs" (McKenna and Richardson, 2007). Additionally, SIEs migrate and seek employment in a foreign nation without assistance from native firms (Selmer and Lauring, 2010; Tharenou and Caulfield, 2010). OEs are offered training and skills before moving overseas, whereas SIEs make their own expatriation determinations (Howe-Walsh and Schyns, 2010).

Literature reveals that SIEs are more prevalent and well-liked than OEs and that the quantity of SIEs is significantly greater than that of OEs (Biemann and Andresen, 2010; Swim et al., 2011). That is, since SIEs are free to commence their journey overseas and are not obligated to serve in specific companies, unlike OEs. The latter return to their firm when the foreign mission is done. Results revealed that SIEs comprise 65% of the professional workforce (Doherty, 2013). Additionally, the research found that 50 to 70% of expatriates fall within the category of SIEs (Jokinen et al., 2008; Peltokorpi and Jintae Froese, 2009; Swim et al., 2011).

2.2. Cross-cultural adjustment of SIEs and OEs

The term "CCA" describes how well an expatriate has adjusted psychologically and socially to live in a new culture (Black, 1988; Black et al., 1991). Expatriates tend to become more at ease and start integrating with the foreign culture through a procedure that entails uncertainties, minimization and transformation (Black, 1988). Through copying and practicing culturally acceptable behaviors, expatriates might lessen fear and confusion. Expatriates who have successfully adjusted to their foreign culture are often receptive to the host society's customs. They can build on the foundation established by their own cultures in terms of new habits, values, and laws (Church, 1982). On the other hand, maladjusted expatriates are incapable or unwilling to adapt and change their behavior to the foreign nation's habits, customs, and standards. Expatriates may consider foreign cultures lower than their own and their own culture overly favorable if they had unpleasant experiences there.

Addressing the CCA of expatriates, there is a substantial corpus of literature (Bhaskar-Shrinivas et al., 2005; Takeuchi, 2010). Black and Stephens (1989) recognized the three significant aspects of CCA in the research on expatriate adjustment: general adjustment, interaction adjustment, and work adjustment. The way expatriates adapt to living abroad is referred to as general adjustment. The process of adjusting to new social contacts is known as interaction adjustment. Expatriates' integration into the workplace is a crucial component of work adjustment. Previous research on expatriate adjustment has frequently used these three elements, which have already been proven valid (Bhaskar-Shrinivas et al., 2005).

While an extensive study was undertaken on the CCA of OEs, fewer are revealed about the CCA of SIEs. Generally, the emphasis of cross-cultural studies on expatriates has been on OEs delegated by the MNEs' corporate headquarters to the overseas subsidiary. The General Agreement on Trade in Services (GATS), signed by countries, establishes the guidelines for the mobility of specialists across national borders and the reciprocal validation of credentials (WTO, 2019; Guo et al., 2021). According to research by Peltokorpi and Jintae Froese (2009), SIEs are more likely to exhibit higher general and interaction adjustment levels than OEs. Regarding work adjustment, Froese and Peltokorpi (2011) discovered that SIEs are less satisfied with their professions than OEs. They suggested that SIEs' pre-existing social networks with locals and stronger desire would favorably impact interaction and

general adjustment. This is problematic because they did not experimentally evaluate the antecedents of SIEs' adjustment. They predicted that SIEs get less assistance at the workplace, which would contribute to lower work satisfaction.

Additionally, Richardson (2006) and Vance (2005) suggested that families and spouses could favor expatriates' adjustment. In conclusion, there are significant differences among SIEs and OEs in terms of CCA, and these differences in precursors may also exist across SIEs and OEs. Therefore, this study explores the differences between the SIEs and OEs and their CCA process in Pakistan's work and non-work environments.

2.3. Cross-cultural training

The CCT has a considerable effect on their work performance. Since the advent of globalization, there has been a rising demand for CCT. According to research by Hunt et al. (2015), multicultural employees and fiscal gains are directly correlated, demonstrating the significance of CCT and its productivity. In other words, a more diversified workforce leads to better financial results. With the help of CCT, expatriates may better locate and adapt to their host settings to perform at a higher standard. The goal of CCT is to train individuals of one culture how to interact successfully and work with individuals of another culture and to assist them in efficiently adjusting to their new place (Tahir, 2022). This training includes cultural orientation, language learning, social skill building, interactions, etc. (Krishnaveni and Arthi, 2015).

The study of expatriates' adjustment has dominated the field of cross-cultural literature (Bruning et al., 2012; Abdul Malek et al., 2015; Kawai and Mohr, 2015; Selmer and Lauring, 2015; Zhang and Oczkowski, 2016). When performing their duties, expatriates encounter difficulties living and working in a foreign country (Black et al., 1991). The challenges in transitioning to these circumstances sparked a heated discussion about ways to increase efficiency in the host nation and reduce the failure rate of an expatriate mission. According to Black and Stephens (1989), expatriates are deemed acclimated to the host culture if they feel at ease, psychologically satisfied, and unbothered by any of the three adjustment components: general, interaction, and work adjustment.

The contribution of CCT professionals working abroad has been substantial. The researchers recognized that CCT plays a crucial role in expatriates' successful international adaptation (Waxin and Panaccio, 2005). Additionally, CCT is frequently referred to as a strategy for enhancing expatriates' ability to perform well overseas (Forster, 2000). According to Black and Mendenhall (1990), CCT has been implemented to improve interactions between people of different cultural backgrounds. Expatriates' ability to adapt to their new surroundings and increase their understanding of local culture are both aided by training (Porter and Tansky, 1999). Caligiuri et al. (2005) stated that CCT was designed to assist individuals in feeling secure while living and working overseas, boost their acculturation, and improve their capacity to detect and comprehend diverse cultural contexts. Appropriate planning, like providing these expatriates with CCT before they depart, can help mitigate or eliminate many potential problems during their time abroad. The CCT strives to accomplish three primary goals. The first is that CCT ought to assist expatriates in anticipating (in ahead) appropriate methods of carrying out work and appropriate cultural behavior in the host nation. The second goal is to increase expatriates' cognitive ability to deal with unexpected occurrences and disputes caused by unanticipated circumstances and acts. The third objective of CCT is for expatriates to have realistic assumptions concerning their living and working conditions in the host nation (Caligiuri et al., 2001). In addition, Mondy and Noe (2005) proposed that various types of pre-departure and CCTs focusing on the host nation's language, culture, living conditions, and social norms will aid expatriates in adjusting to the host culture with ease. Therefore, this training aims to increase expatriates' understanding of the host culture and familiarize them with cultural diversity.

2.3.1. Pre-departure training and informal learning

The initial phase is pre-departure training, and experts discovered that pre-departure CCT is quite successful once expatriates reach overseas (Mendenhall, 1999). First, CCT equips expatriates with the essential information they need as soon as they arrive at their location, such as cultural etiquette, business etiquette, appropriate clothes for the environment, mandatory and optional traditions for individuals and solid language abilities (Avril and Magnini, 2007). Before leaving on a mission, expatriates should be informed that they may encounter uncertain situations. They may see these situations as instructional experiences. If they encounter circumstances where the outcome is obscurely successful, they should design a path for development rather than trying to escape (Avril and Magnini, 2007).

Informal learning is a constant process *via* which knowledge, skills, behaviors, and experiences are acquired. This might be intentional or unintentional, and it encourages the development of new ideas and methods. We have access to an infinite number of materials for informal learning since we live in a digital world. Informal learning is pursued *via* exposure to real-world experts and colleagues in the workplace and through online resources, mentorship programs, and other technical networks. In addition, the expatriates often organize those informal training approaches individually, while the employer may occasionally provide such training (Brewster and Pickard, 1994). Informal learning utilizes a variety of strategies and tools: people share occupational safety knowledge *via* Twitter (Song et al., 2022), construction practitioners and government officials share the construction safety knowledge *via* blog (Li and Poon, 2011) and Weibo (Zeng and Li, 2022) and residential safety *via* Twitter (Li et al., 2022). According to Bear (2008), the majority of expatriates utilize internet-based tools like different Social media websites, e.g., Google, Facebook, YouTube, Whatsapp, Wechat,

and Twitter, as informal learning resources to understand the culture and the new country.

Additionally, informal learning is acquired *via* regular employment and social interactions. According to Sambrook (2005), informal learning occurs in the workplace *via* appraisal, practice, and rather than through participation in a formal training session while employed. As an illustration, informal learning can occur during meetings, customer interactions, mentoring, peer-to-peer interactions, and task exploration (Marsick and Volpe, 1999; Ellinger, 2005).

3. Research method

3.1. Qualitative research approach

Qualitative research approaches are essential for constructing theories in complex and extensive fields (Yin, 2016). Therefore, a combination of critical incident and narrative inquiry approaches (Silverman, 2011; Yin, 2015) was employed to gain insight into, and construct theories around, the cross-cultural adjustment of Chinese SIEs and OEs. We used semi-structured interviews to collect data for this research from high-management Chinese SIEs, and OEs employed in distinct Chinese companies in Pakistan. According to Selmer (2006), employing qualitative strategies may aid the researcher in overcoming "linguistic difficulties" when gathering information and assist Chinese expatriates in understanding the study issue by easing their worries. The research employs two distinct methodologies comprising "narrative analysis" that was included in the research framework (Murray, 2009; Silverman, 2011), and this strategy was utilized to encourage respondents to convey their views throughout the discussion boldly (Yin, 2015).

3.2. The study configurations

As stated earlier, this investigation emphasizes Chinese SIEs and OEs who have worked for various Chinese companies in Pakistan. Due to strict security standards, most of these enterprises are based in the capital of Pakistan, i.e., Islamabad, although some are located in Lahore, Karachi, and other significant areas (Sial, 2014; Arduino, 2017). The enterprises' largest and most significant areas are involved in the infrastructure and power sectors.

Due to its efficacy in qualitative studies, the "snowballing sampling approach" was utilized to get accessibility to more responders (Glassock and Fee, 2015). To do this, the researcher interviewed all the respondents and asked whether they knew any individual who might benefit the study (Green et al., 2010). Also, research in this area (Inkson and Myers, 2003; Myers and Pringle, 2005) has demonstrated that this sampling method is efficient.

3.3. The participants

The following key selection parameters have been used to enrich, organize, and inform the data acquired, resulting in a thorough evaluation and explanation of the topic under investigation in this study. To begin, the first parameters for participation in the research were set as at least 1 year of employment in Pakistan as a member of the high-level management department. They relied on literature indicating that expatriates should spend at least several months in a host nation to grasp the cross-cultural atmosphere sufficiently (Firth et al., 2014). Secondly, the respondents must be able to communicate in English because all the discussions are undertaken in that language.

3.4. Interview process

Before conducting interviews, every participant was assured of their privacy and confidentiality and given a thorough explanation of the study's goals. After obtaining approval from each respondent, they were given a "consent letter" to read and sign before their interviews were recorded. In addition to recording the interviews verbally, we also took notes on the respondents' nonverbal cues, such as their posture and facial expressions, which we matched to the transcripts to ensure we captured the participants' true feelings.

Most of the interviews took place in restaurants where the participants were most comfortable; however, some also took place inside firms. The length of the interviews ranged around 17 to 39 min. The overall length of all interviews was 964 min, with an average interview duration of approximately 27.5 min. There were 28 men and 7 women in the sample, and their average years of employment experience in Pakistan was 4.07 years. Of those interviewed, 4 had less than 2 years, 12 had between 2 and 3 years, and the remaining 19 had more than 3 years of employment experience in Pakistan. To protect the anonymity of the respondents, they were classified as either "CMx-type" (for Chinese male respondents) or "CFx-type" (for Chinese female respondents) and "type of expatriates," while x indicates the number of respondents, respectively. Table 1 represents the participants' demographics and provides information about the interviewees and the length of the interviews.

3.5. Interview guide

To get the best answers to the study questions on the experiences of Chinese SIEs and OEs, finding the factors that would affect Chinese expatriates' adaptability was the main goal of the interviews. The difficulties they have as they acclimate to life in Pakistan in general and their difficulties adjusting to interactions with others and their work were highlighted, along

TABLE 1 Participants demographics.

Identity of participants	Previous experience	Time spent in the host country (Years)	Duration of interviews (minutes)	Number of words transcribed
CM1-SIE	No	3	30	2,347
CM2-SIE	No	3.5	25	1718
CM3-SIE	No	1.5	28	2073
CM4-SIE	Yes	2	35	2,432
CM5-SIE	Yes	3	37	2,741
CM6-SIE	Yes	5	34	2,406
CM7-SIE	Yes	3	39	2,724
CM8-SIE	No	2.5	25	2,146
CM9-SIE	No	6	26	2,290
CM10-SIE	Yes	5	24	1,973
CF11-SIE	No	3	28	2,396
CM12-SIE	Yes	5.5	29	2,597
CM13-SIE	No	2	30	2,752
CM14-SIE	No	8	32	2,673
CM15-SIE	No	4	37	3,091
CM16-SIE	No	3	29	2,272
CM17-SIE	Yes	10	27	2,865
CM18-OE	Yes	6	35	3,320
CM19-OE	No	4	21	1,972
CM20-OE	No	7	17	1,702
CM21-OE	No	8	28	2,229
CM22-OE	Yes	3.5	25	2,152
CF23-OE	Yes	5	19	1,890
CM24-OE	No	6	22	2,074
CF25-OE	No	1.5	26	2,218
CM26-OE	No	9	27	2,933
CM27-OE	No	4	29	3,090
CM28-OE	No	3.5	20	1,901
CF29-OE	No	2	19	1,852
CF30-OE	No	4	25	1,985
CF31-OE	Yes	2	20	2,037
CM32-OE	Yes	2	23	1,897
CM33-OE	Yes	3	36	3,075
CF34-OE	No	1	28	2,395
CM35-OE	No	1	29	2,167
Total values	Yes = 13	142.5	964	82,385
	No = 22	Average = 4.07	Average = 27.5	Average = 2353.8

with how CCT for SIEs and OEs might assist in lessening these difficulties.

According to the results of Stage 1 of the interviews, Chinese SIEs and OEs living in Pakistan encounter various problems related to their professional and personal lives. These issues are unique to SIEs and OEs. Thus, the interview's criteria were enhanced. Chinese expatriates were interviewed in Stage 2 to comprehend better CCT's function in SIEs and OEs cross-cultural adjustment. The interviews aimed to gather knowledge about Chinese expatriate interactions. To encourage participants

to offer "substantial insights" rather than only surface observations, questions were designed to create a comfortable environment for replying (Flick, 2009).

Therefore, the semi-structured interview questions revolved around two primary factors. The first section enquires participants' experiences of difficulties with "general adjustment, interaction adjustment, and work adjustment elements" (e.g., what kinds of difficulties/problems were encountered). The assistance given to address these difficulties is contained in the second section, i.e., cross-cultural training (CCT). Concerning CCA, the questions focused on what the Chinese expatriates perceived as the most challenging cross-cultural practices to engage in and how successfully they transitioned, intellectually and psychosocially, to working and living abroad (Black et al., 1991). The investigators further inquired whether the company provided CCT to them or whether they self-directed their cross-cultural adjustment.

3.6. Data analysis procedures

This study used "MAXQDA 20" to analyze the data in this investigation, using a five-stage process (Yin, 2015). Qualitative data interpretations included 5 steps: compiling, deconstructing, reassembling, interpreting, and concluding (Rademaker, 2011). In the first step, seeking tangible outcomes for the study requires compiling the data in a usable format. Transcription was required during compiling, during which an investigator has access to the information, when information was gathered *via* interviews or focus groups (Sutton and Austin, 2015). The second phase involves deconstructing data, classifying and generating proper classifications.

Additionally, a coding procedure was used to turn the raw data into relevant information by identifying interconnected themes and concepts (Sutton and Austin, 2015). Information was reassembled in the third stage, whereby codes and categories were given significance, and the development of themes is prioritized (Braun and Clarke, 2006). Using data classified as codes and themes, the researcher must do the fourth phase, generating analytical findings (Rademaker, 2011). Finally, every study will start with a reasonable research issue in the last stage and answer it; it may only have changed significantly over the data analysis procedure (Braun and Clarke, 2012).

Extensive literature research was conducted before the interviews to modify the "Thematic analysis" coding scheme (King, 2004). The final form of the hierarchical coding procedure is shown in Figure 1. This portion examines the structure of multilevel coding. The analysis in each subheading summarizes the findings in each key area, and Flick (2009) "narrative arrays" display the recipient's statements from the interviews (1).

4. Findings

The research findings are covered in two primary sections. The findings were outlined in the first section, which focused on the issues Chinese SIEs and OEs in Pakistan encountered throughout their CCA period, particularly those connected to their general interaction and work adjustment. The efficiency of CCT in assisting Chinese SIEs and OEs with their CCA is discussed in more detail in the second section, which also elaborates on how Chinese expatriates aid in this process (i.e., pre-departure training and informal learning).

4.1. Cross-cultural adjustment of SIEs and OEs in Pakistan

The CCA of SIEs and OEs varies according to their expatriation, as evidenced by their responses to queries about general adjustment, interaction adjustment, and work adjustment in Pakistan. Chinese expatriates have emphasized the following essential components are shown in Figure 1. The developed components created by the Chinese SIEs and OEs are presented in Table 2.

4.1.1. General adjustment elements of SIEs and OEs

The findings show that "cultural taboos" were a vital component of both SIEs and OEs' CCA to Pakistan. For instance, Chinese expatriates were highly cautious about the do's and don'ts when living in a multicultural environment. Whereas they have to be familiar with the culture and religion that Pakistanis follow. The majority of interviewees stated that since culture is such a delicate subject in any nation, they must be highly cautious while discussing Pakistan's culture. Since most Pakistanis are Muslims, numerous activities are forbidden there, and more than 25 responders have noted this. Thus, the indigenous culture should be respected by them.

Before arriving in Pakistan, Chinese expatriates were concerned about issues related to food, health and atmosphere. Nevertheless, the vast number of interviewees made it apparent that they did not worry about these when they were in Pakistan. In addition, the interviewees indicated that, although what they regarded as cultural taboos, the availability of "basic necessities" assisted Chinese expatriates in Pakistan in adjusting more effectively. Islamabad, on the other hand, is a lot more reliable area to live and work in terms of security and availability of basic necessities, so that is where most of them are. Table 2 contains several examples of quotes from Chinese SIEs and OEs.

4.1.2. Interaction adjustment elements of SIEs and OEs

The observations addressing the interaction adjustment of SIEs and OEs revealed that "language obstacles" are the biggest

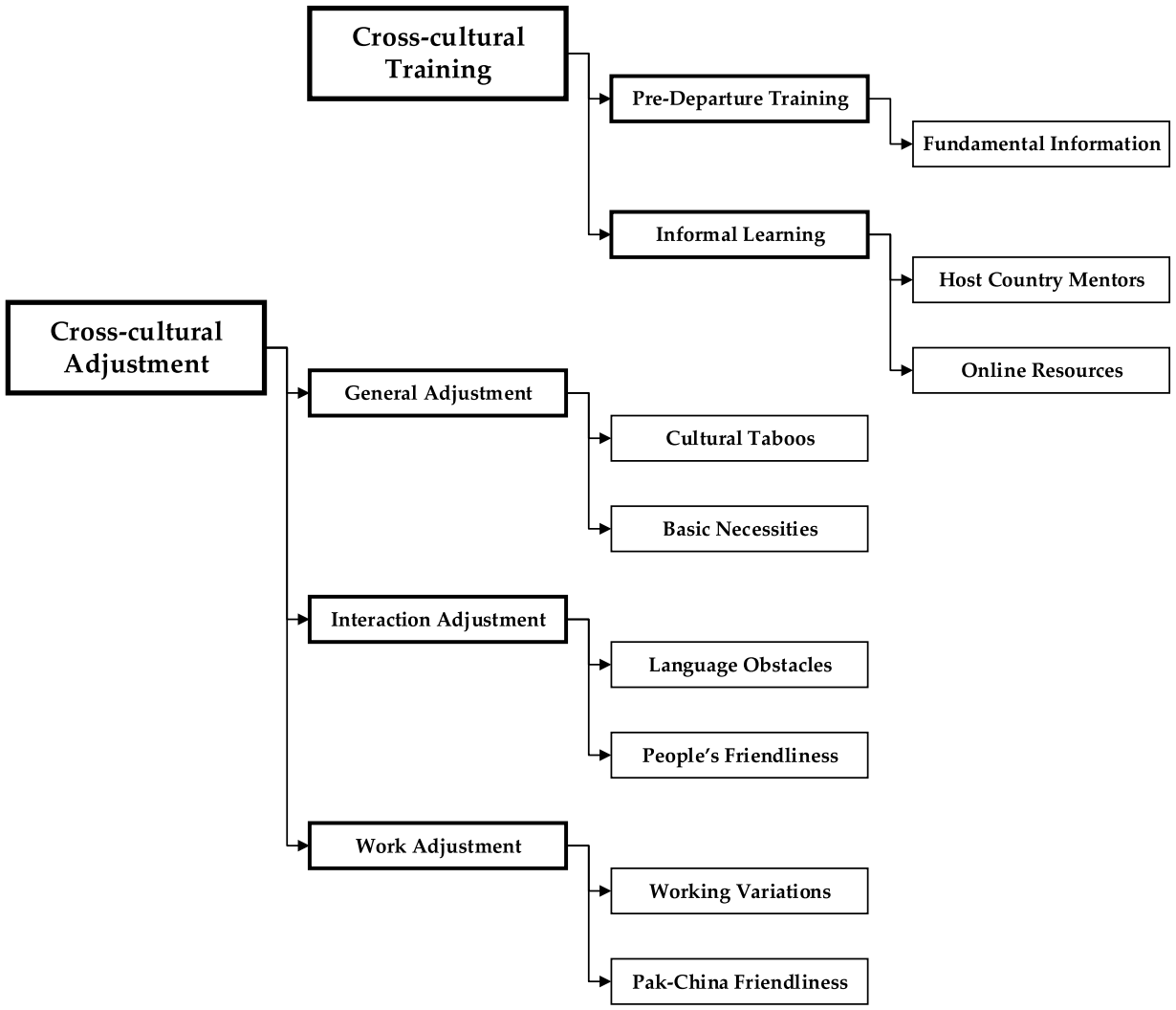

FIGURE 1
Final coding structure.

hurdles when staying in Pakistan. On some level, this element has a more significant impact on the interaction adjustment of OEs than SIEs, as SIEs are more accustomed to interacting with locals and feel more at ease than OEs. However, many responders, both SIEs and OEs, state that language obstacles are the most challenging aspect. Since Urdu is the primary spoken language of the locals, understanding it presents problems for interaction adjustment and hinders their easy integration into Pakistan.

As opposed to this, 28 interviewees emphasized that "people's friendliness" at the workplace and outside was the main element that contributed favorably to improving both SIEs and OEs interaction adjustment. Respondents emphasized that the welcoming nature of the host culture infused their daily lives with renewed vigor. The Chinese expatriates could better integrate into the host society because of the warm welcome they received from the host people living and outside their workplace. One of the best ways to learn about a foreign lifestyle and culture is *via* direct experience and interaction with host people. Table 3 contains several examples of quotes from Chinese SIEs and OEs.

4.1.3. Work adjustment elements of SIEs and OEs

The study's results on SIEs and OEs' work adjustment revealed that "work variations" had a detrimental effect on people's ability to adapt to Pakistan's working environment. These challenges will arise due to the wide variations in cultural customs, beliefs, and morals that characterize the workplaces of people from various backgrounds and cultures. The vast majority of respondents emphasized worries about work variation. Over 20 responders mentioned this difficulty, citing the disparities in business practices and cultural norms are the main reasons. The disparity in working hours between the two nations can be one of the causes. Most interviewees concur that Pakistani professionals

TABLE 2 General adjustment themes and sub-themes.

Themes	Sub-themes	Supporting quotations for each theme
General Adjustment	Cultural taboos	"Chinese people in Pakistan like to eat pork, which is prohibited, but people in this country do not consume pork due to their religious and cultural beliefs." (**CM19-OE**)
		"When we first arrived, people advised us not to shake hands, especially with Chinese females because of their culture men could not shake hands with a female." (**CM15-SIE**)
		"Pakistan is an Islamic state with a distinctive culture; as a result, visitors should exercise caution while interacting with locals. For instance, a friend of mine warned me that women would not appreciate it if I extended my hand to shake." (***CM6*-SIE**)
		"It's important to remember that being a woman in a rural area means wearing the region's traditional garb, which may include a shalwar kameez, a dupatta, and a veil. Big cities pose no such challenges, but tiny towns may treat you differently because of your gender." (***CF*23-OE**)
	Basic necessities	"Islamabad has a pleasant climate (neither too cool nor too warm), and the local cuisine is superb, especially karahi, naan, and BBQ, among many other options." (***CM*4-SIE**)
		"Once I was ill, I visited the hospital, and the doctors there prescribed me some medicines and gave me some good advice; the next day, I felt much better, and the doctors in Pakistan are experts, so I was pleased with the medical care I received." (**CM14-SIE**)
		"When first I arrived in Pakistan, the cuisine and atmosphere of Pakistan were unfamiliar to me, but after 7 years in the country. I am now accustomed to both the food and surroundings." (**CM20-OE**)
		"Currently, Pakistan's government is conducting control and surveillance procedures on the hygiene and food beneath the restaurants, which could improve the hygiene of Pakistani food establishments." (**CF23-OE**)

TABLE 3 Interaction adjustment themes and sub-themes.

Themes	Sub-themes	Supporting quotations for each theme
Interaction adjustment	Language obstacles	"The primary issue is that most of the population speaks Urdu, which Chinese people cannot understand." (***CM*8-SIE**)
		"Many Pakistani locals, including several drivers, are unable to understand English and can only communicate with us by using phrases like "where," making it difficult to go around the city." (***CM*29-OE**)
		"The biggest issue is communication; many locals know English, but many others do not; here, Urdu is widely used, making it difficult for Chinese to understand locals." (***CM*22-OE**)
		"I believe that learning a new language is the hardest part, as the local English is not comparable to that used in various areas of the world, and the accent also differs. However, I believe that after 3 months, all was good, and I can now speak local English with ease." (***CF34*-OE**)
	People's friendliness	"I connect with my Pakistani coworkers and outside with local people, who I truly enjoy engaging. These contacts assist me in my improved transition here in Pakistan, and I acquire a great deal of knowledge from them." (***CM12*-SIE)**
		"Integrating with new people may be challenging in any culture and country, but I found it rather simple in Pakistan since everyone is so warm and welcoming to my fellow Chinese and me." (***CM31*-OE)**
		"We communicate with our coworkers, and they are all delightful. However, when we go out for lunch or dinner, we also engage with locals, who are all quite kind and welcoming." (***CF*34-OE)**
		"When I first arrived in Pakistan's Gilgit area, I could not communicate in English, but locals and individuals from their circles of influence gradually taught me and provided more assistance." (***CM17*-SIE)**

prioritize creating social networks, arriving late to their workplaces, and delaying their duties to complete them on time.

However, "Pak-China friendliness" has been cited as a positive factor by both SIEs and OEs and is significantly influencing the workers' ability to acclimate to life in Pakistan. Additionally, they were passionate in their comments on the friendship between Pakistan and China. Most of them believed that they were in charge of preserving and enhancing this relationship, and they had to tread cautiously in Pakistan to avoid behaving in a way that would harm relations between Pakistan and China. The mutually beneficial relationship between China and Pakistan has facilitated the integration of Chinese SIEs and OEs into Pakistani society and

TABLE 4 Work adjustment themes and sub-themes.

Themes	Sub-themes	Supporting quotations for each theme
Work adjustment	Working variations	"The biggest hurdle is keeping the same work hours as Pakistanis in China. When they leave, we keep working, but we cannot concentrate yet we are alone. This is the obstacle in the workplace, in my opinion." (***CM12*-SIE**)
		"The local employees here do not work effectively, or rather, they work slowly; thus, for me, this is an issue in the workplace." (***CM16*-SIE**)
		"Pakistani people do not intervene with your job if you are in the financial department, but Chinese people work as a group and are very hard-working. I do not want to imply that Pakistani people aren't, but they are relaxed and handle their work differently. So this is the notion of work variation." (***CF*30-OE**)
		"Time management is an issue here; people frequently arrive late for appointments, and when they do show up for meetings, they sometimes claim to be unavailable." (***CM*28-OE**)
	Pak-China Friendliness	"We are great neighbors!! We love one another!! People of Pakistan are very friendly to Chinese people; when they meet with us, they are desirous of taking group photos with us. They offer a cup of tea to us. This is an index of their sincerity with us." (***CM*32-OE**)
		"Pak-China relations are above trades and profits. We are believers and practitioners to do for the best of Pakistan. We want to see a healthier, happier, more prosperous neighboring country. The stronger Pakistan is a matter of immense pleasure for the people and the Republic of China." (**CM24-OE**)
		"I am convinced that Pakistanis are genuine and nice people. Without question, Pakistan is a civilized and economically evolved country." (***CM5*-SIE**)
		"Yeah! We love and respect Pakistan. Brethren country for Chinese. We are good friends just like brothers." (***CM*35-OE**)

encouraged more exposure to Pakistani culture. Table 4 contains several examples of quotes from Chinese SIEs and OEs.

4.2. Cross-cultural training elements

CCT is a set of formally determining actions to educate workers for more genuine social interactions and employment success when they often interact with colleagues from other cultures who work in diverse environments. The world is becoming more globalized; people live and work in different cultural surroundings from their native countries. Thus, CCT seeks to instill confidence in expatriates in their international tasks. Furthermore, this training will enhance their adaptability, understanding, and awareness from many perspectives. The observations are reported in two sections (i.e., pre-departure training and informal learning of SIEs and OEs).

4.2.1. Pre-departure training

Results from pre-departure training shed light on strategies employed by foreign nationals to succeed in their new environment (i.e., basic information). Typically, the company or a training institution provides pre-departure training. This is done to aid in successfully adjusting to working and residing abroad and, most significantly, the host nation's culture. According to the study's outcomes, most Chinese OEs were trained before being assigned to the foreign mission. The respondents who led the pre-departure training expressed that the background knowledge about the host nation assisted them in adjusting to the employment and residential situations and offered suggestions on how to interact or conduct with them. Table 5 contains several examples of quotes from Chinese SIEs and OEs.

4.2.2. Informal learning

Informal learning is becoming increasingly significant in today's technologically advanced, globally interconnected environment, where people may acquire it in various ways. According to the findings, "host country mentors" and "online resources" are effective forms of informal learning. HCNs familiar with the host country's lifestyle and culture, also known as the "host country mentor" can aid expatriates in adjusting. A majority of participants said that for expatriates, interactions with HCNs in the workplace and in daily life are an unavoidable part of their missions abroad. These interactions provide us with knowledge about their working and non-working atmosphere. There are several methods employed for informal learning. Most interviewees thought that they used the internet as a platform to know more about Pakistan and its culture. Yet, in the modern world, internet technology is a popular method that most individuals utilize to stay informed about what is going on around the globe. Table 5 contains several examples of quotes from Chinese SIEs and OEs.

5. Discussion

This study looked at their distinctions to understand how SIEs and OEs adjust to Pakistan's culture. Furthermore, the study is concerned with determining the amount of CCT that will facilitate Chinese SIEs and OEs.

TABLE 5 Cross-cultural training themes and sub-themes.

Themes	Sub-themes	Supporting quotations for each theme
Pre-departure training	Fundamental information	"I came from a huge company, so there was a complete training package before we arrived here. In this training, different sessions were delivered to us, which taught us to respect the host culture and respect people over there." (***CM19*-OE**)
		"Whenever we travel to any foreign nation, it is a form of training. Usually, the firm in China would handle this for us, and the main crucial aspect of the training is specifically to embrace the culture; even if you do not know it, you must accept it, so I believe that's helpful." (***CM*30-OE**)
		"We undergo one week of instruction in China because China and Pakistan have distinct cultural traditions because most individuals are Muslims in Pakistan. We must know more about Muslim and Pakistani culture as we have not previously interacted with Muslim friends and families." (***CM*26-OE**)
Informal learning	Host country mentors	"To better understand Pakistani culture and way of life, I have relied on what my coworkers have taught me about Pakistani history, religion, customs, and festivals since being here." (***CM*24-OE**)
		"I learn much about other people's religions and customs from my friends, and my coworkers always have interesting discussions about these topics during tea break." (***CM*13-SIE**)
		"As you are aware, the Pakistani business is unique; thus, a few of our workers have much knowledge; they offer us recommendations and advise on how to operate the Pakistani business, which aids us in adjusting to Pakistan." (***CM*3-SIE**)
		"When I came here, the local distributor assigned two individuals to assist me. I learned a lot from them, especially about the way of life and the culture. I also attended several Pakistani weddings and am fond of Pakistani wedding culture." (***CF*25-OE**)
	Online resources	"I did not go through any cross-cultural training, but I've gained so much knowledge about Pakistan thanks to the internet, which is the sole reliable source of information about the country." (***CM16*-SIE**)
		"I did not attend such orientation or cross-cultural training before traveling to Pakistan; instead, I conducted my online research." (***CM*1-SIE**)
		"I am familiar with Pakistan and the locals, and before arriving, I conducted my independent online research and did not get any training." (**CM6-SIE**)
		"To learn about Pakistani culture while moving here, I did some online research and engaged in several social media sites. This has been quite helpful." (**CM10-SIE**)

This approach is validated by the literature and contributes to it by developing a step-by-step method for comprehending the CCA of Chinese SIEs and OEs. Literature indicates that expatriates experience a variety of obstacles during their transition to the host country (Zhang and Guttormsen, 2016; Nadeem and Mumtaz, 2018; Noman et al., 2020). The most challenging adjustment issues for Chinese expatriates in Pakistan were cultural taboos referring to general adjustment and language obstacles in interaction adjustment. Finally, work variations are linked with work adjustment. Despite this, they managed to adapt effectively due to various circumstances, such as the availability of basic necessities, the peoples' friendliness and the friendly relations between Pakistan and China, which benefited both Chinese SIEs and OEs in Pakistan.

By examining the causes of variations in expatriate experiences across OEs and SIEs, this study goes above direct correlations and significantly adds to the body of knowledge. Even though OEs and SIEs have significant disparities from one another (Peltokorpi and Jintae Froese, 2009; Biemann and Andresen, 2010; Doherty et al., 2011), prior studies have not clarified why these variations in expatriate experiences exist between SIEs and OEs. According to the current research, SIEs have stronger interaction adjustment because of higher host language ability and a brotherly Pak-China relationship. The findings suggest that SIEs are well acclimated to interaction and general adjustment than OEs, maybe because they frequently interact with locals and stay in the local area. Peltokorpi (2008) asserts that working in a local setting gives SIEs opportunities to engage with locals, allowing them to pick up and adapt corresponding interactional habits. Conversely, OEs could view their overseas posting as a crucial phase in their employment and their interactions with Pakistanis outside of work less significant. OEs may be more likely to contact other expatriates throughout their predetermined duration of expatriation in Pakistan.

Like other studies (Suutari and Brewster, 2000; Jokinen et al., 2008), the results reveal that work characteristics vary. In other words, OEs usually hold senior roles and operate in overseas companies more often. This may partially be due to the frequent dispatch of OEs to manage and transmit information to overseas companies (Edström and Galbraith, 1977). Our results support earlier research (Peltokorpi and Jintae Froese, 2009; Biemann and Andresen, 2010; Froese and Peltokorpi, 2011), which found that

SIEs exhibit more significant levels of interaction and general adjustment but lower overwhelmingly favorable work sentiments, particularly in terms of work happiness, than OEs.

The second objective of this study is to improve the CCA of Chinese SIEs and OEs in the host nation. The literature indicates that CCT is a valuable strategy for supporting expatriates' CCA. Additionally, our research demonstrates that CCT makes expatriates seem more relevant while working abroad (Caligiuri et al., 2005; Noman et al., 2020). This research focuses on the two approaches that expatriates learn about and get familiar with the host nation (i.e., pre-departure training and informal learning). Firms or professional institutions often give pre-departure training; thus, we deduce that this mode of learning is formal, which firms deliver before the departure of expatriates (Tissot, 2008). The findings reveal that Chinese expatriates who received pre-departure training settled well in Pakistan (see Table 5). Previous research has also proven that this first cross-cultural training gives fundamental knowledge of the host nation, which is required for expatriates' initial training on arriving at their planned destination. For example, these training strategies may assist expatriates in learning about cultural beliefs and norms, the country's corporate procedures, dressing conventions, vital rituals, and primary language understanding (Avril and Magnini, 2007).

However, the study also emphasizes how expatriates acquire informally. These informal teaching strategies examined in this study are typically organized by expatriates individually. The findings on informal learning revealed that Chinese expatriates adopt informal learning methods both before and after their entrance to Pakistan (i.e., host country mentors and online resources). The results suggest that the guidance offered by host country mentors assists expatriates in adjusting to their new environment. Moreover, expatriates might benefit more from mentor support networks in their host nation. The findings show that expatriates receive information from their host country mentors about their way of life, culture, and business practices for their simple integration into the host nation. Furthermore, Bear (2008) study shows that in the digital era, most expatriates nowadays acquire crucial information about their host location through informal learning utilizing online technology (i.e., Google, Youtube, Facebook, Whatsapp, Webchat, e-mail, and blogs).

6. Conclusion, practical implications, and limitations of the study

6.1. Conclusion

The current study centered on the qualitative data analysis of 35 Chinese expatriates in Pakistan, with the sample consisting of 17 SIEs and 18 OEs. To build a thorough knowledge of the CCA process of expatriates, the variations between SIEs and OEs' CCA, and the moderating impact of CCT in helping expatriates in CCA. This research adds to our knowledge and comprehension of the variations in CCA between SIEs and OEs. Despite the demographics and cultural backgrounds of SIEs and OEs being quite similar, SIEs have more excellent local knowledge, and OEs operate in a more organizational atmosphere. We contributed to the literature by explaining why expatriate results vary between SIEs and OEs. The results imply that SIEs have better general and interaction adjustment than OEs. In addition, OEs are more successful in work adaptation. However, Chinese companies are increasingly expanding their operations outside of Asia and Africa. Therefore, we recommend that companies create various CCT programs depending on the various sorts of expatriates before and after arriving in the host country. We anticipate that CCT will benefit expatriation as well as the overall organization. The CCT will ease the adjustment process of expatriates and give them a basic grasp of the culture of their new home. Language proficiency is also necessary for expatriates to understand the culture of their new home. To ensure the performance of their foreign mission, companies may provide language training and engage both SIEs and OEs, regardless of the location of the training.

6.2. Practical implications

There are several practical implications in this study. First, the ability to think and act in ways that are appropriate in other cultures is essential for thriving in a new environment. Expatriate employees would benefit more from their overseas missions if they received language and cultural training prior to leaving for the host country. This is because such training helps participant's better grasp the customs and norms of the host culture and its inhabitants (Caligiuri et al., 2001; Selmer, 2009; Selmer and Lauring, 2015; Liu et al., 2018). Second, interpersonal interactions involving expatriates and host peoples enable expatriates to strengthen their bonds with them; as a result, hosting firms must propose numerous efforts to boost interaction between expatriates and HCNs. The effort might include teaching local workers some basic Chinese and the Chinese workers some basic Urdu. This will assist in reducing the interaction gap between local and Chinese workers. Third, firms should engage host peoples to facilitate the expatriates' social transition *via* promotinging social ties. For instance, by bringing close family members to organizational activities, Chinese expatriates and local employees might establish a feeling of a friendly atmosphere. Finally, this will aid in developing cultural awareness and reducing adjustment issues in the host environment.

6.3. Limitations and future research directions

This section elaborates on this study's limitations and future research directions. First, our study employs qualitative methodologies, with data gathered through semi-structured interviews with top-level Chinese SIEs and OEs operating in

Pakistan. We concentrated on Chinese workers who speak English, making it easier to understand that their difficulties and adaptation differed depending on their encounters. Future researchers may investigate non-English speaking Chinese expatriates, e.g., by analyzing their adaptation process and identifying their obstacles with those of English-speaking Chinese expatriates. Our focus on top-level expatriates aided in the development of an extensive understanding of their adjustment; however, the adjustment of expatriates working at various levels and in different roles varies. As a result, future research will perform an investigation that takes into account many levels, such as defining the process of adaptation and acknowledging that the problems of adaptation vary depending on the management levels.

Second, the research methodology centered on Chinese expatriates working in Pakistan in managerial positions and encouraged participants to express their own experiences and thoughts. Due to their heavy workload, time constraints, and security issues, some respondents could not share important information regarding their encounters. This shortcoming was addressed by conducting more interviews and analyzing unstructured memoranda in the mix of collected data. Therefore, it is suggested that future studies incorporate expatriates and their coworkers in a research design to verify results with another person the respondents dealt with daily. Additionally, if access can be gained, combining several qualitative methodologies, such as observations and interviews, may help investigators better understand the causes and the adaptation mechanism.

Third, the Chinese expatriates who participated in this study came from various regions of China. Most came from big cities, while others were from small areas. In addition, some resided nearer to the Pakistan-China border. These distinctions may have had a distinct effect on respondents' exposure and information level. Although this study did include several features, location-based impacts were not analyzed since no information was gathered regarding the city in which each expatriate resides. It is advised that future studies consider those location-based variances to further their comprehension of how expatriates adapt to their new environment. Fourth, almost all other studies of expatriates, including this one, only gathered data once. In order to offer more convincing evidence of correlation and to effectively comprehend the temporally dependent procedure of CCA, longitudinal data would be beneficial. Finally, research has shown a strong correlation between CCT and expatriates' adjustment, even though there are limited Chinese SIEs and OEs. Therefore, quantitative approaches may use in future studies to examine the findings of this research.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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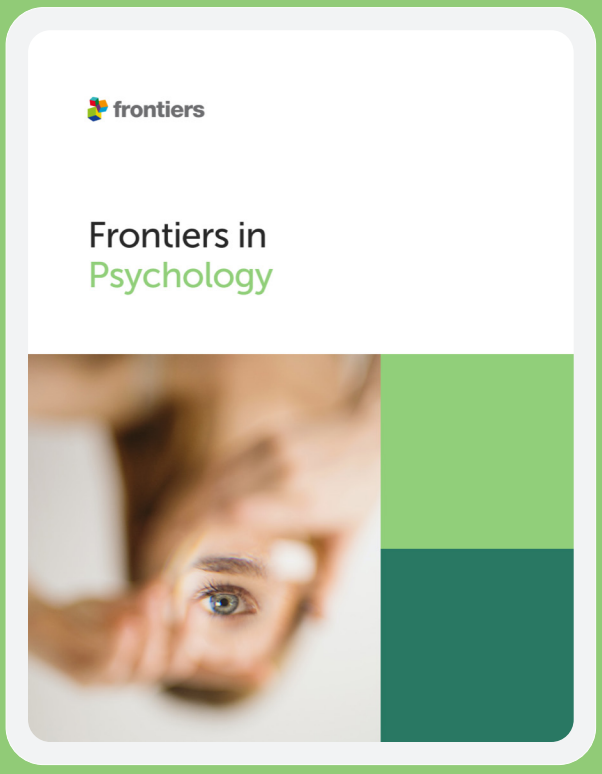

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