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Association between autonomy support, academic motivation, and life skills in pre-service physical education teachers and pre-service sport coaches

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This study aimed to analyze the relationships between the perception of the autonomy-support style created by the professor, the global academic intrinsic motivation and its three subtypes (to know, toward accomplishments, and to experience stimulation), and the life skills of future physical education (PE) teachers and sports coaches. The participants were 583 students (M_{age} = 20.77 years, *SD* = 2.94; 65% were men) belonging to a higher education program specialized in the training of PE teachers and sports coaches in Mexico. The results of the structural equation models showed that the perception of the autonomy-support style adopted by the professors was positively and significantly related to global academic intrinsic motivation and its three subtypes, and these were positively and significantly associated with each life skill. The mediation analyses confirmed the mediating role of global academic intrinsic motivation and subtypes between the perception of the autonomy-support style adopted by the professors and the student's life skills. In conclusion, to promote the development of life skills in future PE teachers and sport coaches, it will not only be enough for their teachers to generate positive environments of autonomy-supportive styles, but they must also have intrinsic reasons to enhance these skills.

KEYWORDS

intrinsic motivation, motivation to know, motivation toward accomplishment, motivation to experience stimulation, self-determination theory

1 Introduction

The training processes of future PE teachers and sport coaches have been relevant not only to have competent professionals but also to achieve multiple psychological and motor benefits for their future students or athletes (Lander et al., 2015; Pulido et al., 2016). Several studies have shown that when pre-service PE teachers are more and better motivated, they perceive a greater academic engagement (López-García et al., 2023) and can suffer less reality shock (i.e., discrepancies between what they learned and the teaching reality) during their first years of professional teaching (Kim and Cho, 2014).

In educational contexts, motivation has been addressed from different approaches (Cook and Artino, 2016). One of the most used for its study is the Self-Determination Theory (SDT; Ryan and Deci, 2017), which postulates that motivation varies not only in quantity but also in quality, proposing a *continuum* that goes from the most self-determined (intrinsic motivation,

i.e., when a behavior occurs only for enjoyment and satisfaction) to the less self-determined (extrinsic motivation, i.e., when an external factor drives behavior), and ending in the absence of motivation (amotivation; Ryan and Deci, 2020). Studies performed under this theory have found that higher-quality motivation is related to greater academic success and student wellbeing (Howard et al., 2021).

The evidence obtained from research in higher education settings has shown that motivated students intrinsically have better cognitive, behavioral, and affective results (for a review, see Orsini et al., 2016) and Vallerand et al. (1992), based on the SDT, have classified intrinsic academic motivation into three subtypes: (1) *intrinsic motivation to know*, which refers to the pleasure and satisfaction derived from learning new things or discovering new ideas. Students with this subtype of motivation enjoy the process of acquiring knowledge; (2) *intrinsic motivation toward accomplishment*, which implies the pleasure experienced when trying to achieve or overcome a personal goal or academic challenge. Students with this subtype of motivation enjoy the effort invested in achieving a competence or skill, and (3) *intrinsic motivation to experience stimulation*, that is, when the pleasure comes from stimulating and positive sensations that are generated by performing academic activities. Students who have this motivation seek to experience pleasurable sensations through their participation in academic tasks. These three subtypes of motivation are related with higher academic achievement (Islam and Chakrabarty, 2020) and lower academic procrastination (Tisocco and Fernández Liporace, 2023). In turn, with the increased digitization of higher education academic programs as a consequence of the COVID-19 pandemic (Leal Filho et al., 2023), the three subtypes of academic intrinsic motivation have also been found to play an important role in preventing student anxiety and depression (Vallone et al., 2023).

In addition, from SDT, various interpersonal styles that teachers or coaches may adopt when interacting with their students or athletes have been posited, ranging from autonomy support and structure to control and chaos (Aelterman et al., 2019; Cheon et al., 2020). These styles can be contextualized to various educational settings such as youth sport (Cronin et al., 2022), PE (Diloy-Peña et al., 2024), or teacher education (Moreno-Murcia et al., 2019). Likewise, the literature has proven the relationship between the perception of the autonomy-support style (i.e., when teachers adopt the perspective of their students, vitalize internal motivational resources in activities, provide explanations and arguments, avoid oppressive language, recognize and accept negative affect, and show patience; Reeve, 2016) and intrinsic motivation in their students (Hornstra et al., 2018), so this study, is focused on analyzing this motivational interpersonal style. Despite the benefits in multiple areas that better quality motivation can generate (see Orsini et al., 2016; Howard et al., 2021), recent works (e.g., Cronin et al., 2020; Cronin et al., 2021; Vergara-Torres et al., 2022) have pointed out the importance of developing different life skills at school and university ages, which can be considered those particular skills that, once learned and used satisfactorily, can lead to the development of the desired competencies (Goudas, 2010). The development of these skills is not only relevant for physical and mental wellbeing (Nasheeda et al., 2019), but also for successful insertion into the workforce (Tushar and Sooraksa, 2023).

Research on life skills such as teamwork, goal setting, time management, emotional skills, interpersonal communication, social skills, leadership, decision-making and problem-solving has focused on areas of youth sport (Nascimento et al., 2021; Cronin et al., 2022; Freire et al., 2023), PE (Cronin et al., 2019; Cronin et al., 2020) and higher education (Ortiz-Rodríguez et al., 2024) finding that the autonomy-support style adopted by the professors, teachers and sport coaches is related to the satisfaction of the basic psychological needs of their athletes and students, and that these, in turn, play a mediating role in the development of life skills (Cronin et al., 2019; Cronin et al., 2022; Freire et al., 2023; Ortiz-Rodríguez et al., 2024).

Studies conducted in higher education settings have demonstrated that the perception of autonomy support as an instructional behavior is associated with higher levels of perceived autonomy (Großmann et al., 2023), intrinsic motivation (Chan et al., 2023) and satisfaction of basic psychological needs (Ortiz-Rodríguez et al., 2024). Other studies have found that variables such as self-leadership (Park and Kim, 2017) or exposure to teaching strategies based on problem-solving (Roh and Kim, 2015) are associated with motivation and some life skills such as communication, leadership, and problem-solving. Nevertheless, these works that have associated motivation and life skills have focused on other theoretical approximations of motivation and not on intrinsic motivation and its adaptation in academic settings supported by the SDT, which has demonstrated multiple benefits (see Orsini et al., 2016; Howard et al., 2021; Okada, 2021). In this sense, the evidence on autonomy support and the development of life skills is focused on basic psychological needs as a mediating mechanism and has been studied in contexts of PE, youth sports and higher education. Likewise, the relationship between autonomy support and autonomous motivation has been recently analyzed in Mexican PE teacher training environments (Espinoza-Gutiérrez et al., 2024), but the development of life skills and the mechanisms of academic intrinsic motivation that could be related to the development of these skills are not studied.

Given this, little is known about intrinsic motivation as a mediating mechanism between autonomy support style and life skills development. Studies carried out in this regard have focused on students or pre-service teachers of other disciplines (e.g., Roh and Kim, 2015; Park and Kim, 2017; Chan et al., 2023) but not on future PE teachers and sports coaches, while the studies developed with these populations have focused on the analysis of basic psychological needs (Ortiz-Rodríguez et al., 2024) or do not incorporate life skills (Espinoza-Gutiérrez et al., 2024). Therefore, considering that differences in intrinsic motivation have been found as a function of the type of higher education (López-García et al., 2024), and the gaps in the literature on the mediating role of academic intrinsic motivation between autonomy support and life skills, as well as the impact that physical activity education professionals have on quality motivation as a determinant of physical activity practice (Raabe et al., 2019), the purpose of this study was to analyze the relationship between the perception of the autonomy support style adopted by the professors, the global academic intrinsic motivation and its subtypes, and life skills in future PE teachers and sports coaches.

Furthermore, building on what has been presented up to this point and on the existing evidence of the relationships between autonomy support and intrinsic (Chan et al., 2023) and autonomous motivation (Espinoza-Gutiérrez et al., 2024), and satisfaction with basic psychological, as well as the latter with life skills (Cronin et al., 2019; Cronin et al., 2022; Freire et al., 2023; Ortiz-Rodríguez et al., 2024), the following hypotheses are proposed:

H1: Autonomy support will be positively related to intrinsic academic motivation both globally and in each of its subtypes

(motivation to know, motivation toward accomplishment and motivation to experience stimulation).

H2: Intrinsic academic motivation, both globally and in each of its subtypes, will be positively related to life skills.

H3: Intrinsic academic motivation, both globally and in each of its subtypes, will mediate the relationship between autonomy support and life skills.

2 Methods

2.1 Study design, participants and sample size

This non-experimental, cross-sectional, correlational study (Weathington et al., 2010) used a randomized clustered sampling design, considering the groups established in the school where the study took place. Five hundred and eighty-three students (M_{age} = 20.77 years, SD = 2.94; 379 men and 204 women) belonging to 21 groups from the first to seventh semester of a higher education program specializing in training PE teachers and sports coaches in a public university in the state of Nuevo Leon, Mexico participated. In this program, students take an average of seven subjects per semester, and at the time of data collection, they received a mean of 6.33 h/class (SD = 0.77) per school day. The participants came from middle-class families, and all lived in one of the municipalities in the metropolitan area of Monterrey, Mexico.

Regarding the statistical power analysis, based on sample size and power calculations for multiple regression with a low effect size (f^2 = 0.05), a maximum number of two predictors, and an alpha level of 0.05, a sample size of 218 would be required to achieve a statistical power of 0.80 (Faul et al., 2009). Therefore, with 583 subjects, this sample is larger than that required to achieve an adequate level of statistical power.

2.2 Procedure

Before data collection, the study was registered in the Dirección de Investigación of the Facultad de Organización Deportiva (REPRIN-FOD-81). In addition, authorizations were obtained from the director of the faculty where the research took place both to carry out the data collection and to obtain access to the faculty's computer room. A previously trained interviewer went, within a normal school day, to the classrooms of each group to invite them to participate in the study. Those students who agreed to participate were summoned, together with their classmates from the same group, to the faculty computer room at a time within their school day that did not interfere with any of their classes, which allowed their teachers to be absent. In the computer room, the interviewer explained the purpose of the study, the principle of voluntary participation, the confidential treatment of data, its scientific use, and the importance of providing honest answers. The interviewer also pointed out the nonexistence of physical, psychological, and academic risks associated with participating in the study. In addition, if they felt discomfort when completing the questionnaires, they could abandon the process and their participation in the research. As a last indication, before collecting the data, the interviewer informed that the questionnaires would be answered through an Internet platform. As a first step before responding, informed consent would be displayed. This process was carried out with each of the 21 groups that participated in the research. All participants were of legal age and consented to continue the study.

The questionnaires were captured on the Google Forms® platform, and the *"mandatory response"* option was used for all responses, so there was no missing data. The data collection process was carried out during the semester from August–December 2023, and the entire process lasted approximately 30 min per group, in which the interviewer was present to clarify any questions from the participants. To guarantee the secure handling and privacy of the information collected, the researcher in charge of data collection and analysis was in charge of safeguarding the database and only the authors had access to it for analysis and interpretation; in addition, the database was password-protected and personal data that would lead to the identity of the participants were recorded in the final database. The ethical protocols outlined by the American Psychological Association (APA) and the Declaration of Helsinki were followed throughout the procedure.

2.3 Measurements

The perception of the autonomy-support style adopted by the professors was evaluated with the Autonomy Support Scale in Higher Education (Moreno-Murcia et al., 2019). The scale consists of 12 items with a Likert-type response from 1 (*"Strongly disagree"*) to 5 (*"Strongly agree"*). The items were preceded by the heading: *"In my classes, my teachers…"* and one example of an item is "*Explain why it is important to carry out the activity.*" Recently, the validation of the Interpersonal Teaching Style in Higher Education (ITSHE; Espinoza-Gutiérrez et al., 2024) instrument has been published, which represented a more contextualized option for the measurement of perceived autonomy support; however, this instrument had not been published at the time of data collection for this study, so, based on previous research (e.g., Lozano-Jiménez et al., 2021; Ortiz-Rodríguez et al., 2024) that has found good psychometric performance, the scale proposed by Moreno-Murcia et al. (2019) was employed.

Academic intrinsic motivation was measured using the Spanish version of the Academic Motivation Scale adapted for university students (Nuñez Alonso et al., 2005). This instrument has 28 items distributed in seven factors with four items each (intrinsic motivation to know, intrinsic motivation toward accomplishment, intrinsic motivation toward experience stimulation, identified regulation, introjected regulation, external regulation, and amotivation). Only 12 items were used for this study, corresponding with three intrinsic motivation subscales. A Likert-type response is used where 1 represents *"Does not correspond at all"* and 7 *"Completely corresponds"* Before displaying the items, they are preceded by the heading: "*Why do you come to this school?*" One example of the item (of the intrinsic motivation to know subscale) is: *"For the satisfaction of discovering new things unknown to me."* To guarantee the semantic equivalence and cultural adaptation of the items to a Mexican setting, a panel of experts of specialists in higher-level teaching (n = 2), psychologists (n = 2), and linguists (n = 1) was consulted. All had previous experience in instrument validation and scientific publication. After the experts' recommendations, the term *"pleasure"* in several items of the original Spanish scale was changed to "*satisfaction*," which is more

in line with the Mexican context. Other studies that have adapted the instrument to Latin American settings (Stover et al., 2012) have found adequate psychometric properties in the three subscales used for this work. The adequate internal consistency (see Table 1) and factorial structure of this scale (see Table 2) showed that the adjustments made to the questionnaire did not affect its validity and reliability.

The Life Skills Scale for higher education students (Cronin et al., 2021) in its Mexican Spanish version (Vergara-Torres et al., 2022) was used to evaluate life skills. This instrument consists of 43 items distributed in eight dimensions which measure life skills (seven items for Teamwork, seven items for Goal setting, four items for Time management, four items for Emotional skills, four items for Interpersonal communication, five items for Social skills, eight items for Leadership, and four items for Problem-solving and decision making). The scale has a Likert-type response from 1 (*"Strongly disagree"*) to 5 (*"Strongly agree"*). Before displaying the items, this heading is shown: *"In my classes I can…,"* and an example of an item (from the Goal setting dimension) is: *"establish short-term goals to achieve long-term goals."* Recent work in Mexico (Vergara-Torres et al., 2022; Ortiz-Rodríguez et al., 2024) has demonstrated the adequate psychometric function of the scale.

2.4 Risk of bias

To control for potential sources of bias associated with various elements of this study, the following strategies were employed:

Randomization bias. The academic program in which the participants were enrolled consists of nine semesters, and the sample was made up only of subjects from the first seven semesters because, in the eighth and ninth semesters, students carry out professional internships and *social service* activities outside the school and are not subject to classroom classes in the same way as their counterparts in the first seven semesters. To ensure the representativeness and proportional assignment of groups, and taking into account that on average, the academic program consisted of five groups per semester, three groups were randomly selected per semester, obtaining the final sample of 21 groups out of the 35 that made up the program.

Blinding bias among participants and use of questionnaires. In an attempt to reduce this bias, the study hypotheses were not revealed to the participants when communicating the objectives of the study. Likewise, anonymity and confidential treatment of the information provided was guaranteed. In addition, it has been found that the use of self-reported questionnaires can lead to biases related to social desirability (Bernardi and Nash, 2022). Therefore, to reduce this bias,

TABLE 1 Descriptive statistics of internal consistency and variable correlation.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Autonomy support	–	0.28	0.25	0.27	0.27	0.39	0.34	0.24	0.27	0.31	0.26	0.30	0.26
2. Global academic IM		–	0.93	0.94	0.90	0.59	0.63	0.52	0.46	0.60	0.56	0.61	0.63
3. IM to know			–	0.82	0.73	0.55	0.58	0.51	0.43	0.56	0.53	0.57	0.57
4. IM toward accomplishment				–	0.85	0.56	0.60	0.47	0.43	0.56	0.51	0.57	0.59
5. IM to experience stimulation					–	0.58	0.60	0.47	0.44	0.57	0.53	0.58	0.59
6. Teamwork						–	0.69	0.50	0.52	0.64	0.62	0.68	0.60
7. Goal setting							–	0.59	0.58	0.64	0.56	0.67	0.66
8. Time management								–	0.57	0.56	0.46	0.52	0.56
9. Emotional skills									–	0.65	0.54	0.57	0.58
10. Communication										–	0.70	0.71	0.66
11. Social skills											–	0.71	0.60
12. Leadership												–	0.76
13. Problem solving													–
Mean	3.79	6.03	5.84	6.11	6.14	4.31	4.23	3.84	4.06	4.14	4.07	4.19	4.15
Standard deviation	0.99	1.12	1.24	1.17	1.14	0.81	0.83	0.99	0.89	0.83	0.86	0.79	0.82
Skewness	−1.11	−2.21	−1.62	−2.19	−2.33	−1.88	−1.54	−0.84	−1.06	−1.29	−1.07	−1.24	−1.20
Kurtosis	0.62	6.62	3.52	6.02	6.89	4.74	3.16	0.48	1.22	2.46	1.34	2.36	2.20
Cronbach's alpha (α)	0.95	0.97	0.92	0.94	0.95	0.96	0.96	0.94	0.89	0.89	0.89	0.95	0.93
McDonald's omega (ω)	0.95	0.97	0.92	0.94	0.95	0.96	0.96	0.94	0.90	0.89	0.89	0.95	0.93

IM, Intrinsic motivation; Communication, Interpersonal communication; Problem-solving, Problem-solving and decision-making. All correlations are significant at a p-value < 0.01.

TABLE 2 Fit indices of the confirmatory factor models.

Variable	χ^2	*df*	*p*	CFI	TLI	RMSEA (90% CI)
Autonomy support	601.15	54	0.000	0.97	0.96	0.131 (0.122, 0.141)
Academic IM one-factor model	823.72	54	0.000	0.98	0.97	0.156 (0.146, 0.165)
Academic IM three-factor model	469.40	51	0.000	0.99	0.98	0.118 (0.108, 0.128)
Life skills eight-factor model	2269.20	832	0.000	0.97	0.97	0.054 (0.051, 0.057)

CFI, Comparative fit index; TLI, Tucker-Lewis index; RMSEA, Root-mean-square-error of approximation.

and following the aforementioned indications, emphasis was placed on the non-existence of correct and incorrect answers and the importance of sincerity in the responses.

Bias associated with the honeymoon-hangover effect. An attempt was made to control this bias by collecting the data a month and a half before the end of the semester, thus providing enough time for the students to have sufficient interaction with their professors and, therefore, a clearer perception of the degree of support for autonomy shown in the classes.

Bias associated with the researcher. To prevent researchers from voluntarily or involuntarily influencing participants' responses, only the previously trained interviewer interacted with participants during the data collection process.

2.5 Statistical methods

The information was organized in a database in SPSS software version 25, in which descriptive analyses (central tendency, dispersion, and distribution) were carried out; internal consistency was assessed with the coefficients Cronbach's Alpha (α) and McDonald's Omega (ω; the latter was estimated using the OMEGA macro for SPSS; see Hayes and Coutts, 2020). Correlations were determined with Spearman's coefficient. The −1, 1 criterion was used in the skewness and kurtosis values in each item that made up the scales to determine the type of data distribution (Muthén and Kaplan, 1992; Ferrando and Anguiano-Carrasco, 2010). Confirmatory factor analyses were performed to test the adequate factor structure of the instruments, while structural equation modeling and indirect effects analysis were used to test the relationships between variables. Structural equation modeling was used because it allows testing complex relationships between latent variables, comparing models and measuring their overall fit (Kline, 2023). These analyses were carried out with Mplus 8 software, using Weighted Least Square Mean and Variance (WLSMV) as an estimation method. This method has been suggested for ordinal variables and makes no distinction in compliance with the assumption of data normality (Li, 2016). The following goodness-of-fit indices were considered for testing the fit of the confirmatory factorial and structural equation models: the Chi-square statistic (χ^2), the degree of freedom (*df*), the Comparative Fit Index (CFI; values >0.90), the Tucker-Lewis Index (TLI; values >0.90), and the Root-Mean-Square-Error of Approximation (RMSEA; values <0.08). The cutoff points of the adjustment indices were considered according to Kline (2023).

On the other hand, indirect effects analysis has been suggested to determine the existence of a mediation relationship, and in these, the indirect effects involved in the model are calculated with the bias-corrected (BC) bootstrap confidence interval method (MacKinnon et al., 2004; Williams and MacKinnon, 2008). This study, which aims to explore the relationships between the perception of the autonomy-support style adopted by the professors, global academic intrinsic motivation and its subtypes, and the eight life skills of future PE teachers and sports coaches, identified 32 indirect effects.

Indirect effects were calculated considering the following: as a predictor variable, the perception of the autonomy-support style adopted by the professors; as a consequent variable, the eight life skills of future PE teachers and sports coaches; and as mediating variables, global academic intrinsic motivation (eight indirect effects), intrinsic motivation to know (eight indirect effects), intrinsic motivation toward accomplishment (eight indirect effects), and intrinsic motivation toward experience stimulation (eight indirect effects).

3 Results

3.1 Descriptive results

Table 1 presents the descriptive results, internal consistency, and the correlation between study variables. Regarding variable means, in scales and subscales with a score range of 1–5, except autonomy support ($M = 3.79$) and time management ($M = 3.84$), all presented values above four, while academic intrinsic motivation with a score range from 1 to 7, global academic intrinsic motivation and intrinsic motivation toward accomplishment and experience stimulation scored above six. Only intrinsic motivation to know scored below that value ($M = 5.84$).

Regarding the internal consistency of each scale and subscale, all had satisfactory scores with coefficients over 0.70 for Cronbach's alpha and 0.65 for McDonald's omega (Kalkbrenner, 2023). In addition, skewness and kurtosis coefficients were obtained for each of the 13 factors that compose the study variables, as well as 67 items that in total form the scales used; of these, 12 factors (92.3%) and 50 items (74.6%) were outside the range of −1 to 1, so the absence of a normal distribution was assumed (Muthén and Kaplan, 1992; Ferrando and Anguiano-Carrasco, 2010), while the lack of high standard deviations determined the absence of atypical values. The correlations between variables were obtained using Spearman's *rho*. All were positive and significant ($p < 0.01$).

3.2 Confirmatory factor analysis

Confirmatory factor analysis was performed to determine the factorial validity of the instruments used. Given the purposes of the study and the nature of the variables analyzed, autonomy support was

TABLE 3 Fit indices of the structural equation analyses for each model.

Model	χ^2	*df*	*p*	CFI	TLI	RMSEA (90% CI)
Model A	4482.63	2,107	0.000	0.96	0.96	0.044 (0.042, 0.046)
Model B	3547.67	1,615	0.000	0.97	0.96	0.045 (0.043, 0.047)
Model C	3347.09	1,615	0.000	0.97	0.97	0.043 (0.041, 0.045)
Model D	3332.61	1,615	0.000	0.97	0.97	0.042 (0.040, 0.045)

CFI, Comparative fit index; TLI, Tucker-Lewis index; RMSEA, Root-mean-square-error of approximation.

tested in a single-factor model. In contrast, academic intrinsic motivation was tested in two models, one with one factor and the other with three (intrinsic motivation to know, academic motivation toward accomplishment, and academic motivation toward experience stimulation). Finally, life skills were tested with an eight-factor model.

Table 2 shows the goodness-of-fit indices for each of the studied models. It can be seen that except for the RMSEA values for autonomy support and intrinsic motivation both overall and by factors, all the goodness-of-fit indices were satisfactory. Regarding the lack of fit in the RMSEA, several studies (e.g., Chen et al., 2008; Lai and Green, 2016) have pointed out that this index can be affected by the type of data distribution. They suggest that the model's fit should not be discarded just because the assumption of some of the indices is not met but should be examined with others. Therefore, taking into account that: (1) satisfactory CFI and TLI values were presented; (2) all the items showed statistically significant factor loadings ($p < 0.001$) with their respective factors; and (3) in the case of the three-factor model of intrinsic academic motivation and the model of life skills, the factors correlated positively and significantly ($p < 0.001$) among these, the fit and factorial validity of the measurement instruments were determined.

3.3 Structural equation analysis

To comply with the main objective of this work and to determine the type and degree of associations between the study variables, structural equation analyses of the four models, each with 10 factors, were performed. The first model (Model A) consisted of the following factors: autonomy support, global academic intrinsic motivation (grouping the 12 items that measure this variable), and each of the eight life skills. The second model (Model B) consisted of the following factors: autonomy support, intrinsic motivation to know (grouping only the four items that compose this academic motivation factor), and each of the eight life skills. The third model (Model C) consisted of autonomy support, intrinsic motivation toward accomplishment (grouping only the four items that measure this academic motivation factor), and each of the eight life skills. Finally, the fourth model (Model D) consisted of the following factors: autonomy support, intrinsic motivation toward experience stimulation (grouping only the four items that measure this academic motivation factor), and the eight life skills.

Table 3 presents each of the goodness-of-fit indices. It can be seen that by scoring above 0.90 for the CFI and TLI and below 0.08 for the RMSEA, all models presented a satisfactory fit.

Figure 1 shows the standardized regression values of the models. A positive and significant association between autonomy support and intrinsic motivation both global ($\beta = 0.47$, $p < 0.001$) and in all its subtypes (ranges $\beta = 0.50$ to 0.52, $p < 0.001$) is seen. Likewise, academic intrinsic motivation, global and in its subtypes, was positively and significantly related to each life skill (ranges $\beta = 0.57$ to 0.77, $p < 0.001$). According to Kang and Ahn (2021) and Kline (2023), the association between autonomy support and global intrinsic motivation can be considered as significant or moderate, while with the three subtypes of intrinsic motivation they can be considered as "practically significant" or strong. In the case of the relationships between academic intrinsic motivation both globally and in its subtypes with each of the life skills, they can also be considered as "practically significant" or strong.

3.4 Mediation analysis

By finding significant relationships between the study variables in each of the analyzed models, and with the intention of testing hypothesis 3, which indicated the mediating role of academic intrinsic motivation (both global and in its three factors in the relationship between the perception of the autonomy support style adopted by the professors and the eight life skills of future PE teachers and sports coaches), indirect effects analyses were carried out for each of the four models. The results of the indirect effects analyses are presented in Table 4. It can be seen by observing the minimum and maximum values in the confidence intervals (95% CI) that none cross the zero value; thus, empirical support was found for hypothesis 3, confirming the mediating relationship of academic intrinsic motivation both global and by subtypes.

As a final step, to know the type of mediation exercised by academic intrinsic motivation, the four models were analyzed again with direct relationships between the perception of the autonomy support style adopted by the teacher and the eight life skills of future PE teachers and sports coaches (mediation models). Table 5 shows the goodness-of-fit of the mediation models, which were satisfactory.

When a comparison is made between the initial (see Table 3) and the mediation models (see Table 5) according to the criteria of differences, ≥ 0.010 for the CFI and ≥ 0.015 for the RMSEA (Chen, 2007), no relevant differences are found in any of the models (Model A: ΔCFI = 0.009, ΔRMSEA = 0.006; Model B: ΔCFI = 0.009, ΔRMSEA = 0.007; Model C: ΔCFI = 0.006, ΔRMSEA = 0.005; Model D: ΔCFI = 0.006, ΔRMSEA = 0.004). Table 4 presents the standardized values of the direct effects of the relationships between autonomy support and life skills in each model. In it, it is possible to see that all the associations were positive (ranges $\beta = 0.10$ to 0.30) and significant ($p < 0.01$); therefore, evidence of partial mediation by academic intrinsic motivation was obtained.

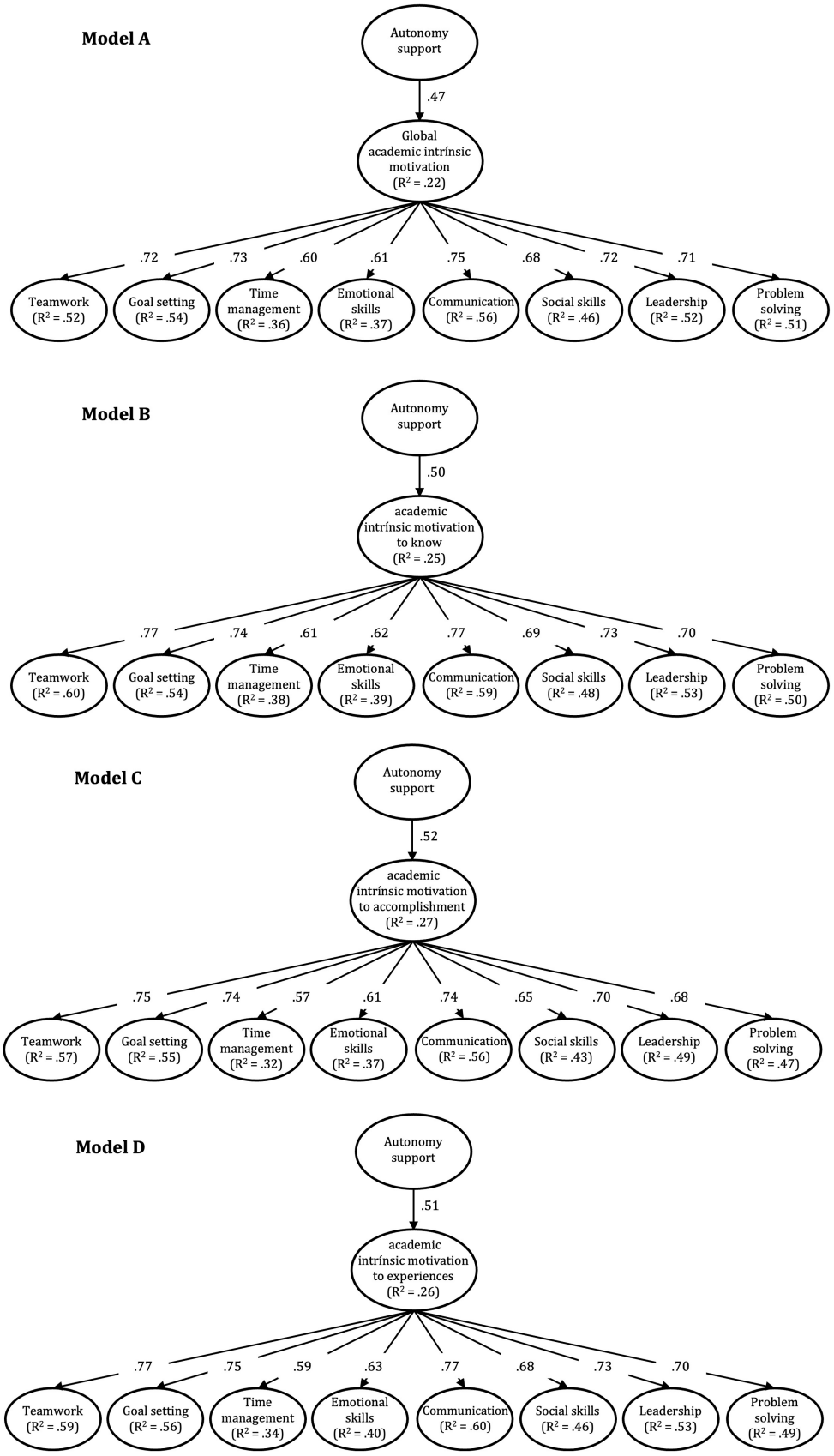

FIGURE 1
Standardized regression values of the structural equation models. All associations are significant at a $p < 0.001$ level. The items are not shown for clarity purposes; however, all saturated positively (ranges between 0.69 and 0.93) and significantly ($p < 0.001$) with their respective factors.

TABLE 4 Indirect effects of the structural equation models.

	Estimate	95% CI		
		Lower	Upper	Direct effect
Model A: Indirect effect via *global academic intrinsic motivation*				
Teamwork	0.42	0.31	0.53	0.29***
Goal setting	0.43	0.32	0.54	0.19***
Time management	0.34	0.25	0.44	0.11**
Emotional skills	0.34	0.24	0.44	0.19***
Communication	0.40	0.30	0.51	0.21***
Social skills	0.37	0.27	0.47	0.14***
Leadership	0.41	0.31	0.52	0.15***
Problem-solving	0.41	0.31	0.52	0.10**
Model B: Indirect effect via *intrinsic motivation to know*				
Teamwork	0.48	0.36	0.60	0.32***
Goal setting	0.47	0.35	0.58	0.22***
Time management	0.37	0.28	0.47	0.12**
Emotional skills	0.37	0.27	0.48	0.21***
Communication	0.45	0.34	0.56	0.23***
Social skills	0.40	0.30	0.50	0.16***
Leadership	0.45	0.34	0.56	0.18***
Problem-solving	0.44	0.33	0.54	0.13***
Model C: Indirect effect via *intrinsic motivation toward accomplishment*				
Teamwork	0.48	0.36	0.60	0.30***
Goal setting	0.48	0.36	0.60	0.20***
Time management	0.36	0.26	0.45	0.12**
Emotional skills	0.38	0.27	0.48	0.19***
Communication	0.45	0.34	0.55	0.21***
Social skills	0.39	0.29	0.49	0.15***
Leadership	0.45	0.33	0.55	0.16***
Problem-solving	0.44	0.33	0.54	0.11**
Model D: Indirect effect via *intrinsic motivation toward experience stimulation*				
Teamwork	0.48	0.36	0.60	0.29***
Goal setting	0.47	0.36	0.59	0.19***
Time management	0.36	0.26	0.46	0.11**
Emotional skills	0.38	0.28	0.48	0.18***
Communication	0.45	0.34	0.56	0.20***
Social skills	0.40	0.30	0.50	0.14***
Leadership	0.45	0.40	0.56	0.15***
Problem-solving	0.44	0.33	0.54	0.10**

***$p < 0.001$, **$p < 0.01$.

4 Discussion

To High-quality motivation is related to various indicators of academic success and wellbeing in students (Howard et al., 2021). The importance of the training processes of PE teachers and sports coaches not only for their future pedagogical practices (Lander et al., 2015; Pulido et al., 2016) but also for their successful insertion into the workforce (Tushar and Sooraksa, 2023), led to the objective of this research which was to analyze the existing relationships between the perceived autonomy support, academic intrinsic motivation global and in its three subtypes, and life skills in future PE teachers and sports coaches.

TABLE 5 Fit indices of structural equation analyses for mediation models.

Model	χ^2	*df*	*p*	CFI	TLI	RMSEA (90% CI)
Model A	3853.70	2,099	0.000	0.97	0.97	0.038 (0.036, 0.040)
Model B	2997.50	1,607	0.000	0.98	0.97	0.038 (0.036, 0.040)
Model C	2960.37	1,607	0.000	0.98	0.98	0.038 (0.036, 0.040)
Model D	2962.04	1,607	0.000	0.98	0.98	0.038 (0.036, 0.040)

CFI, Comparative fit index; TLI, Tucker-Lewis index; RMSEA, Root-mean-square-error of approximation.

The results from the study of life skills indicated that in various contexts (e.g., youth sport, PE, and higher education), life skills development is related to the satisfaction of basic psychological needs and the autonomy support shown by teachers and coaches (Cronin et al., 2019; Cronin et al., 2022; Ortiz-Rodríguez et al., 2024); however, this study provides evidence of academic intrinsic motivation as a mediating mechanism between autonomy support and life skills development. Three hypotheses were tested to verify this.

The first (H1) indicated that the autonomy support perceived by students would be related to global intrinsic motivation and its three subtypes. The results from the four models tested support this hypothesis. SDT (Ryan and Deci, 2017) states that the social context in which a person lives affects their type of motivation, and specifically, autonomy-supportive environments foster intrinsic motivation (Ryan and Deci, 2020). The literature has proved this fact in higher education settings (Okada, 2021); thus, the results of this study add to what the theoretical framework indicates regarding intrinsic motivation and autonomy support, in addition to extending the evidence to contexts related to the training of PE teachers and sports coaches.

The second hypothesis (H2) in this research stated that global academic intrinsic motivation, and its three subtypes, would be associated with life skills. The results support the hypothesis, finding positive and significant relationships between global academic intrinsic motivation and its subtypes and life skills development. In this sense, life skills research conducted according to the SDT has focused on relating them to basic psychological needs (e.g., Cronin et al., 2019; Cronin et al., 2022; Ortiz-Rodríguez et al., 2024); therefore, little is known about the association between motivation and skill development. Some other studies have pointed out that global intrinsic academic motivation is negatively associated with anxiety and depression in academic settings (Vallone et al., 2023), while the subtypes of motivation toward achievement and toward stimulating experiences present the same type of relationship with academic procrastination (Tisocco and Fernández Liporace, 2023). Regarding cognitive skills, it has been found that intrinsic motivation toward knowledge is associated with improvements in reading accuracy and pseudoword decoding as a cognitive skill (Smith et al., 2020), so the findings of this study are in line with the findings of similar studies and also contribute to the literature by providing information that when students in higher education settings are intrinsically motivated by what they will learn (i.e., to know), by the goals or skills they will achieve (i.e., toward accomplishment), and by the positive feelings they will experience during academic activities (i.e., to experience stimulation), they will also perceive a higher level of life skills.

The last of the proposed hypotheses (H3) established that global academic intrinsic motivation and its three subtypes would mediate the relationship between perceived autonomy support and each of the eight life skills. Regarding this, indirect effects analyses showed the existence of this mediation relationship, which provides support for the hypothesis and adds to the evidence that just as the satisfaction of basic psychological needs is a mechanism that favors life skills development (Cronin et al., 2019; Cronin et al., 2022; Ortiz-Rodríguez et al., 2024), academic intrinsic motivation also does. This finding represents another important contribution of this work; however, it was also found that autonomy support is directly related to life skills, so it seems that the mediating role of academic intrinsic motivation is not decisive for life skills development. This could be because, since autonomy support consists of providing choice options on how to learn and perform tasks, as well as setting flexible rules, students could directly have the opportunity to perform the activities with peers, which implies the use of life skills such as teamwork, social and emotional skills, communication or leadership; but in addition, students could set their times and methods for performing and delivering their tasks, which entails the use of skills such as time management, goal setting and problem solving.

Delving into the above, the SDT proposes that intrinsic motivation depends on satisfying the psychological needs of autonomy, competence, and relatedness. Related studies (e.g., Niemiec and Ryan, 2009; Jiang and Tanaka, 2022) support this idea; however, this study did not include an analysis of psychological needs, so it is not possible to determine the degree of satisfaction of these needs and whether this situation exerts some mediating or moderating effect on academic motivation and life skills development. Future studies can explore the associations between these mechanisms as mediators or moderators of the relationship between autonomy support and life skills.

Another limitation of this study is that the sample consisted of students from a single higher education program that trains PE teachers and sports coaches, so it is not possible to extrapolate the results to other populations, and it is necessary to consider that the fact that the population of this study had classes that involved physical activity may have had some impact on the results, since it has been shown that the practice of physical activity is associated with higher rates of learning motivation (Berki and Tarjányi, 2022). Additionally, only questionnaires were used as data collection instruments, hence that what was found regarding the variables studied only corresponds to the perspective of the students and could be affected by social desirability. In view of this, future studies could use external evaluators as a complementary method in data collection and involve populations from other higher education programs related to the training of physical activity professionals or the training of pre-service teachers of other subjects. Finally, it would be interesting to explore what happens with the opposite of autonomy support, that is, the controlling style and its relationships not only with intrinsic motivation but with the other types of motivation proposed by SDT and life skills.

5 Conclusion

After the analysis and discussion of the results found, it is possible to conclude that in a higher education environment specialized in the training of PE teachers and sports coaches, the autonomy support adopted by professors is related to intrinsic academic motivation both globally and in each of its subtypes, and that these, in turn, are associated with the development of life skills, being, in addition, a mediating mechanism. Accordingly, when PE teachers and pre-service sports coaches participating in this study perceive that their professors adopt their perspective, provide explanations and arguments for the tasks performed, communicate empathetically, and use activities that vitalize internal motivational resources, that is, by adopting an autonomy support style, they tend to be more intrinsically motivated toward what they learn and achieve, and the experiences that the class activities provide, which, in turn, are associated with greater development of teamwork skills, goal setting, time management, emotional skills, interpersonal communication, social skills, leadership and problem-solving and decision making.

6 Practical applications

The knowledge obtained from this study can be used by higher education institutions that focus on training physical activity professionals for the creation of teacher training programs and the necessary adjustments in their curricula and educational programs in such a way that strategies and methodologies that complement the development of academic competencies with life skills are incorporated. It could also be used to develop public policies aimed at higher education and educational models based on academic motivation. However, the most relevant practical application that the authors suggest for using the contributions of this study falls directly on the teaching actions toward their students since creating autonomy-supportive environments that lead their students to experience these conditions could result in these students, and specifically in the case of future PE teachers and sports coaches, adopting and putting it into practice with their future students or athletes.

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 humans were approved by the Dirección de Investigación of the Facultad de Organización Deportiva. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

VO-R: Conceptualization, Data curation, Investigation, Writing – original draft, Writing – review & editing. AV-T: Conceptualization, Formal analysis, Investigation, Methodology, Writing – review & editing. RR-N: Funding acquisition, Investigation, Resources, Writing – review & editing. JT: Conceptualization, Funding acquisition, Methodology, Project administration, Writing – review & editing, Supervision. JL-W: Methodology, Project administration, Validation, Writing – review & editing.

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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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References

Aelterman, N., Vansteenkiste, M., Haerens, L., Soenens, B., Fontaine, J. R. J., and Reeve, J. (2019). Toward an integrative and fine-grained insight in motivating and demotivating teaching styles: the merits of a circumplex approach. *J. Educ. Psychol.* 111, 497–521. doi: 10.1037/edu0000293

Berki, T., and Tarjányi, Z. (2022). The role of physical activity, enjoyment of physical activity, and school performance in learning motivation among high school students in Hungary. *Children* 9:320. doi: 10.3390/children9030320

Bernardi, R. A., and Nash, J. (2022). The importance and efficacy of controlling for social desirability response bias. *Ethics Behav.* 33, 413–429. doi: 10.1080/10508422.2022.2093201

Chan, S., Maneewan, S., and Koul, R. (2023). An examination of the relationship between the perceived instructional behaviours of teacher educators and pre-service teachers' learning motivation and teaching self-efficacy. *Ed. Rev.* 75, 264–286. doi: 10.1080/00131911.2021.1916440

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Struct. Equ. Modeling* 14, 464–504. doi: 10.1080/10705510701301834

Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., and Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models. *Sociol. Methods Res.* 36, 462–494. doi: 10.1177/0049124108314720

Cheon, S. H., Reeve, J., and Vansteenkiste, M. (2020). When teachers learn how to provide classroom structure in an autonomy-supportive way: benefits to teachers and their students. *Teach. Teach. Educ.* 90:103004. doi: 10.1016/j.tate.2019.103004

Cook, D. A., and Artino, A. R. Jr. (2016). Motivation to learn: an overview of contemporary theories. *Med. Educ.* 50, 997–1014. doi: 10.1111/medu.13074

Cronin, L., Allen, J., Ellison, P., Marchant, D., Levy, A., and Harwood, C. (2021). Development and initial validation of the life skills ability scale for higher education students. *Stud. High. Educ.* 46, 1011–1024. doi: 10.1080/03075079.2019.1672641

Cronin, L., Ellison, P., Allen, J., Huntley, E., Johnson, L., Kosteli, M. C., et al. (2022). A self-determination theory based investigation of life skills development in youth sport. *J. Sports Sci.* 40, 886–898. doi: 10.1080/02640414.2022.2028507

Cronin, L., Marchant, D., Allen, J., Mulvenna, C., Cullen, D., Williams, G., et al. (2019). Students' perceptions of autonomy-supportive versus controlling teaching and basic need satisfaction versus frustration in relation to life skills development in PE. *Psychol. Sport Exerc.* 44, 79–89. doi: 10.1016/j.psychsport.2019.05.003

Cronin, L., Marchant, D., Johnson, L., Huntley, E., Kosteli, M. C., Varga, J., et al. (2020). Life skills development in physical education: a self-determination theory-based investigation across the school term. *Psychol. Sport Exerc.* 49:101711. doi: 10.1016/j.psychsport.2020.101711

Diloy-Peña, S., García-González, L., Burgueño, R., Tilga, H., Koka, A., and Abós, Á. (2024). A cross-cultural examination of the role of (de-) motivating teaching styles in predicting students' basic psychological needs in physical education: a circumplex approach. *J. Teach. Phys. Educ.* 22, 1–13. doi: 10.1123/jtpe.2023-0036

Espinoza-Gutiérrez, R., Baños, R., Calleja-Núñez, J. J., and Granero-Gallegos, A. (2024). Effect of teaching style on academic self-concept in Mexican university students of physical education: multiple mediation of basic psychological needs and motivation. *Espiral.* 17, 46–61. doi: 10.25115/ecp.v17i36.10087

Faul, F., Erdfelder, E., Buchner, A., and Lang, A. G. (2009). Statistical power analyses using G*power 3.1: tests for correlation and regression analyses. *Behav. Res. Ther.* 41, 1149–1160. doi: 10.3758/BRM.41.4.1149

Ferrando, P. J., and Anguiano-Carrasco, C. (2010). El análisis factorial como técnica de investigación en psicología. *Pap. Psicól.* 31, 18–33.

Freire, G. L. M., Do, J. R. A., Junior, N., Cronin, L. D., and Fiorese, L. (2023). An investigation of basic needs satisfaction as a mediator of the associations between coach autonomy support and participant's life skills development in sport. *Int. J. Sport Exerc. Psychol.* 54, 209–226. doi: 10.7352/IJSP.2023.54.209

Goudas, M. (2010). Prologue: a review of life skills teaching in sport and physical education. *Hell. J. Psychol.* 7, 241–258.

Großmann, N., Fries, S., and Wilde, M. (2023). Is the practice of autonomy support the missing element in teacher training at university? A study on the effects of an intervention based on self-determination theory on biology preservice teachers' knowledge, beliefs, and intentions. *Front. Psychol.* 14:1279771. doi: 10.3389/fpsyg.2023.1279771

Hayes, A. F., and Coutts, J. J. (2020). Use omega rather than Cronbach's alpha for estimating reliability. *Commun. Methods Meas.* 14, 1, 1–24. doi: 10.1080/19312458.2020.1718629

Hornstra, L., Stroet, K., van Eijden, E., Goudsblom, J., and Roskamp, C. (2018). Teacher expectation effects on need-supportive teaching, student motivation, and engagement: a self-determination perspective. *Educ. Res. Eval.* 24, 324–345. doi: 10.1080/13803611.2018.1550841

Howard, J. L., Bureau, J. S., Guay, F., Chong, J. X. Y., and Ryan, R. M. (2021). Student motivation and associated outcomes: a meta-analysis from self-determination theory. *Perspect. Psychol. Sci.* 16, 1300–1323. doi: 10.1177/1745691620966789

Islam, M. N., and Chakrabarty, S. (2020). A study of the relationship between familial factors and academic motivation and achievement in high school students. *Psychol. Stud.* 65, 87–96. doi: 10.1007/s12646-019-00500-7

Jiang, J., and Tanaka, A. (2022). Autonomy support from support staff in higher education and students' academic engagement and psychological well-being. *Educ. Psychol.* 42, 42–63. doi: 10.1080/01443410.2021.1982866

Kalkbrenner, M. T. (2023). Alpha, omega, and H internal consistency reliability estimates: reviewing these options and when to use them. *Couns. Outcome Res. Eval.* 14, 77–88. doi: 10.1080/21501378.2021.1940118

Kang, H., and Ahn, J. W. (2021). Model setting and interpretation of results in research using structural equation modeling: a checklist with guiding questions for reporting. *Asian Nurs. Res.* 15, 157–162. doi: 10.1016/j.anr.2021.06.001

Kim, H., and Cho, Y. (2014). Pre-service teachers' motivation, sense of teaching efficacy, and expectation of reality shock. *Asia-Pac. J. Teach. Educ.* 42, 67–81. doi: 10.1080/1359866X.2013.855999

Kline, R. B. (2023). Principles and practice of structural equation modeling. *5th* Edn. London: Guilford Press.

Lai, K., and Green, S. B. (2016). The problem with having two watches: assessment of fit when RMSEA and CFI disagree. *Multivar. Behav. Res.* 51, 220–239. doi: 10.1080/00273171.2015.1134306

Lander, N. J., Barnett, L. M., Brown, H., and Telford, A. (2015). Physical education teacher training in fundamental movement skills makes a difference to instruction and assessment practices. *J. Teach. Phys. Educ.* 34, 548–556. doi: 10.1123/jtpe.2014-0043

Leal Filho, W., Lange Salvia, A., Beynaghi, A., Fritzen, B., Ulisses, A., Avila, L. V., et al. (2023). Digital transformation and sustainable development in higher education in a post-pandemic world. *Int. J. Sustain. Dev. World Ecol.* 31, 108–123. doi: 10.1080/13504509.2023.2237933

Li, C. H. (2016). Confirmatory factor analysis with ordinal data: comparing robust maximum likelihood and diagonally weighted least squares. *Behav. Res. Methods* 48, 936–949. doi: 10.3758/s13428-015-0619-7

López-García, G. D., Carrasco-Poyatos, M., Burgueño, R., and Granero-Gallegos, A. (2023). Relationships between needs satisfaction and the quality of motivation with academic engagement in pre-service physical education teachers. *SAGE Open* 13:3. doi: 10.1177/21582440231197507

López-García, G. D., Granero-Gallegos, A., Carrasco-Poyatos, M., and Burgueño, R. (2024). Motivational and cognitive variables in pre-service teachers: differences between physical education and STEM, social-linguistic and artistic areas. *Rev. Interuniv. Form. Profr.* 38, 323–342. doi: 10.47553/rifop.v99i38.2.100620

Lozano-Jiménez, J. E., Huéscar, E., and Moreno-Murcia, J. A. (2021). From autonomy support and grit to satisfaction with life through self-determined motivation and group cohesion in higher education. *Front. Psychol.* 11:579492. doi: 10.3389/fpsyg.2020.579492

MacKinnon, D. P., Lockwood, C. M., and Williams, J. (2004). Confidence limits for the indirect effect: distribution of the product and resampling methods. *Multivar. Behav. Res.* 39, 99–128. doi: 10.1207/s15327906mbr3901_4

Moreno-Murcia, J. A., Huéscar Hernández, E., Pintado Verdú, R., and Marzo Campos, J. C. (2019). Diseño y validación de la Escala de Apoyo a la Autonomía en educación superior: Relación con la competencia laboral del discente. *REOP Rev. Esp. Orient. Psicop.* 30, 116–130. doi: 10.5944/reop.vol.30.num.1.2019.25197

Muthén, B., and Kaplan, D. (1992). A comparison of some methodologies for the factor analysis of non-normal Likert variables: a note on the size of the model. *Br. J. Math. Stat. Psychol.* 45, 19–30. doi: 10.1111/j.2044-8317.1992.tb00975.x

Nascimento, J. R. A., Freire, G. L. M., Quinaud, R. T., Oliveira, D. V., and Cronin, L. D. (2021). Life skills development through sport in Brazil: a study based on self-determination theory. *Percept. Mot. Skills* 128, 1017–1036. doi: 10.1177/00315125211000860

Nasheeda, A., Abdullah, H. B., Krauss, S. E., and Ahmed, N. B. (2019). A narrative systematic review of life skills education: effectiveness, research gaps and priorities. *Int. J. Adolesc. Youth* 24, 362–379. doi: 10.1080/02673843.2018.1479278

Niemiec, C. P., and Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: applying self-determination theory to educational practice. *Theory Res. Educ.* 7, 133–144. doi: 10.1177/1477878509104318

Nuñez Alonso, J. L., Lucas, J. M.-A., and Navarro Izquierdo, J. G. (2005). Validación de la versión española de la Échelle de Motivation en Éducation. *Psicothema* 17, 344–349.

Okada, R. (2021). Effects of perceived autonomy support on academic achievement and motivation among higher education students: a Meta-analysis. *Jpn. Psychol. Res.* 65, 230–242. doi: 10.1111/jpr.12380

Orsini, C., Binnie, V. I., and Wilson, S. L. (2016). Determinants and outcomes of motivation in health professions education: a systematic review based on self-determination theory. *J. Educ. Eval. Health Prof.* 13:19. doi: 10.3352/jeehp.2016.13.19

Ortiz-Rodríguez, V., Vergara-Torres, A. P., Ramírez-Nava, R., López-Walle, J. M., Huerta-López, E., and Tristán, J. (2024). Las habilidades para la vida en futuros profesores de educación física y entrenadores deportivos: un estudio bajo la Teoría de la Autodeterminación. *Sportis Sci. J.*, 10, 261–282. doi: 10.17979/sportis.2024.10.2.10259

Park, Y. B., and Kim, M. S. (2017). The influence of leadership life skills and achievement motivation on self-leadership in nursing students. *J. Korean Acad. Nurs.* 23, 494–503. doi: 10.11111/jkana.2017.23.5.494

Pulido, J. J., Sánchez-Oliva, D., Sánchez-Miguel, P. A., Leo, F. M., and García-Calvo, T. (2016). Influencia de la formación de los entrenadores sobre la motivación de los deportistas. *Rev. Int. Med. Cienc. Act. Fis.* 64, 685–702. doi: 10.15366/rimcafd2016.64.005

Raabe, J., Schmidt, K., Carl, J., and Höner, O. (2019). The effectiveness of autonomy support interventions with physical education teachers and youth sport coaches: a systematic review. *J. Sport Exerc. Psychol.* 41, 345–355. doi: 10.1123/jsep.2019-0026

Reeve, J. (2016). "Autonomy-supportive teaching: what it is, how to do it" in Building autonomous learners. eds. W. Liu, J. Wang and R. Ryan (Singapore: Springer), 129–152.

Roh, Y. S., and Kim, S. S. (2015). Integrating problem-based learning and simulation: effects on student motivation and life skills. *Comput. Inform. Nurs.* 33, 278–284. doi: 10.1097/CIN.0000000000000161

Ryan, R. M., and Deci, E. L. (2017). Self-determination theory. Basic psychological needs in motivation, development, and wellness. New York, NY: The Guilford Press.

Ryan, R. M., and Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: definitions, theory, practices, and future directions. *Contemp. Educ. Psychol.* 61:101860. doi: 10.1016/j.cedpsych.2020.101860

Smith, Z. R., Langberg, J. M., Cusick, C. N., Green, C. D., and Becker, S. P. (2020). Academic motivation deficits in adolescents with ADHD and associations with academic functioning. *J. Abnorm. Child Psychol.* 48, 237–249. doi: 10.1007/s10802-019-00601-x

Stover, J. B., de la Iglesia, G., Boubeta, A. R., and Fernández Liporace, M. (2012). Academic motivation scale: adaptation and psychometric analyses for high school and college students. *Psychol. Res. Behav. Manag.* 5, 71–83. doi: 10.2147/PRBM.S33188

Tisocco, F., and Fernández Liporace, M. (2023). Structural relationships between procrastination, academic motivation, and academic achievement within university students: a self-determination theory approach. *Innov. High. Educ.* 48, 351–369. doi: 10.1007/s10755-022-09622-9

Tushar, H., and Sooraksa, N. (2023). Global employability skills in the 21st century workplace: a semi-systematic literature review. *Heliyon* 9:e21023. doi: 10.1016/j.heliyon.2023.e21023

Vallerand, R. J., Pelletier, L. G., Blais, M. R., Brière, N. M., Senecal, C., and Vallieres, E. F. (1992). The academic motivation scale: a measure of intrinsic, extrinsic, and a motivation in education. *Educ. Psychol. Meas.* 52, 1003–1017. doi: 10.1177/0013164492052004025

Vallone, F., Galvin, J., Cattaneo Della Volta, M. F., Akhtar, A., Chua, S., Ghio, E., et al. (2023). Technostress and academic motivation: direct and indirect effects on university students' psychological health. *Front. Psych.* 14:1211134. doi: 10.3389/fpsyg.2023.1211134

Vergara-Torres, A. P., Ortiz-Rodríguez, V., Reyes-Hernández, O., López-Walle, J. M., Morquecho-Sánchez, R., and Tristán, J. (2022). Validation and factorial invariance of the life skills ability scale in Mexican higher education students. *Sustain. For.* 14:2765. doi: 10.3390/su14052765

Weathington, B. L., Cunningham, C. J., and Pittenger, D. J. (2010). Research methods for the behavioral and social sciences. New York, NY: Wiley.

Williams, J., and MacKinnon, D. P. (2008). Resampling and distribution of the product methods for testing indirect effects in complex models. *Struct. Equ. Modeling* 15, 23–51. doi: 10.1080/10705510701758166