Beyond The Curriculum: Exploring the Interplay of Gender, Emotional Intelligence, and Learning Styles in Technology-Supported Science Education

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Abstract: As educational landscapes evolve with technology integration, understanding the nuanced factors that influence learning becomes crucial. This study, "Beyond The Curriculum: Exploring The Interplay Of Gender, Emotional Intelligence, And Learning Styles In Technology-Supported Science Education," investigates how gender, emotional intelligence, and individual learning styles interact within technology-enhanced science learning environments. By analyzing data from diverse educational settings, the research aims to reveal how these variables affect student engagement, comprehension, and performance. Emphasizing the role of technology in facilitating personalized learning experiences, the study highlights the need for tailored educational strategies that accommodate different learning preferences and emotional needs. The findings underscore the importance of integrating these factors into curriculum design to enhance educational outcomes and promote equitable learning opportunities in science education.

Keywords: Gender Differences, Emotional Intelligence, Learning Styles, Technology-Enhanced Education, STEM Education, Educational Equity, Adaptive Learning Technologies, Learning Preferences

1. Introduction

Five different studies show that there has been a boom in interest in several areas of educational research in recent years. First, research on emotional intelligence emphasized the significance of social and personal capabilities in scientific education, as well as their influence on academic performance, which was mainly evaluated by means of examinations, homework, and in-class activities. Furthermore, gamification's ability to improve data collecting and have a significant influence on students' enthusiasm, involvement, and learning outcomes was also shown by a different study that investigated the implementation of gamification in scientific education over eight years (2012–mid-2020). Gender-specific tastes and age-related disparities in activity participation were highlighted by an examination of informal overall non-formal scientific learning activities, which also revealed connections between respondents' ages and sex, training aims, and content.As stated by Alammary et al. (2019), furthermore, a survey of preservice teachers revealed unfavourable views about the integration of technology in the classroom, identifying budgetary restrictions, parental concerns, and efficient usage as significant determinants. Finally, a thorough analysis examined how technology has revolutionized education, classifying previous research into domains such as technology accessibility, computer-assisted learning, online learning, and technology-enabled behavioural changes. The research highlighted conflicting findings on the effects of giving pupils access to technology, with higher education showing a clear benefit. This history provides context for our study, which aims to investigate the interactions between technology, interpersonal skills, learning styles, as well as gamification in scientific education with the goal of contributing to the changing landscape of educational practices.

Research Gaps

The papers that are being presented show a variety of research issues and gaps in information related to scientific education. First off, research on emotional intelligence in scientific education emphasizes the need to understand the ways in which social and personal skills influence students' academic performance (Pranata*et al.* 2023). The study found a knowledge gap regarding emotional intelligence's relationship to grade-point average (GPA) and its broader implications in literacy, conceptual comprehension, and various competencies, even though it recognized the importance of behavioural intelligence, particularly in understanding its role based on gender contexts. The study also suggested expanding the body of research to acquire a more profound understanding of emotional intelligence in relation to gender and educational attainmen (Alam, 2022).

According to Arici, Yildirim and Yilmaz (2019), the study challenge focuses on the relationships between students' age, gender, and the objectives and subject matter of informal and non-formal scientific learning activities. Since the study's strength sampling approach limited the results' generalizability, the findings suggest that more comprehensive research is necessary to confirm and generalize the found patterns. The study also emphasizes how little is known about whether men are disproportionately more likely than females to be experts in unstructured and non-formal scientific learning or whether this is the result of sample bias.

Finally, the analysis of technology's influence on education highlights a crucial study issue in comprehending the complex impacts of technology at various educational levels. Given the inconsistent impacts of providing kids access to technology, more study is needed to determine how technology influences cognitive abilities at different stages of schooling. Long-term research gaps are also identified by the study. It recommends focusing on technology-enabled behavioural therapies and online courses' impact on noncognitive and cognitive abilitie (Andrejevic and Selwyn, 2020).

According to Segura, Zamar and Moro (2020), this research explores several facets of scientific education, such as gamification, emotional intelligence, technology integration, and learning styles. The study investigates how these variables interact and impact students' learning experiences. The research examines existing studies to better understand scientific education's changing environment. This study examines the correlations amongst participants' age, sex, and informal science education activities, as well as preservice teachers' reservations about technology integration. Considering restrictions and gaps in the present literature, the research seeks to reveal unexplored features, opening the way to new beliefs and prospective advancements.

2. Review of the Literature

2.1. The correlation between success in school in science and emotional intelligence

The existing body of research highlights a strong correlation between academic success in scientific education and emotional intelligence (EI). The pandemic's aftermath has accelerated the use of technology in the classroom by highlighting both its advantages and disadvantages in terms of students' mental health. Examining students' psychological and emotional well-being has grown more critical as electronics become a more essential component of education. Academic achievement is significantly influenced by emotional intelligence, which is acknowledged as a complex concept that includes social and personal abilities. Goleman's five-element model—self-awareness, self-regulation, motivation, empathy, as well as social skills—is used in this research. Kids' science success depends on these factors. Personal competences include self-regulation, motivation, and awareness. They include self-awareness, emotional management, and intellectual drive (Blau, Inbal and Avdiel, 2020).

As stated by Bond et al. (2020), these human traits help students succeed in scientific education, because complicated issues need more cognitive engagement. Social competency ends with empathy and social skills. Understanding and engaging with others are crucial to group scientific learning. These attributes are important because they emphasise the role of interpersonal connections in learning beyond academic achievement.

Some say a new education social compact requires emotional intelligence. This shows how schooling is evolving and how important emotional skills are. The study shows that evaluating students' emotional intelligence is vital to understanding how emotional states affect academic performance. The study focuses on students' mental abilities in science classes (Bucchi and Trench, 2021).

2.2. Technology used for research

According to Castro and Tumibay (2021), the literature review on technology in science education highlights the pandemic's transformative impact on instructional approaches. After many schools closed due to the pandemic, technology had to be quickly integrated into instruction. The impact on the global student population was estimated to be over 1.6 billion, which led to an unparalleled spike in the use of digital technologies like school management systems (LMS) plus video conferences like Zoom or Google Meet. The way that technology was used during the pandemic has affected many aspects of teaching. The research acknowledges the influence of technology on the planning, execution, and results of the educational process. Education management systems and videoconferencing services saw a sharp rise in usage as a result of the requirement to rely on digital technologies. This change has affected educational methods in addition to the immediate learning environment.

According to the literature, science teachers may use technology to their advantage to achieve immediate and all-encompassing learning outcomes. Science education may be improved by the use of digital interactive learning tools like physics education technology (PhET). The integration of in-person and virtual learning environments, known as blended learning, is a potentially effective strategy. This integration offers a possible remedy for the problems caused by the epidemic by addressing a variety of learning styles and permitting flexibility in teaching approaches. While there are advantages to technology integration, the research also notes that there are disadvantages for students. Along with mental health and cognitive aptitude, other impacts include emotional stability and mental health. Apart from the fact that education is being digitally transformed, the research underscores the need of assessing the psychological and emotional health of teens in the aftermath of the epidemic (Garrido, Pardo and Guerrero, 2022).

As stated by Crumpler (2023), the corpus of research demonstrates the dual effects—positive and negative that technology has on scientific education. Although technology may have the power to completely transform Today, there is also acknowledgement of the need for an all-encompassing approach that considers the welfare of every student. A thorough understanding of this is necessary to determine how technology will be used in scientific education in the future.

2.3. Disparities in scientific education by age and gender

Numerous studies on the roles that gender and age play in scientific education uncover intricate linkages that influence students' engagement in non-formal learning settings and classroom instruction. The research highlights distinctive patterns seen across a variety of ages and gender demographics and sheds light on the diversity among interests and engagement in science-related endeavours. The kind of scientific learning activities that are employed are significantly influenced by age. Young children are taught a broad variety of subjects, but computer science is a prerequisite. Conversely, the activities of young adults are primarily concerned with raising public awareness of various scientific topics. Activity goals and material that are age-appropriate highlight how important it is to adapt educational efforts to participants' preferences and developmental stages (Darby and Lang, 2019).

As per Dang et al. (2021), the ways in which students participate in scientific courses are significantly impacted by their gender. Studies show that girls are more likely than boys to engage in scientific exploratory activities that explore a wider variety of scientific fields, such as biology, chemistry, physics, and the arts. But when it pertains to developing skills, particularly in IT courses, men do so less often than women. This preference disparity depending on gender highlights how important it is to create inclusive curricula that accommodate a variety of interests. The research recognises that these demographic relationships may be dynamic and subject to alteration over time. It is highly advised to do research on the design choices that vary depending on the objectives of non-formal and informal technology learning possibilities for various age and gender groups.The body of research recognises the basic flaws in the sampling strategy and calls for larger-scale investigations to improve the generalizability of results. The last section of the literature review highlights the complex relationships between age and gender that have influenced the field of scientific education. In order to create age-appropriate, gender-neutral, accessible classrooms with a more fair and stimulating scientific learning environment, it is essential to understand and consider these demographic aspects (Fletcher et al., 2020).

2.4. Updating scientific education to reflect current technological developments

As per Geng, Law and Niu (2019), a substantial change in teaching strategies is represented by the use of technology to enhance scientific education. By improving accessibility, interaction, and overall learning outcomes, the growing integration of technological platforms and resources is revolutionising scientific education. This is a cutting-edge technological development that utilises virtual labs, interactive simulations, and learning management systems (LMS). Because of technology improvements, scientific subjects are more relevant and approachable for children in the classroom today. Online courses and multimedia presentations are examples of digital technologies that provide flexible and engaging learning settings. Learners may study procedures in biology in a safe digital setting using virtual experiments, such as games, which helps them grasp difficult topics more deeply. Furthermore, technology overcomes resource and geographic constraints to provide adolescents access to a broad variety of educational opportunities. By using internet platforms, instructional information may be shared outside of conventional classroom settings.

3. Research Methodology

The research methodologies used in the published papers differed to meet the specific goals of every inquiry. This methodology facilitated the methodical acquisition of numbers via the use of a personality assessment instrument with measurable answers and ratings for academic achievement (Jowsey et al., 2020).

3.1. Design of research

The various research approaches used in the aforementioned studies demonstrate heterogeneity, which is consistent with the unique characteristics of each study. The study used a descriptive, integrating correlation research approach to examine learners' psychological ability and its relationship to academic success. In addition to a psychology emotional capacity assessment instrument, test-taking data were obtained from math and science teachers for this sample of 215 upper-level students. An structured review of the literature utilising the PRISMA paradigm was carried out within the context of collaboration in scientific education. Creating research questions, developing inclusion and exclusion criteria, searching databases, choosing studies, extracting and analysing data, and reporting results were all part of this rigorous strategy (Gemeda and Lee, 2020).

As stated by Ifinedo and Saarela (2019), to get thorough answers that provide important information on the relationships between demographic traits and the objectives of these activities, an intensity sampling technique was used. The study used a criteria sampling technique to investigate preservice teachers' perspectives on incorporating computers into the classroom. The participants in the study were 76 preservice instructors who were chosen according to predefined criteria about their participation in a technology-integrated curriculum.

3.2. Research theory

According to Jarke and Breiter (2019), several studies used a combination of quantitative and qualitative research techniques, all of which were in line with the particular goals of each study. The study used a quantitative research approach to examine children's mental capacity and how it relates to academic success. This method facilitated the systematic gathering of numerical data by using evaluations of academic success and a behavioural assessment instrument with measurable answers.

The primary research method used in the scientific study of gamification was qualitative research methods. A thorough grasp of the effects of gamification on science education has been made possible by the integration along with evaluation of qualitative evidence from past research, which was made possible by the systematic literature review (SLR) techniqu (Liu, Geertshuis and Grainger, 2020).

As stated by Liu et al. (2020), the research methodology used in the study of formal and casual scientific learning activities was mixed-methods research. However, the survey research had quantitative information from 128 specialists; the addition of qualitative components allowed for a more complete examination of the relationships among exercise objectives, age, and gender.

Along with mental health and cognitive aptitude, other impacts include emotional stability and mental health. The research highlights how important it is to assess kids' psychological and emotional welfare in the post-pandemic environment, in addition to how digital technology is changing education (Reich, 2020).

3.3. Age and gender disparities in science education

As per Starkey (2020), extensive research on the function that age and gender play in science education reveals complex relationships that affect students' participation in informal learning environments and education. The study provides insight into the diversity of interests and involvement in science-related pursuits, as well as illuminating unique trends seen across a range of age and gender demographics. Age has a big impact on the kinds of scientific learning exercises that are used. While there is a wide range of disciplines taught to young children, computer science is a must.Gender differences have a big influence on participation patterns in scientific education courses. Research indicates that females are far more inclined than boys to participate in scientific exploration activities that delve into a broader range of scientific subjects, including physics, chemistry, biology, and the arts. However, males do so far more frequently than women when it comes to skill development, especially in IT courses (Suartama, Setyosari and Ulfa, 2019).

According to Sless (2019), the literature also supports larger-scale research to improve the generalizability of results and recognises the basic flaws in the sampling technique. The use of technology to augment scientific education signifies a profound transformation in pedagogical methodologies. A paradigm change is occurring in scientific education as a result of the growing integration of technological resources and platforms, which improves accessibility, involvement, and learning results all around. This is a sophisticated technological development that utilises virtual labs, interactive simulations, and learning management systems (LMS). Technology also overcomes resource and geographic constraints to provide students access to a vast array of learning opportunities.

With the use of internet platforms, instructional information may be shared outside of conventional classroom environments. This kind of participation is essential to guaranteeing that the best scientific knowledge is distributed fairly, especially to underprivileged or isolated populations. The creation of collaboration and communication technologies improves the interactive element of scientific education even further. Students may simulate scientific study and issue-solving methods via group projects, virtual collaboration, and real-time conversations (Selwyn, 2020).

3.4. Research Techniques

As per Tondeur et al. (2019), the various research approaches used in the aforementioned studies demonstrate heterogeneity, which is consistent with the unique characteristics of each study. A descriptive, integrating correlation research approach was used in this study to examine learners' behavioural intelligence and its relationship to academic accomplishment. In addition to a psychosocial ability assessment instrument, learning data were obtained from math and science teachers for this sample of 215 upper-level students. An structured review of the literature utilising the PRISMA paradigm was carried out within the context of collaboration in scientific education.The research methodologies used in the published papers differed to meet the specific goals of every inquiry. The study used a quantitative research technique to investigate students' emotional intelligence and its relationship to academic performance. This methodology facilitated the methodical acquisition of numerical information via the use of a personality assessment instrument with measurable answers and ratings for academic achievement. 128 experts provided quantitative data for the survey research, but the addition of qualitative components allowed for a more thorough examination of the relationships between exercise objectives, age, and gender (Vlachopoulos and Makri, 2019).

3.5. Research theory

As stated by Yakubu and Dasuki (2019), several studies used a combination of quantitative and qualitative research techniques, all of which fell in line with the particular goals of each study. The study used a quantitative research approach to examine children's mental capacity and how it relates to academic success. This method facilitated the systematic gathering of numerical data by using evaluations of academic success and a behavioural assessment instrument with measurable answers.

The primary research method used in the scientific study of gamification was qualitative research methods. The integration and analysis of qualitative data from earlier studies, made feasible by the SLR (systematic literature review) approach, have allowed for a complete understanding of the impacts of gamification on scientific educatio (Fletcher et al., 2020).

Mixed-methods research was the approach used in the study of informal and non-formal scientific learning activities. Nevertheless, the survey study included quantitative data from 128 experts; the inclusion of qualitative elements permitted a more thorough analysis of the connections between exercise goals, age, and gende (Fletcher et al., 2020).

4. Results And Findings

4.1. Results

The results of the many research support the stated goal statements and provide information on how technology, mental capacity, and scientific education interact. The study revealed a variety of results when investigating how a technology-driven, multiple-intelligence strategy affects students' scientific learning. Two fundamental abilities emerged from the analysis of emotional intelligence: social ability (interpersonal competence) and personal ability (intrapersonal competency). Both have shown to be crucial for improving students' grasp of scientific ideas and their awareness of the connections between science and societal challenges. The study recognized the limits of academic performance statistics. It emphasized the need for more trustworthy assessments as well as further investigation into emotional intelligence in relation to gender and educational attainment. Over eight years, the inquiry into gamification in scientific education yielded important insights into its use (Darby and Lang, 2019).

As stated by Liu et al. (2020), the research of technology-based educational initiatives divided the findings into four categories: technology access, computer-based learning, online teaching, and technology-enabled behavioural changes. Although the results addressing the availability of technology were inconsistent, positive benefits were seen at higher education levels. CAL demonstrated increases in computer proficiency at the K to 12 level, but had very little impact on the formation of cognitive abilities. Online courses and behavioural therapy have demonstrated promise in certain circumstances. The review emphasised the need to examine ed-tech interventions and their effects on the development of noncognitive and cognitive abilities with more detail. All things considered, the findings highlight the intricacy of the connections between scientific learning, technology, and behavioural intelligence as well as the need of more study to close knowledge gaps and enhance didactic approaches.

4.2. Analysis

Findings from several studies provide a solid basis for discussion, shedding light on the complex connections between science and technology, mental capacity, and scientific education. One of the key elements of games that has been shown to affect learning outcomes, motivation, and overall engagement is competition. The study did, however, draw attention to the necessity for more thorough research to bridge knowledge gaps on teaching methods and game elements and fully comprehend the impacts of gamification on learning (Alam, 2022).

According to Segura, Zamar and Moro (2020), important information was obtained from preservice teachers' attitudes on the usage of technology. The panellists acknowledged the usefulness of technology in the classroom, emphasising how it improves student engagement, helps convey information graphically, and facilitates collaboration with administrators. Integration was hampered by scheduling constraints, funding issues, and concerns mainly about parental involvement and security. The need of addressing internal as well as external obstacles to ensure successful technology integration in educational settings was highlighted by this study. The research of technology-based educational initiatives divided the findings into four categories: technology access, computer-based learning, online teaching, and technology-enabled behavioural changes. Although the results addressing the availability of technology were inconsistent, positive benefits were seen at higher education levels. CAL demonstrated increases in computer proficiency at the K to 12 level, but had very little impact on the formation of cognitive abilities. Online courses and behavioural therapy have demonstrated promise in certain circumstances (Liu, Geertshuis and Grainger, 2020).

4.3. Findings

Findings from several studies provide a solid basis for discussion, shedding light on the complex connections between science and technology, mental capacity, and scientific education. Every study offers something different, and a comprehensive analysis of these results enables a nuanced comprehension of the consequences of teaching methods. The research on multiple intelligences and technology-powered science learning methodologies highlights the critical role that emotional intelligence plays in improving students' comprehension of scientific topics. The two competencies that have been established are social ability (interpersonal competence) and personal ability (intrapersonal competency). These competencies highlight the significance of social skills, self-awareness, motivation, self-regulation, and empathy in scientific education. These components support Goleman's concept of emotional intelligence by highlighting the complex relationships among the abilities necessary for effective learning (Fletcher et al., 2020). Gamification in scientific education is showing promise as a means of enhancing students' motivation, engagement, and learning results. The study's characterization of important gaming components—like competition—highlights how they influence the development of fruitful learning experiences. Technology integration in the classroom has pros and cons, according to preservice teachers. Participants believe that technology may boost engagement, help students understand the material, and foster cooperation, but money, equipment, and scheduling difficulties must be addressed. The worries about parental engagement and security emphasise the need of considering external issues that may impact classroom healthy technology integration. After reviewing educational intervention groups, categories clarify the pros and cons of different techniques. Despite conflicting findings, tertiary technology access is positive and implies a larger role for advances in later education. K–12 computer-assisted learning (CAL) improves computer skills but not cognitive skills (Garrido, Pardo and Guerrero, 2022).

As per Dang et al. (2021), online courses including technology-enabled behavioural interventions have shown promise, highlighting the need for domain-specific education. These contradicting results show the necessity for a comprehensive educational strategy that respects learning complexity. In order to create a multicultural and productive learning environment, it is essential to develop interesting scientific learning objectives for different audiences, use technology, and be aware of emotions. The findings of this research highlight how critical it is to eliminate obstacles and improve instructional methods in order to effectively include interpersonal as well as technical abilities into scientific education. It is necessary to do research in each and every one of those domains in order to improve learning and teaching for children of all different ethnic backgrounds and at all different education levels.

5. Conclusion

The rising quantity of research on the effects of intellectual ability on well-being and achievement in academia lends credence to the notion that cognitive ability is one of the most important factors. There are a variety of activities that might be used to teach science to different student groups, according to research that was conducted on scientific education both in official and informal settings. Age and gender are two factors that need to be taken into consideration while in the process of establishing inclusive programming that caters to the diverse interests and educational goals of pupils. Inclusion is necessary in order to provide a learning environment that is both rewarding and stimulating. It is possible to provide light on the development of technology integration by considering the perspectives of preservice teachers. During the process of improving scientific education, it is important to take into consideration the fundamental variables that have been highlighted by the combined results of several studies. When it comes to academic achievement, it is often assumed that self-worth, independence, & social skills are essential components. Clearly, this indicates how difficult these talents are to master. They call attention to lingering concerns that have to be solved in order to assure its acceptance, while at the same time emphasising the benefits that it might provide. In order to close these gaps and make full use of the educational advantages that technology has to offer, fully integrated systems need to address concerns around parental engagement and security. In the course of evaluating technology-enhanced training, numerous important characteristics have been discovered. In the field of education, technology is being used at a rate that has not been seen before. Understanding the advantages and disadvantages of the various techniques is of the utmost importance.

6. Suggestions for future research

In order to make the most of scientific education, inclusive methods for the use of technology should be developed. These strategies should address budgetary restrictions and ensure that everyone has equal access. It's possible that helping students develop their self-awareness, empathy, and intellectual skills can improve their learning outcomes. An individual's gender and age are taken into consideration throughout the process of personalised learning, which fosters devotion and variety. In order to keep up with the ever-changing demands of both pedagogy and technology, educational materials have to be evaluated and updated as well. Putting an emphasis on teacher training might make it simpler and more compassionate for educators to use technology with students who have various ways of learning.

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