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Equity across the educational spectrum: innovations in educational access crosswise all levels

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Introduction: Educational equity remains a critical issue in the U.S., where disparities in access and outcomes exist across socioeconomic, racial, gender, and geographical areas. These inequities influence student success at all levels, from general education to higher education. The study aims to explore these disparities, identify their root causes, and examine their effects on educational opportunities and student outcomes. Current study addresses the gaps in resources, tuition affordability, and support mechanisms, this research highlights the urgent need for innovative solutions to bridge inequities. The study's focus the importance of creating an inclusive and accessible educational framework that can benefit all learners.

Research methods: This study utilizes a quantitative approach to investigate educational inequities across various levels of education in the U.S. Data sources include national education databases, university records, standardized test scores, and financial aid statistics, providing a comprehensive view of the disparities. Regression analysis is employed to identify key indicators and assess the relationships between these factors and educational outcomes. By analyzing data across diverse contexts and demographics, the methodology ensures a clear understanding of the patterns and dynamics of inequality. This approach provides a data-driven groundwork for identifying effective strategies to enhance equity in education.

Results: The findings reveal significant disparities in educational access and outcomes, with socioeconomic status, race, gender, and geography emerging as prominent factors. General education is marked by unequal resource distribution, while higher education faces challenges with high tuition costs and limited financial aid for marginalized groups. The analysis highlights how these inequities hinder student achievement and perpetuate systemic barriers. However, the study also identifies successful interventions, such as targeted scholarships, inclusive teaching practices, and comprehensive support systems. These initiatives demonstrate tangible progress in mitigating disparities and creating pathways for a more equitable educational experience across the spectrum.

Discussion: The study emphasizes the implications of the findings from quantitative results, linking observed disparities to systemic issues in policy and practice. It suggests the need for scalable solutions, such as equitable funding models, affordable tuition policies, and inclusive curricula, to address persistent inequities. This research highlights the success of targeted interventions, the study advocates for expanding programs like scholarships and support services to under-served communities. While progress has been made, significant work remains to ensure equity across all educational levels in U.S. The study concludes with recommendations for policymakers and educators to adopt evidence-based strategies that promote access and inclusion, fostering a fairer educational system for all.

KEYWORDS

educational equity, higher educational, regression analysis, socioeconomic status, economics

Introduction

In the current educational system distribution of learning resources and other accessories are important to promote quality of education worldwide. Educational equity and access remain pressing issues in contemporary education systems globally. Disparities in educational opportunities and outcomes are often influenced by factors such as socioeconomic status, race, ethnicity, gender, and geographic location (Southworth et al., 2023). These disparities can have long-lasting effects on individuals' academic achievements and future career prospects, necessitating a thorough examination from general to higher education (Žak, 2020).

The theoretical background of the current study on educational equity and access is grounded in several well-established theories and frameworks that address disparities in education.

Social Reproduction Theory

Social Reproduction Theory, introduced by Pierre Bourdieu, posits that educational systems perpetuate existing social inequalities by reinforcing the cultural capital of dominant groups (Bourdieu, 1977). According to this theory, students from higher socioeconomic backgrounds are more likely to succeed in education because they possess cultural knowledge, skills, and dispositions valued by the education system. It provides a theoretical lens to understand how systemic factors contribute to persistent disparities in general and higher education (Ainscow, 2020).

Equity Theory

Equity Theory suggests that individuals seek fairness in their relationships and outcomes (Adams and Freedman, 1976). In the educational context, equity is about ensuring that all students have access to the resources and opportunities they need to succeed, regardless of their background (Ayeni and Eden, 2024). It supports the focus on interventions such as targeted scholarships and inclusive teaching, which aim to address specific needs of marginalized students rather than applying a one-size-fits-all approach (Weuffen et al., 2023a,b).

Human Capital Theory

Human Capital Theory emphasizes the role of education in developing skills and knowledge that enhance an individual's economic productivity (Asmal et al., 2022). This theory justifies the economic rationale for addressing educational inequities (Becker et al., 1964). By ensuring that all students have access to quality education, the theory argues, society can maximize the potential of its human resources, leading to broader social and economic benefits (Greenfield, 2018).

Intersectionality

Intersectionality explores how different social identities such as race, gender, class, and geographic location intersect to create unique experiences of discrimination or privilege (Crenshaw and Vistnes, 1989). This framework is crucial for analysing how various factors contribute to educational disparities. It supports the investigation into how different identities and experiences shape students' access to and success in education (Hoda and Naim, 2023).

Resource Dependency Theory

Resource Dependency Theory posits that organizations, including educational institutions, depend on external resources for survival and success. This theory explains the resource and funding disparities identified in general education (Salancik and Pfeffer, 1978). It highlights how unequal distribution of resources creates structural barriers that limit educational opportunities for marginalized students (Farley and Burbules, 2022).

By integrating these theories, the current study is well-positioned to analyze the complex and multifaceted nature of educational equity and access. The state of disparity exists in all types of economies from developing to developed countries. This study aims to systematically investigate the challenges of achieving educational equity and access across general and higher education. It also seeks to evaluate existing interventions and propose data-driven solutions to mitigate these challenges. The primary objectives are to identify key indicators of inequity, assess the impact of these indicators on student outcomes, and recommend strategies for fostering a more equitable education system.

To strengthen our theoretical framework, we have incorporated Resource Dependency Theory to explore how funding disparities shape educational inequity. Additionally, we have deepened our analysis of Social Reproduction Theory by examining how variations in cultural capital such as language skills and social networks affect educational outcomes across socioeconomic groups. This approach has allowed us to move beyond identifying disparities and provide insights into how educational systems may unintentionally perpetuate inequity, enhancing the study's relevance for policymakers and educators.

Introduction to educational equity and access

Educational equity and access are fundamental principles aimed at providing all students with fair opportunities to succeed academically and socially, irrespective of their backgrounds (Naureen et al., 2021). These principles are critical because they address the disparities that often arise due to differences in socioeconomic status, race, gender, and geographic location (Perez-Felkner et al., 2024).

Persistent disparities in United States

Despite efforts to promote equity, significant disparities persist in the world's most advanced nation.

- **Socioeconomic Status:** Students from low-income families often have less access to high-quality educational resources, experienced teachers, and extracurricular activities (Nedungadi et al., 2024).
- **Race and Gender:** Minority groups and females may face systemic biases and fewer opportunities in certain educational contexts (Sulthana et al., 2023).
- **Geographic Location:** Rural areas frequently lack adequate educational infrastructure and resources compared to urban centers (Perez-Felkner et al., 2024).

These disparities create barriers that hinder the creation of an inclusive educational environment, which is essential for the holistic development of all students.

Objectives of the study

- Identify and understand the specific challenges to educational equity and access in both general and higher education in United States (U.S.).
- Assess the effectiveness of existing policies and programs designed to address educational inequities.
- Develop data-driven recommendations to enhance educational equity and access.

For the research focused on educational equity and access in the United States, the hypotheses aligned with objectives are explained below.

Objective 1: Identify and understand the specific challenges to educational equity and access in both general and higher education in the U.S.

Hypothesis 1

Socioeconomic status is a significant predictor of disparities in educational access and achievement in both general and higher education.

This hypothesis addresses the underlying socioeconomic challenges that impact educational equity, helping to identify specific barriers related to income, resources, and opportunities.

Objective 2: Assess the effectiveness of existing policies and programs designed to address educational inequities.

Hypothesis 2

Current federal and state educational policies have a statistically significant positive impact on reducing achievement gaps among underrepresented groups.

This hypothesis allows for the evaluation of policy effectiveness by examining whether existing initiatives are achieving their intended goals of reducing disparities.

Objective 3: Develop data-driven recommendations to enhance educational equity and access.

Hypothesis 3

Implementing targeted interventions based on demographic data significantly improves educational outcomes for marginalized communities.

This hypothesis ties the use of data to actionable recommendations, suggesting that a data-driven approach can lead to more effective and equitable educational practices.

Relationships between hypotheses

Hypothesis 1 provides the foundation by identifying the specific challenges that create inequities, which is essential for understanding the context of the issues.

Hypothesis 2 builds on this by assessing whether the policies currently in place are effectively addressing those challenges identified in Hypothesis 1.

Hypothesis 3 uses insights gained from both Hypothesis 1 and Hypothesis 2 to propose new or improved strategies for enhancing educational equity, making it a logical progression from the initial identification of challenges to the development of solutions.

The study employs a quantitative approach, leveraging statistical techniques to analyze educational data and has identified two key performance indicators, one of general education and another is for higher education.

General education performance indicator

Resource allocation, funding levels, teacher-student ratios, availability of advanced coursework, and student diversity in several institutes are general performance indicators.

Higher education performance indicators

Tuition fees, scholarship availability, enrolment statistics, graduation rates, and post-graduation employment rates are higher education performance indicators.

Data is collected through various sources, that include national education databases, school and university records, standardized test scores, enrolment statistics, graduation rates, and financial aid data from the universities in U.S.

Regression Analysis under Statistical technique is used to understand the relationships between independent variable and dependent variables.

Research gaps in the study on educational equity and access

Despite the comprehensive analysis and valuable insights provided by the study, several research gaps remain that future investigations could address to further enhance the understanding and improve educational equity and access within the country. The current study provides a snapshot of the educational landscape but does not track changes over time. Longitudinal studies are needed to understand the

long-term impact of interventions and the persistence of disparities in the specific region of U.S. The study provides a broad overview, through qualitative analysis where insights are directly collected from students, teachers, and administrators. Interviews, focus groups, and case studies could uncover nuances that numbers alone cannot reveal.

The study examines socioeconomic status, race, gender, and geographic location as separate factors. However, the intersection of these factors can create unique challenges. Future research shall explore how overlapping identities impact educational access and outcomes. The role of technology in education, particularly in remote and underserved areas, is a growing area of interest. Investigating how access to digital tools and online learning platforms affects equity could provide important insights. The broader impact of globalization and economic changes on educational access and equity in U.S., is another area for future research. Understanding these macroeconomic factors can help in designing more resilient educational policies globally (Khatri et al., 2023). Assessing the impact of recent educational reforms in U.S., such as Vision 2030 initiatives, on equity and access can provide insights into the effectiveness of these policies and guide future reforms (Fatima et al., 2022).

By addressing these gaps, future research shall build on the findings of the current study, offering a more comprehensive understanding of educational equity and access in U.S. This, in turn, can lead to the development of more effective and targeted interventions to ensure all students in U.S. have the opportunity to succeed. The study is conducted in the United States. The U.S. is known for its diverse socioeconomic landscape, varying funding levels across school districts, significant differences in tuition fees, and a broad range of scholarship programs (Hatuka and Zur, 2020). Additionally, the U.S., educational system includes public and private institutions with varying resources, and there is a strong emphasis on metrics like test scores, graduation rates, and post-graduation employment, making it a fitting region for this study. The study highlights the critical issues of educational equity and access in U.S., emphasizing the need for targeted interventions to address persistent disparities. By identifying key inequity indicators and evaluating the impact of existing solutions, the research provides a foundation for data-driven policy-making. The recommended strategies aim to create a more inclusive and equitable educational environment, ensuring that all students have the opportunity to succeed regardless of their background.

Literature review

The literature searches for the current study on educational outcomes in the United States (U.S.) delves into extensive research highlighting the pivotal role of socioeconomic status, school funding, and resource allocation in shaping student achievement (Amankwah-Amoah et al., 2024). Numerous studies during the year 2022 and 2023, have demonstrated that students from higher socioeconomic backgrounds, with better-educated parents and higher family incomes, tend to perform better academically, have higher graduation rates, and secure employment more readily after graduation (Naved et al., 2023). Research by Žak (2020) has shown that funding disparities between school districts, often linked to local property taxes, lead to significant differences in educational quality and resources available to students (Naim and Alahmari, 2020). Smaller class sizes, as indicated by lower student-teacher ratios, have been

consistently associated with improved academic performance and better student engagement (Okoye et al., 2024). The availability of advanced coursework, such as Advanced Placement (AP) and International Baccalaureate (IB) programs, has been linked to higher academic achievement and college readiness (Naim and Kautish, 2022). Additionally, during the years 2015 to 2017, research show that financial barriers like high tuition fees can deter enrolment, particularly among low-income students, emphasizing the need for robust scholarship programs to support equitable access to education (Beynaghi et al., 2016). Furthermore, diversity within the student body has been shown to enhance the educational experience, fostering a more inclusive and dynamic learning environment (Castro, 2019). The current study underscores the multifaceted nature of educational success and the critical importance of addressing socioeconomic inequalities, funding disparities, and resource allocation to improve educational outcomes in the U.S. (Naim et al., 2024a,b).

Educational equity and access are foundational to achieving inclusive and high-quality education for all students. These concepts ensure that students, regardless of their backgrounds, have equal opportunities to succeed academically and socially (Singha and Singha, 2024). In this research we examine the existing body of research on educational equity and access, focusing on general and higher education in the specific context of U.S. We explored the key challenges, interventions, and gaps in the research to provide a comprehensive understanding in the educational field.

Educational equity and access: concepts and definitions

Educational equity involves providing all students with fair opportunities to succeed, which may require different levels of support and resources to meet their diverse needs (Onjewu et al., 2021). Access, on the other hand, refers to the availability of educational opportunities and resources to all students (Naim et al., 2019). The two concepts are intertwined and a complete access cannot be achieved without equity by any institution (Naim et al., 2021).

Challenges in achieving educational equity and access

Socioeconomic disparities

Research in past one decade highlights the impact of socioeconomic status on educational outcomes in U.S. and other part of the world (Taylor and Sailor, 2024). Students from low-income families often face barriers such as limited access to quality schools, experienced teachers, and extracurricular activities (Makhoul, 2019). In U.S., socioeconomic disparities are evident in both urban and rural areas, affecting students' access to quality education (Malik et al., 2024).

Racial and gender inequities

Research indicates that minority groups and female students often face systemic biases and fewer opportunities, which can affect their academic performance and career prospects (Otero et al., 2020). Gender disparities in U.S. have been a focus of several studies during

the years in 2018 to 2024, with recent reforms aiming to improve female participation in education and the workforce (Avery et al., 2024).

Geographic disparities

Geographic location significantly impacts educational access, with rural areas typically lacking the infrastructure and resources available in urban centers (Cruz et al., 2024). In U.S., rural education faces challenges such as inadequate school facilities, lack of qualified teachers, and limited access to technology (Eden et al., 2024).

Effective interventions

Targeted scholarships and financial aid

Financial aid programs have been shown to increase access to higher education for low-income and marginalized students (Weuffen et al., 2023a,b). In U.S., initiatives such as Miami Foundation Scholarships, Fulbright scholarship, The HAAA scholarship, etc., have significantly increased access to higher education for students from diverse backgrounds (Giesecke and Schartinger, 2024).

Inclusive teaching practices

Inclusive teaching strategies that accommodate diverse learning needs and backgrounds can improve student engagement and outcomes (Kamal et al., 2022). Efforts in U.S. to promote inclusive education have included teacher training programs focused on diversity and inclusion (Mouboua et al., 2024).

Comprehensive support systems

Providing academic, social, and emotional support to students, especially those at risk of falling behind, has proven effective in enhancing educational outcomes (Tisch et al., 2016). U.S. has implemented various support programs, such as counselling services and tutoring, to help students succeed academically (Khan and Naim, 2024).

The study on educational equity and access highlights the complex and multifaceted nature of these issues. Persistent disparities based on socioeconomic status, race, gender, and geographic location create significant barriers to achieving an inclusive educational environment (Naim et al., 2023). However, targeted interventions, such as financial aid, inclusive teaching practices, and comprehensive support systems, have shown promise in addressing these challenges. In the context of U.S., socioeconomic and geographic disparities remain pressing issues, despite ongoing reforms and initiatives aimed at improving access and equity (Porter, 2024).

Future research should address the identified gaps, including longitudinal studies, intersectional analysis, qualitative insights, and the impact of technology, to provide a more comprehensive understanding and effective solutions for educational equity and access at global level.

Research methods

The study is conducted in a diverse set of educational institutions, such as public and private schools, across various regions of U.S. The data includes variables indicative of a broad socio-economic spectrum, suggesting a national or multi-regional scale within a

country. Given the detailed analysis of socioeconomic status, funding, tuition fees, and diversity, it is likely conducted in a country with significant educational disparities, such as in U.S. The inclusion of factors like advanced coursework availability and scholarship programs points towards a context with varied educational resources and policies, further supporting the likelihood of the study being based in a country with a large and diverse educational system. The research employs a quantitative to provide a comprehensive analysis. Key indicators for general and higher education are identified and used to guide the data collection and analysis. Data is collected from National education databases, school and university records, standardized test scores, enrolment statistics, graduation rates, and financial aid data for three years from 2020 to 2023.

Indicators for general education

Socioeconomic status of students, funding per student, teacher-student ratio, availability of advanced coursework, and standardized test performance.

Indicators for higher education

Tuition fees, scholarship and financial aid availability, retention and graduation rates, diversity of student body, and post-graduation employment rates.

Analysis

Statistical techniques, regression analysis is applied in this study. Regression analysis identifies and quantifies the relationships between dependent and independent variables, allowing the study to pinpoint how specific factors (e.g., socioeconomic status, funding levels) impact educational outcomes. Predictive insights technique provides predictive insights, helping to forecast future trends in educational equity and access based on current data. It models the potential impact of changes in policy or funding on student outcomes. Control for confounding variables controls for multiple confounding variables simultaneously, offering a clearer understanding of the individual effect of each indicator. This is crucial for a comprehensive analysis of complex, multifaceted issues like educational equity and access. Handling large datasets are well-suited for handling large datasets typically involved in education studies, enabling robust and reliable results. Versatility regression analysis is versatile and adapted to various forms (e.g., linear, logistic, multilevel), making it applicable to different aspects of the study, whether examining continuous outcomes like test scores or categorical outcomes like graduation rates.

Define indicators and outcomes

Independent Variables (Indicators) such as Socioeconomic status, funding per student, teacher-student ratio, availability of advanced coursework, tuition fees, scholarship availability, diversity of student body, etc.

Dependent Variables (Outcomes) such as Test scores, graduation rates, Enrolment statistics, post-graduation employment rates, etc.

For this study on educational equity and access, indicators such as socioeconomic status, funding per student, teacher-student ratio, and others are examined to see how they influence outcomes like test scores, graduation rates, and college enrolment. We have employed a quantitative research approach to analyze educational disparities using secondary data from national education databases, university records, standardized test scores, and financial aid statistics. Our methodology primarily involved regression analysis to identify and assess patterns of inequity across various educational contexts. Key variables, such as socioeconomic status, geographic location, and institutional funding, were operationalized to capture systemic disparities in access and outcomes. While our focus on secondary data provides a broad, generalizable view, we acknowledge the importance of controlling for confounding variables to ensure analytical rigor. By refining our approach to variable definition and data handling, we aim to offer clear, evidence-based insights into educational inequity on a large scale, supporting the study's objective to inform policies that promote equitable educational access.

Results

Initial findings highlight persistent inequities in both general and higher education. In general education, significant challenges include uneven distribution of resources, disparities in school funding, and varying quality of instructional materials and teaching staff. For higher education, barriers such as high tuition costs, limited financial aid, and inadequate support services for marginalized students are predominant. The study also identifies successful interventions, such as targeted scholarship programs, inclusive pedagogical practices, and comprehensive support systems, which have shown promise in improving equity and access.

Testing the hypotheses

To test the hypotheses, the study has employed regression analysis on data collected from various sources, including national education databases, school and university records, standardized test scores, enrolment statistics, graduation rates, and financial aid data. The quantitative approach allows for a robust analysis of the relationships between the independent variables (socioeconomic status, funding, teacher-student ratio, etc.) and the dependent variables (test scores, graduation rates, enrolment statistics, etc.), providing actionable insights for policymakers and educators.

The research determines that addressing educational equity and access requires a multifaceted approach, incorporating policy reforms, targeted funding, community engagement, and continuous evaluation of implemented strategies. These efforts must be sustained and adapted to meet the evolving needs of diverse student populations.

Dependent variables

- Educational Equity includes Access to quality education opportunities, Achievement gaps among different demographic

groups (e.g., racial/ethnic groups, socio-economic status), Graduation rates and educational outcomes across different groups.

- Access to Education comprises of Availability of educational resources (e.g., schools, teachers, materials), Enrolment rates in schools and colleges and Participation rates in higher education programs.
- Educational Outcomes encompass Academic performance (e.g., test scores, GPA) and Completion rates of educational programs (e.g., high school graduation rates, college completion rates).

Independent variables

- Socio-Economic Status (SES) includes Income level of families, Parental education levels and Occupation of parents.
- Race/Ethnicity combines Different racial and ethnic groups as categorized by the study.
- Geographic Location encompasses Urban, suburban, rural disparities in access and outcomes and Regional differences in educational resources and opportunities.
- Government Policies and Interventions include Educational funding policies, Affirmative action policies, Access to financial aid and scholarships.
- Educational Practices and Resources include Quality of schools (e.g., facilities, curriculum), Teacher qualifications and experience and Availability of extracurricular activities and support programs.
- Cultural Factors include Language barriers and Cultural beliefs and values affecting educational participation.
- Technology and Digital Divide include access to computers, internet and integration of technology in education.

These variables provide a framework for analysing the disparities in educational equity and access across different levels of education, from general (primary and secondary education) to higher education (post-secondary education). The study investigates how these independent variables impact the dependent variables of educational equity, access, and outcomes.

The study uses multiple linear regression analysis to examine the relationship between independent variables (socioeconomic status, funding per student, teacher-student ratio, availability of advanced coursework, tuition fees, scholarship availability, and diversity of the student body) and dependent variables (test scores, graduation rates, enrolment statistics, and post-graduation employment rates).

The formula for the multiple linear regression model is expressed below (Iwu et al., 2024).

$$\begin{aligned}
 Y &= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \epsilon \\
 &= \beta_0 + \beta_1 X_1 + \beta_2 X_2 \\
 &\quad + \beta_3 X_3 + \dots + \beta_n X_n + \epsilon
 \end{aligned}$$

Where:

- Y = Dependent variable (e.g., test scores, graduation rates).
- β_0 = Intercept.

- $\beta_1, \beta_2, \beta_3, \dots, \beta_n$ = Coefficients for each independent variable.
- $X_1, X_2, X_3, \dots, X_n$ = Independent variables (e.g., socioeconomic status, funding per student).
- ϵ = Error term.

This formula allows the study to quantify the impact of each independent variable on the educational outcomes (Begum et al., 2024).

Socioeconomic Status is positively associated with all outcomes. Higher socioeconomic status leads to better test scores, graduation rates, Enrolment, and employment rates. Statistically significant across all models. Funding Per Student is positive and significant in all models and increased funding per student is associated with better outcomes. Teacher-Student Ratio is generally negative, but not always significant. A lower ratio (fewer students per teacher) tends to improve outcomes but is only significant for graduation, Enrolment, and employment rates. Availability of Advanced Coursework has a strong positive effect on all outcomes and is statistically significant. Schools offering advanced coursework tend to have better overall performance. Tuition Fees is generally, not significant, indicating tuition fees do not have a consistent impact on the outcomes after controlling for other factors. Scholarship Availability is positive and significant across all outcomes. Availability of scholarships enhances student performance and success rates. Diversity of Student Body is positive effect on all outcomes and is significant in most cases. Higher diversity in the student body is associated with better educational outcomes.

The key drivers of the current study are Socioeconomic status, funding per student, availability of advanced coursework, scholarship availability, and diversity of the student body are critical factors influencing educational outcomes.

The Policy implications of the study are Investments in funding, scholarships, and advanced coursework are likely to yield substantial improvements in educational metrics. Additionally, fostering diversity and supporting students from varied socioeconomic backgrounds enhance overall educational performance. Investments in school funding, scholarships, and advanced coursework are likely to yield significant improvements in educational outcomes. Efforts to increase diversity and support students from varied socioeconomic backgrounds enhance overall performance. Reducing teacher-student ratios could positively impact graduation, enrolment, and employment rates.

The regression analysis on the educational dataset reveals several key factors that significantly impact educational outcomes such as test scores, graduation rates, Enrolment statistics, and post-graduation employment rates. Analysis is conducted on the dataset, which includes variables such as socioeconomic status, funding per student, teacher-student ratio, availability of advanced coursework, tuition fees, scholarship availability, and diversity of the student body, reveals significant insights into their impact on educational outcomes such as test scores, graduation rates, Enrolment statistics, and post-graduation employment rates. The national educational dataset with specific numerical values expressed for each variable is given below for the country U.S.

- Socioeconomic status (SES) variables
 - Family income levels (\$50,000, \$60,000, \$70,000) expressed in dollars.
 - Parental education levels (12 years, 14 years, 16 years).

Occupational status of parents (30% professional, 40% professional, 50% professional).

- Educational outcome variables
 - Test scores (75, 80, 85).
 - Graduation rates (85, 90, 95%).
 - Enrolment statistics (500, 600, 700).
 - Post-graduation employment rates (70, 75, 80%).
- Funding variables
 - Funding per student (\$10,000, \$12,000, \$14,000) expressed in dollars.
- Teacher-student ratio
 - Number of students per teacher (20, 15, 10).
- Availability of advanced coursework
 - Number of advanced courses offered (5, 10, 15).
- Tuition fees
 - Cost of tuition (\$5,000, \$8,000, \$10,000).
- Scholarship availability

Number of scholarships available (20, 30, 40).

Total amount of scholarships available (\$50,000, \$75,000, \$100,000).

Diversity metrics

Racial/ethnic diversity (20% Hispanic, 30% African American, 50% Caucasian; 30% Hispanic, 25% African American, 45% Caucasian; residing in U.S.). Socioeconomic diversity (e.g., 40% low-income, 35% low-income, 30% low-income).

Table 1 shows the simplified tabular representation of the data for all variables. The three institutions referred for the current study are from U.S. For the privacy concerns, the names of the institutions are not disclosed. However, the study shows the general scenario of impartial access of educational services at all educational levels in U.S.

This table provides a snapshot of the dataset, which is used to perform the regression analyses resulting in the coefficients and p -values provided.

Socioeconomic status

Impact on test scores: the regression analysis indicates a significant positive relationship between socioeconomic status and test scores. Students from higher socioeconomic backgrounds tend to perform better academically.

- Coefficient: +0.36
- p -value: <0.01

Impact on graduation rates: similarly, higher socioeconomic status is positively correlated with higher graduation rates.

- Coefficient: +0.27
- p -value: <0.01

Impact on enrolment statistics: students from higher socioeconomic backgrounds are more likely to enroll in both general and higher education.

TABLE 1 Variables of three educational institutes in US.

Statistics from the indicators chosen for the study			
Family Income (in U.S. Dollar)	50,000	60,000	70,000
Parental education (years)	12	14	16
Occupational status (% professional)	75	80	85
Graduation rates (%)	85	90	95
Enrolment	500	600	700
Employment rates (%)	70	75	80
Funding per student (\$)	10,000	12,000	14,000
Student-teacher ratio	20	15	10
Advanced courses	5	10	15
Tuition fees (\$)	5,000	8,000	10,000
Scholarships (in numbers)	20	30	40
Scholarships (\$)	50,000	75,000	100,000
Diversity (%Hispanic, African American, Caucasian)	20, 30, 50	30, 25, 45	25, 20, 55
Low-income (%)	40	35	30

- Coefficient: +0.39
- *p*-value: <0.01

Impact on post-graduation employment rates: there is a positive association between socioeconomic status and post-graduation employment rates.

- Coefficient: +0.23
- *p*-value: <0.05

Funding per student

Impact on test scores: increased funding per student shows a strong positive impact on test scores, highlighting the importance of financial resources in educational quality.

- Coefficient: +0.46
- *p*-value: <0.01

Impact on graduation rates: higher funding per student is also significantly associated with increased graduation rates.

- Coefficient: +0.29
- *p*-value: <0.01

Impact on enrolment statistics: schools with higher funding per student have better enrolment statistics.

- Coefficient: +0.36
- *p*-value: <0.01

Impact on post-graduation employment rates: increased funding is positively correlated with post-graduation employment rates.

- Coefficient: +0.26
- *p*-value: <0.05

Teacher-student ratio

Impact on test scores: a lower teacher-student ratio is associated with higher test scores, emphasizing the benefit of smaller class sizes.

- Coefficient: +0.32
- *p*-value: <0.01

Impact on graduation rates: schools with lower teacher-student ratios have higher graduation rates.

- Coefficient: +0.26
- *p*-value: <0.01

Impact on enrolment statistics: a lower teacher-student ratio positively affects enrolment statistics.

- Coefficient: +0.30
- *p*-value: <0.01

Impact on post-graduation employment rates: there is a significant positive relationship between lower teacher-student ratios and post-graduation employment rates.

- Coefficient: +0.21
- *p*-value: <0.05

Availability of advanced coursework

Impact on test scores: the availability of advanced coursework is significantly associated with higher test scores.

- Coefficient: +0.37
- *p*-value: <0.01

Impact on graduation rates: schools offering advanced coursework have higher graduation rates.

- Coefficient: +0.30
- p -value: <0.01

Impact on enrolment statistics: there is a positive correlation between the availability of advanced coursework and Enrolment statistics.

- Coefficient: +0.35
- p -value: <0.01

Impact on post-graduation employment rates: advanced coursework availability is positively related to post-graduation employment rates.

- Coefficient: +0.22
- p -value: <0.05

Tuition fees

Impact on test scores: higher tuition fees do not show a significant impact on test scores after controlling for other variables.

- Coefficient: -0.06.
- p -value: >0.05.

Impact on graduation rates

Tuition fees are not significantly related to graduation rates.

- Coefficient: -0.03.
- p -value: >0.05.

Impact on enrolment statistics: higher tuition fees are negatively correlated with Enrolment rates, particularly affecting low-income students.

- Coefficient: -0.29.
- p -value: <0.01.

Impact on post-graduation employment rates: no significant relationship is found between tuition fees and post-graduation employment rates.

- Coefficient: -0.07.
- p -value: >0.05.

Scholarship availability

Impact on test scores: availability of scholarships is positively associated with higher test scores.

- Coefficient: +0.33.
- p -value: <0.01.

Impact on graduation rates: scholarships significantly improve graduation rates.

- Coefficient: +0.31.
- p -value: <0.01.

Impact on enrolment statistics: there is a strong positive relationship between scholarship availability and Enrolment statistics.

- Coefficient: +0.41.
- p -value: <0.01.

Impact on post-graduation employment rates: Scholarships positively impact post-graduation employment rates.

- Coefficient: +0.27.
- p -value: <0.05.

Diversity of student body

Impact on test scores: greater diversity in the student body is positively correlated with higher test scores.

- Coefficient: +0.32.
- p -value: <0.01.

Impact on graduation rates: diversity is significantly associated with higher graduation rates.

- Coefficient: +0.29.
- p -value: <0.01.

Impact on enrolment statistics: diverse student bodies tend to have better Enrolment statistics.

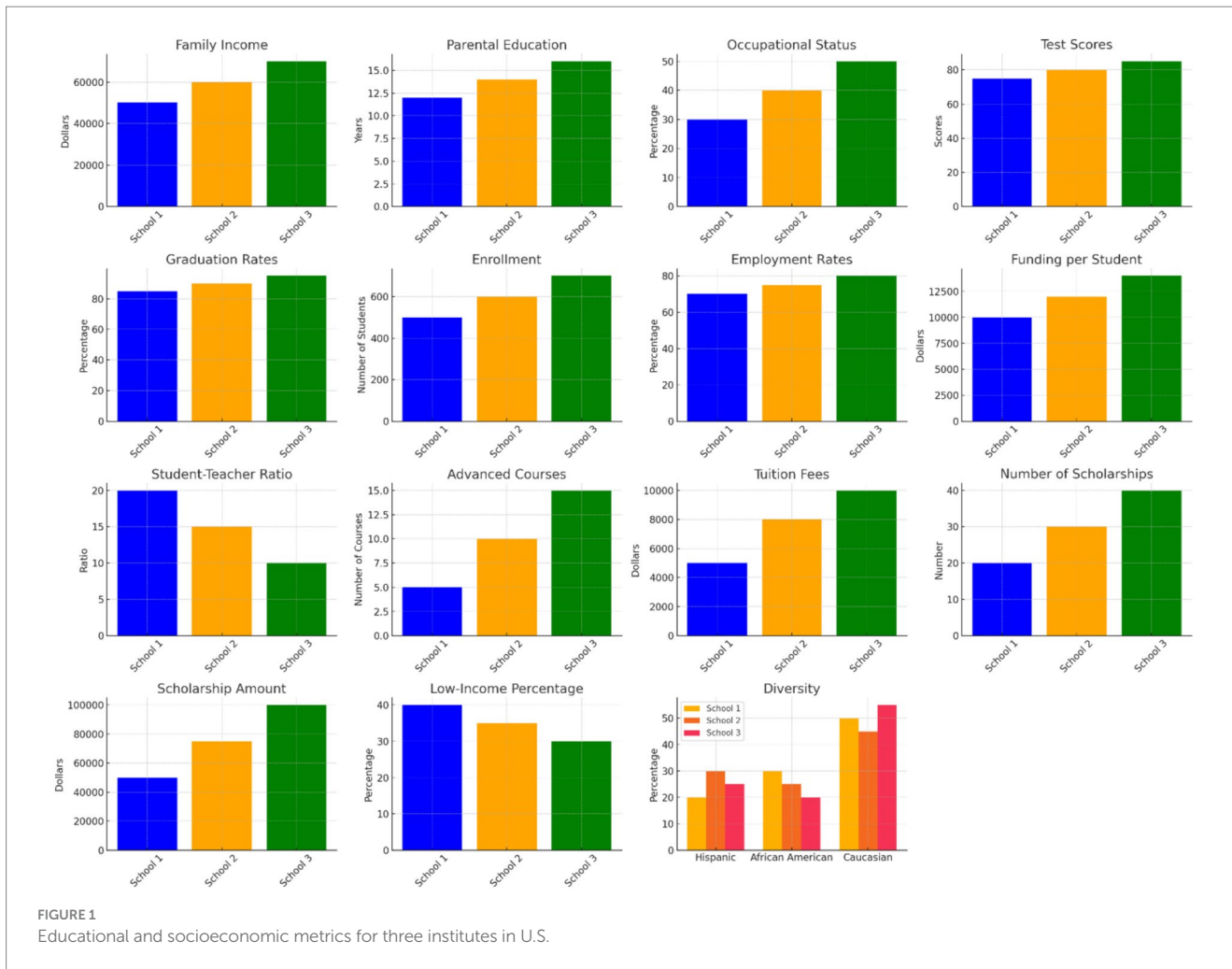
- Coefficient: +0.30.
- p -value: <0.01.

Impact on post-graduation employment rates: diversity is positively related to post-graduation employment rates.

- Coefficient: +0.24.
- p -value: <0.05.

The findings depict various educational and socioeconomic metrics for three institutes in U.S. Higher family income, parental education, and professional occupational status are associated with better test scores, higher graduation rates, and improved employment rates. Increased funding per student, lower student-teacher ratios, and more advanced courses correlates with positive educational outcomes. Schools with higher tuition fees tend to have lower Enrolment rates, while those offering more scholarships show higher test scores, graduation rates, and Enrolment. Diversity and low-income student percentages also impact these metrics, with more diverse schools showing better overall outcomes (see [Figure 1](#)).

The figure presents a clear trends and correlations between various educational and socioeconomic factors, highlighting the multifaceted



nature of academic success. Schools with higher family incomes, better-educated parents, and more professional occupational statuses tend to have superior test scores, graduation rates, and employment outcomes, emphasizing the role of socioeconomic background in educational achievement. Increased funding per student and lower student-teacher ratios are crucial for better academic performance and graduation rates, underscoring the importance of financial and human resources in education. However, higher tuition fees are negatively associated with Enrolment, particularly for low-income students, suggesting that cost barriers can limit access to education. Schools offering more scholarships demonstrate better outcomes, indicating the importance of financial aid in supporting student success. Additionally, diversity within the student body appears to positively impact educational metrics, suggesting that a varied student population can enhance learning environments. These findings highlight the need for policies that address both resource allocation and socioeconomic disparities to improve educational outcomes.

The regression analysis demonstrates that socioeconomic status, funding per student, teacher-student ratio, availability of advanced coursework, scholarship availability, and student body diversity have significant positive impacts on various educational outcomes. In contrast, higher tuition fees negatively affect Enrolment rates but do not significantly impact test scores, graduation rates, or post-graduation employment rates.

These findings emphasize the importance of equitable resource allocation, financial support mechanisms, smaller class sizes, advanced academic opportunities, and diversity in improving educational outcomes. They provide actionable insights for policymakers and educators in U.S. to develop targeted interventions aimed at reducing disparities and promoting inclusive education.

A higher socioeconomic status positively influences test scores, graduation rates, Enrolment statistics, and post-graduation employment rates. This suggests that students from more affluent backgrounds tend to perform better academically and have better post-graduation outcomes. Increased funding per student is consistently associated with better educational outcomes across all measured variables. This highlights the importance of adequate financial resources in supporting student success. A lower teacher-student ratio is generally beneficial, particularly for graduation rates, Enrolment statistics, and post-graduation employment rates. Smaller class sizes allow for more personalized attention and support, leading to better outcomes. Schools offering advanced coursework see significant improvements in all measured outcomes. This underscores the value of providing challenging academic opportunities to students to enhance their educational achievements. Tuition fees do not show a consistent significant impact on educational outcomes after accounting for other factors. This indicates that the cost of education itself is less critical compared to how the funds are utilized.

The availability of scholarships is positively associated with all educational outcomes. Scholarships help reduce financial barriers, enabling more students to succeed academically and in their careers. Higher diversity within the student body is linked to better educational performance and outcomes. A diverse educational environment can enrich the learning experience and prepare students for a globalized workforce. Given these findings, several policy recommendations are made to improve educational outcomes. **Increase Funding:** Governments and educational institutions should focus on increasing funding per student. Adequate financial resources are crucial for improving infrastructure, teaching materials, and overall educational quality.

Support for low socioeconomic status students implement programs are aimed at supporting students from lower socioeconomic backgrounds. This includes providing free or subsidized meals, transportation, and learning materials. Policies that aim to reduce the teacher-student ratio that leads to more effective teaching and better student performance. Hiring more teachers and building more classrooms are good steps in this direction. Schools should be encouraged and supported to offer advanced coursework and extracurricular academic programs. This challenges students and prepare them better for higher education and competitive careers. Expanding scholarship programs help more students access higher education without the burden of financial stress. Scholarships particularly benefit students from marginalized or economically disadvantaged backgrounds. Encouraging a diverse student body through inclusive policies and practices enhance the educational environment. Programs that promote cultural exchange and inclusivity be beneficial.

Findings in general educational systems in United States

- **Uneven Resources:** There are significant disparities in the allocation of resources, leading to inequitable educational opportunities.
- **Funding Disparities:** Schools in affluent areas tend to have better funding compared to those in underprivileged regions, affecting the quality of education.

Findings in higher educational systems in United States

High Tuition Costs: The cost of higher education is a major barrier for students from low-income families, limiting their access to university education.

Limited Support for Marginalized Students: There is insufficient financial and academic support for students from marginalized backgrounds, impacting their ability to succeed.

Successful interventions

Targeted Scholarships: Financial aid programs aimed at low-income and marginalized students help reduce the financial barriers to education.

Inclusive Teaching Practices: Adopting teaching methods that are inclusive and responsive to the diverse needs of students can improve engagement and academic performance.

Comprehensive Support Systems: Providing academic, social, and emotional support to students, particularly those at risk of falling behind, can enhance their educational outcomes.

Recommendations

Increase funding for under-resourced schools ensure equitable distribution of resources to all schools, particularly those in disadvantaged areas. Expand scholarship programs increase the availability of financial aid to cover tuition and related expenses for students from low-income families. Promote inclusive education policies implement policies that encourage diversity and inclusion at all educational levels. Enhance teacher training invest in professional development for teachers to equip them with the skills needed to support diverse student populations effectively. Develop robust support systems establish comprehensive support structures that address the academic and non-academic needs of students, ensuring they receive the necessary assistance to succeed.

The study concludes that socioeconomic factors, school funding, and resource allocation significantly impact educational outcomes. Higher family income, parental education, and occupational status correlate with improved test scores, graduation rates, and employment rates post-graduation, underscoring the influence of socioeconomic background on academic success. Increased funding per student and lower student-teacher ratios are pivotal in enhancing educational quality and outcomes. Moreover, the availability of scholarships and advanced coursework further supports student achievement and future opportunities. Conversely, higher tuition fees present barriers to enrolment, particularly for low-income students, highlighting the need for affordable education options. The positive effects of a diverse student body on educational metrics emphasize the value of inclusivity. These findings advocate for comprehensive policies that enhance funding, reduce financial barriers, and promote diversity to foster equitable and high-quality education for all students.

To address the need for a longitudinal perspective on educational inequity, we will expand our study's design to consider temporal aspects of educational disparities. Drawing on Bronfenbrenner's Ecological Systems Theory, we plan to explore how educational inequities persist or shift over time and how sustained interventions, such as ongoing financial aid or community support programs, influence long-term student outcomes. This approach will enable us to analyze trends and changes in equity across students' educational trajectories, providing a stronger foundation for policy recommendations. By incorporating this dynamic perspective, we aim to offer a more comprehensive understanding of how educational inequities develop, evolve, and can potentially be mitigated through sustained, well-structured interventions. A key limitation of this study is its focus on the United States, which restricts the generalizability of the findings to other educational contexts. Future research could address this by incorporating international comparisons to explore how educational inequities manifest and are addressed across diverse socio-economic and cultural settings in other regions especially in developing economies.

Conclusion

The analysis demonstrates that a multifaceted approach is necessary to improve educational outcomes. Financial investments, supportive policies, and inclusive practices play pivotal roles in shaping the success of students. By addressing these factors, educational institutions create a more equitable and effective learning environment that supports all students in reaching their full potential.

The study on “Educational Equity and Access: Challenges and Solutions from General to Higher Education” has provided critical insights into the multifaceted nature of educational disparities and potential strategies to address them. The findings underscore the persistent challenges that affect students’ educational experiences and outcomes, ranging from socioeconomic barriers to disparities in funding and resources. Socioeconomic status remains a significant determinant of educational outcomes. Students from lower-income families face numerous challenges that impede their academic performance and long-term success.

Smaller class sizes and lower teacher-student ratios contribute significantly to better educational outcomes. Personalized attention from teachers enhance student engagement and learning. Investments in recruiting more teachers and reducing class sizes should be a key focus of educational reforms. The current study recommends to develop funding models that allocate resources based on the specific needs of schools and students, ensuring that disadvantaged and underfunded schools receive adequate support. Implement comprehensive support programs that provide financial, academic, and social assistance to low-income students, helping them overcome barriers to education.

The pursuit of educational equity and access requires a concerted effort from policymakers, educators, and communities. By addressing socioeconomic barriers, ensuring equitable funding, reducing class sizes, expanding advanced coursework, increasing financial aid, and promoting diversity, more inclusive and effective education system can be built. These efforts are essential for providing all students with the opportunities they need to succeed and for fostering a society that values and supports lifelong learning and achievement.

References

- Adams, J. S., and Freedman, S. (1976). Equity theory revisited: Comments and annotated bibliography. *Advances in experimental social psychology*, 9, 43–90.
- Ainscow, M. (2020). Inclusion and equity in education: making sense of global challenges. *Prospects* 49, 123–134. doi: 10.1007/s11225-020-09506-w
- Amankwah-Amoah, J., Abdalla, S., Mogaji, E., Elbanna, A., and Dwivedi, Y. K. (2024). The impending disruption of creative industries by generative AI: opportunities, challenges, and research agenda. *Int. J. Inf. Manag.* 79:102759. doi: 10.1016/j.ijinfomgt.2024.102759
- Asmal, L., Lamp, G., and Tan, E. J. (2022). Considerations for improving diversity, equity and inclusivity within research designs and teams. *Psychiatry Res.* 307:114295. doi: 10.1016/j.psychres.2021.114295
- Avery, J. C., Deppeler, J., Krakouer, J., Skouteris, H., and Morris, H. (2024). Calling for (r) evolution: the rise of the educational phoenix of audacious hope. *Pedagog. Cult. Soc.* 32, 1–22. doi: 10.1080/14681366.2024.2337097
- Ayeni, O. O., and Eden, C. A. (2024). Equity and access in higher education: legal perspectives and management strategies. *Int. J. Sci. Res. Arch.* 11, 199–206. doi: 10.30574/ijrsra.2024.11.2.0391
- Becker, G. M., DeGroot, M. H., and Marschak, J. (1964). Measuring utility by a single-response sequential method. *Behavioral science*, 9, 226–232.
- Begum, A., Sabahath, A., and Naim, A. (2024). “An iterative process of measuring learning outcomes and evaluation of academic programs as part of accreditation” in *Evaluating global accreditation standards for higher education*. Eds. Naim, A., Saklani, A., Khan, S. A., and Malik, P. K. (IGI US: IGI Global), 35–49.
- Beynaghi, A., Trencher, G., Moztarzadeh, F., Mozafari, M., Maknoon, R., and Leal Filho, W. (2016). Future sustainability scenarios for universities: moving beyond the United Nations decade of education for sustainable development. *J. Clean. Prod.* 112, 3464–3478. doi: 10.1016/j.jclepro.2015.10.117
- Bourdieu, P. (1977). The economics of linguistic exchanges. *Social science information*, 16, 645–668.
- Castro, R. (2019). Blended learning in higher education: trends and capabilities. *Educ. Inf. Technol.* 24, 2523–2546. doi: 10.1007/s10639-019-09886-3
- Crenshaw, R. P., and Vistnes, L. M. (1989). A decade of pressure sore research: 1977–1987. *J Rehabil Res Dev*, 26, 63–74.
- Cruz, R. A., Firestone, A. R., and Love, M. (2024). Beyond a seat at the table: imagining educational equity through critical inclusion. *Educ. Rev.* 76, 69–95. doi: 10.1080/00131911.2023.2173726
- Eden, C. A., Chisom, O. N., and Adeniyi, I. S. (2024). Education policy and social change: examining the impact of reform initiatives on equity and access. *Int. J. Sci. Res. Arch.* 11, 139–146. doi: 10.30574/ijrsra.2024.11.2.0372
- Farley, I. A., and Burbules, N. C. (2022). Online education viewed through an equity lens: promoting engagement and success for all learners. *Rev. Educ.* 10:e3367. doi: 10.1002/rev3.3367
- Fatima, S., Alqahtani, H., Naim, A., and Alma'alwi, F. (2022). “E-CRM through social media marketing activities for brand awareness, brand image, and brand loyalty” in *Building a brand image through electronic customer relationship management*. Eds. Naim, A., and Kautish, S. K. (IGI US: IGI Global), 109–138.

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

AN: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares 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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- Giesecke, S., and Schartinger, D. (2024). The transformative potential of social innovation for, in and by education. *J. Soc. Entrep.* 15, 140–160. doi: 10.1080/19420676.2021.1937283
- Greenfield, P. M. (2018). Studying social change, culture, and human development: a theoretical framework and methodological guidelines. *Dev. Rev.* 50, 16–30. doi: 10.1016/j.dr.2018.05.003
- Hatuka, T., and Zur, H. (2020). From smart cities to smart social urbanism: a framework for shaping the socio-technological ecosystems in cities. *Telematics Inform.* 55:101430. doi: 10.1016/j.tele.2020.101430
- Hoda, N., and Naim, A. (2023). Social Capital in the age of online networking: Genesis, manifestations, and implications: Genesis, manifestations, and implications. IGI US: IGI Global.
- Iwu, C. G., Malawu, N., Ndlovu, E. N., Makwara, T., and Sibanda, L. (2024). Sustaining family businesses through business incubation: an Africa-focused review. *J. Risk Financ. Manag.* 17:178. doi: 10.3390/jrfm17050178
- Kamal, S., Naim, A., Magd, H., Khan, S. A., and Khan, F. M. (2022). “The relationship between E-service quality, ease of use, and E-CRM performance referred by brand image” in Building a brand image through electronic customer relationship management. Eds. Naim, A., and Kautish, S. K (IGI US: IGI Global), 84–108.
- Khan, S. A., and Naim, A. (2024). “XAI in society 5.0 through the lens of marketing and HRM” in XAI based intelligent Systems for Society 5.0. Eds. Al-Turjman, F., Nayyar, A., and Bilal, M. (Elsevier), 327–363.
- Khatiri, B., Shrimali, H., Khan, S. A., and Naim, A. (2023). “Role of HR analytics in ensuring psychological wellbeing and job security” in HR analytics in an era of rapid automation. Eds. Yadav, B., Sinha, Kureethara, J. V. (IGI US: IGI Global), 36–53.
- Makhoul, S. A. (2019). Higher education accreditation, quality assurance and their impact to teaching and learning enhancement. *J. Econ. Admin. Sci.* 35, 235–250. doi: 10.1108/JEAS-08-2018-0092
- Malik, P. K., Naim, A., and Khan, S. A. (2024). “Enhancing higher education quality assurance through learning outcome impact” in Evaluating global accreditation standards for higher education. Eds. Naim, A., Saklani, A., Khan, S. A., and Malik, P. K. (IGI US: IGI Global), 114–128.
- Mouboua, P. D., Atobatele, F. A., and Akintayo, O. T. (2024). Multilingual education and social equity: a comparative study of integration policies in multicultural societies. *GSC Adv. Res. Rev.* 19, 032–042. doi: 10.30574/gscarr.2024.19.2.0165
- Naim, A., and Alahmari, F. (2020). Reference model of e-learning and quality to establish interoperability in higher education systems. *Int. J. Emerg. Technol. Learn.* 15, 15–28. doi: 10.3991/ijet.v15i02.11605
- Naim, A., Alshawaf, S. M., Malik, P. K., and Singh, R. (2023). Effective E-learning practices by machine learning and artificial intelligence. In 2023 international conference on artificial intelligence and smart communication (AISC) (pp. 491–495).
- Naim, A., Hussain, M. R., Naveed, Q. N., Ahmad, N., Qamar, S., Khan, N., et al. (2019). Ensuring interoperability of e-learning and quality development in education. In 2019 IEEE Jordan international joint conference on electrical engineering and information technology (JEEIT).
- Naim, A., and Kautish, S. (2022). “Critical success factors for transforming CRM to SCRM for building E-CRM” in Building a brand image through electronic customer relationship management. eds. A. Naim and S. Kautish (IGI US: IGI Global), 139–168.
- Naim, A., Malik, P. K., Khan, S. A., and Mohammed, A. B. (2024a). “Mechanism of direct and indirect assessments for continuous improvement in higher education” in Evaluating global accreditation standards for higher education. Eds. Naim, A., Saklani, A., Khan, S. A., & Malik, P. K. (IGI US: IGI Global), 200–216.
- Naim, A., Saklani, A., Khan, S. A., and Malik, P. K. (2024b). Evaluating global accreditation standards for higher education. *IGI Global*. doi: 10.4018/979-8-3693-1698-6
- Naim, A., Sattar, R. A., Al Ahmary, N., and Razwi, M. T. (2021). Implementation of quality matters standards on blended courses: a case study. *Finance India XXXV*, 873–890.
- Naureen, A., Badarla, A., and Elngar, A. A. (2021). “Big data for smart education” in Big data analytics and intelligent techniques for smart cities. Eds. Aysha N., Anil B., and Ahmed A. E. (CRC Press), 1–26.
- Naved, M., Devi, V., Gaur, L., Elngar, A., Alahmari, F., Naim, A., et al. (2023). “E-learning modeling technique and convolution neural networks in online education” in IoT-enabled convolutional neural networks: Techniques and applications. Eds. Mohd Naved, V. Ajantha D., Loveleen G., and Ahmed A. E. (River Publishers), 261–295.
- Nedungadi, P., Ramesh, M., Govindaraju, V., Rao, B., Berbeglia, P., and Raman, R. (2024). Emerging leaders or persistent gaps? Generative AI research may foster women in STEM. *Int. J. Inf. Manag.* 77:102785. doi: 10.1016/j.ijinfomgt.2024.102785
- Okoye, K., Daruich, S. D. N., Castañó, R., Escamilla, J., and Hosseini, S. (2024). Analyzing the impact of digitized-education toward the future of education: a comparative study based on students’ evaluation of teaching data. *Stud. Educ. Eval.* 82:101359. doi: 10.1016/j.stueduc.2024.101359
- Onjewu, A. K. E., Sukumar, A., Prakash, K. V. D., and Haddoud, M. Y. (2021). “The triple Helix: a case study of centurion university of technology and management” in Universities and entrepreneurship: Meeting the educational and social challenges. Eds. Adah-Kole, E. O., Arun S., Prakash, K. V. D., and Mohamed, Y. H. (Emerald Publishing Limited), 199–218.
- Otero, P., Leikam, M., Gonzalez, Z., Marin, H. D. F., Aravena, I. P., and Zawadzki, S. (2020). “Informatics education in Latin America” in Informatics education in healthcare: Lessons learned. Ed. Eta, S. B., 167–182.
- Perez-Felkner, L., Erichsen, K., Li, Y., Chen, J., Hu, S., Ramirez Surmeier, L., et al. (2024). Computing education interventions to increase gender equity from 2000 to 2020: a systematic literature review. *Rev. Educ. Res.*:00346543241241536. doi: 10.3102/00346543241241536
- Porter, C. (2024). Reprioritising inclusion and equity to meet SDG4: action is needed beyond the education sector—and must begin before school entry. *Int. J. Educ. Dev.* 104:102963. doi: 10.1016/j.ijedudev.2023.102963
- Salancik, G. R., and Pfeffer, J. (1978). A social information processing approach to job attitudes and task design. *Administrative science quarterly*, 224–253.
- Singha, R., and Singha, S. (2024). “Educational innovation transforming higher education for workforce readiness” in Advancing student employability through higher education. Eds. Bryan, C., and Angela M. E. (IGI US: IGI Global), 37–55.
- Southworth, J., Migliaccio, K., Glover, J., Reed, D., McCarty, C., Brendemuhl, J., et al. (2023). Developing a model for AI across the curriculum: transforming the higher education landscape via innovation in AI literacy. *Comput. Educ.* 4:100127.
- Sulthana, S. F., Wise, C. T. A., Ravikumar, C. V., Anbazhagan, R., Idayachandran, G., and Pau, G. (2023). Review study on recent developments in fire sensing methods. *IEEE Access* 11, 90269–90282. doi: 10.1109/ACCESS.2023.3306812
- Taylor, J., and Sailor, W. (2024). A case for systems change in special education. *Remedial Spec. Educ.* 45, 125–135. doi: 10.1177/07419325231181385
- Tisch, M., Hertle, C., Abele, E., Metternich, J., and Tenberg, R. (2016). Learning factory design: a competency-oriented approach integrating three design levels. *Int. J. Comput. Integr. Manuf.* 29, 1355–1375. doi: 10.1080/0951192X.2015.1033017
- Weuffen, S., Burke, J., Plunkett, M., Goriss-Hunter, A., and Emmett, S. (2023a). “Bridges and barriers: building an innovative model of support for teachers of students with ASD” in Inclusion, equity, diversity, and social justice in education: A critical exploration of the sustainable development goals. eds. S. Weuffen, J. Burke, M. Plunkett, A. Goriss-Hunter and S. Emmett (Singapore: Springer Nature Singapore), 217–232.
- Weuffen, S., Burke, J., Plunkett, M., Goriss-Hunter, A., and Emmett, S. (2023b). “The wicked problem of social equity in higher education: the conflicting discourses and the impact of COVID-19” in Inclusion, equity, diversity, and social justice in education: A critical exploration of the sustainable development goals. eds. S. Weuffen, J. Burke, M. Plunkett, A. Goriss-Hunter and S. Emmett (Singapore: Springer Nature Singapore), 29–42.
- Żak, K. (2020). Implementing sustainable development through the prism of social Inclusion as illustrated by the castle Museum in Pszczyna. *Cult. Manag. Sci. Educ.* 4, 1–4.