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Research Article

The influence of augmented reality on creativity, student behavior, and pedagogical strategies in technology-infused education management

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In the ever-changing sector of education, the use of technology has become critical to innovation and increased learning opportunities. This research illustrates the intricate connections that exist between augmented reality [AR] and tremendous educational attributes, thinking about how AR might modify conventional teaching approaches. The important motive is to offer an entire knowledge of how augmented fact influences crucial areas of the educational revel in. Utilizing a quantitative studies method, the study seems at how AR impacts pupil behavior, creativity, and instructional practices, in addition to the mediating and moderating elements that influence these relationships. An online questionnaire was used to collect data from 444 random samples. The relationships between AR, teacher competence, technology acceptance, and educational outcomes were examined. Data shows that augmented reality has a positive effect on creativity, student behavior, and teaching strategies. Teacher competence moderated these relationships, highlighting the critical role of teachers in successfully integrating augmented reality, while technology acceptance emerged as a significant mediator demonstrating the significance of user perceptions. This study has critical implications for educators, administrators, and policymakers interested in using AR to improve instructional development, as well as for the field of generation-infused schooling administration. Additionally, it advances theoretical frameworks through a better understanding of the complicated tactics that impact the uptake and acceptability of AR.

Keywords: Augmented reality; Creativity; Student behavior; Pedagogical strategies; Technology acceptance; Teacher competence

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1. Introduction

Augmented reality [AR] is one of the most fascinating new technologies, with potentially transformative consequences for both educators and students (Teo et al., 2022a). As classrooms develop into immersive digital environments, the potential consequences of AR on creativity, student behavior, and instructional techniques are becoming increasingly crucial to examine. This research investigates how technology-enhanced education management interacts with the complex

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dynamics of AR to explain how AR influences student behavior, stimulates innovation, and redefines teaching methodologies. Through a thorough examination, this study aims to give important insights for educators navigating the frontiers of augmented learning experiences, while also improving our understanding of the intricate relationships between AR and educational outcomes (Hu et al., 2021).

The use of augmented reality in the classroom is starting to change teaching methods, student behavior, and creativity in a big way. Virtual reality [VR] provides immersive, interactive experiences that surpass traditional learning constraints, so serving as a catalyst in the realm of creativity (Vocke et al., 2019). It helps students visualize abstract concepts, fostering a dynamic environment that supports creative thinking and problem-solving skills. Similar effects on student behavior are caused by AR, which modifies the dynamics of involvement and participation (O'Connor & Mahony, 2023). Students' attention is drawn to the dynamic and gamified elements of AR applications, which promotes involvement and group projects. In addition, AR transforms teaching practices by bringing experiential and contextual learning (Malaquias & Malaquias, 2021). Educators use augmented reality to develop dynamic lessons that provide students with real-world applications of academic information. As a result, traditional teaching methods are being replaced by more student-centered and inquiry-based approaches.

The effects of integrating AR into teaching were investigated by Tatarinova et al. (2022), who found that students' innovative thinking significantly improved. The results of (Georgiou & Kyza, 2018), who noted improvements in student motivation and engagement in AR-enhanced learning environments, were corroborated by this. Furthermore, Jadán-Guerrero et al. (2020) found that students had higher levels of linguistic originality when they looked into the impact of AR on language learning. Research by de Giorgio et al. (2023) demonstrated revolutionary shifts in pedagogical practices beyond the viewpoint of the student, pointing to a shift toward more student-centered and inquiry-based teaching methods made possible by AR applications. Although the impact of AR on creativity, student behavior, and pedagogical tactics has been fundamentally understood by these studies, there is still a significant vacuum in the full examination of the mediating function of technological acceptance and the moderating influence of teacher competency.

Despite advances in understanding the overall influence of augmented reality on education, there is a major research gap in determining the intricate interplay between technology acceptability, teacher competence, and the transformative potential of augmented reality. Existing research focuses on the direct impact of augmented reality on educational results, leaving unexplored the mechanisms by which users, particularly educators, understand and use this revolutionary technology (Buchner & Kerres, 2023). The significance of technological acceptability in shaping the linkages between AR and creativity, student behavior, and instructional practices is still largely unknown. Furthermore, Catala et al., (2022) research recognize the importance of teacher competence in technology adoption, the specific moderating impact of teacher competence on the link between AR, technology acceptance, and educational results warrants further investigation. This study tries to fill that void by giving a full knowledge of the intricate dynamics that determine the successful integration of augmented reality in education.

This study's main goal is to look at the complex effects of AR on student behavior, creativity, and pedagogical approaches in technology-enhanced education management. The study aims to reveal the revolutionary potential of AR in changing the face of education and improving important aspects of the learning process through an extensive investigation. The objective of the study are as follows:

- To assess the impact of Augmented Reality on creativity
- To examine the influence of Augmented Reality on student behavior
- To analyze the impact of Augmented Reality on pedagogical strategies
- To investigate the mediating role of technology acceptance
- To explore the moderating role of teacher competence

This study contributes significantly to the field of technology-infused school administration by providing a comprehensive knowledge of Augmented Reality's revolutionary potential. By thoroughly investigating the impact of augmented reality on creativity, student behavior, and pedagogical tactics, the study not only adds to the current body of information but also offers insight on the mediating function of technology acceptance and the moderating influence of teacher competency. The study's findings have practical consequences for educators, administrators, and legislators, since they provide actionable insights for effective AR integration into educational practices. Furthermore, the study refines our understanding of how emerging technologies interface with education by contributing to theoretical frameworks by revealing the complex dynamics that regulate the acceptability and utilization of AR. With augmented reality developing becoming a dynamic tool in the toolbox of education, this research provides direction for educators who are venturing into the frontiers of creative, tech-driven pedagogy.

2. Literature Review

2.1. Supportive Theory: Technology Acceptance Model

The Technology Acceptance Model [TAM], developed by Davis (1989), serves as the theoretical basis for this study, clarifying the elements influencing individuals' acceptance and adoption of technology. TAM is built on two pillars: perceived ease of use [PEOU] and perceived usefulness [PU] (Antonietti et al., 2022). TAM is very important in this context since it focuses on educators' and students' intents to use Augmented Reality into their teaching and learning processes. thought ease of use is an important component in determining how user-friendly AR is thought to be, whereas perceived utility addresses the value and benefits of incorporating AR into educational activities (Ponzoa et al., 2021). The study's focus on the integration of augmented reality in education is in perfect alignment with TAM's relevance to the field of educational technology and its emphasis on user-centered viewpoints. By utilizing TAM, the research may methodically investigate how educators and students view augmented reality, assess its applicability and usability, and offer insightful information on the variables affecting the effective uptake of AR technology (Andrews et al., 2021). This user-centric approach makes it possible to compare and contrast various user groups, including students and educators, which helps to provide a more nuanced understanding of the ways in which AR acceptability differs among these cohorts.

2.2. Augmented Reality and Creativity

In recent years, augmented reality has emerged as a promising new tool for educators, with the potential to significantly spark students' originality. According to Benvenuti et al., (2023) study it has been suggested that bringing digital information into the real world can help foster more innovative and problem-solving mindsets. Numerous research has looked at the correlation between AR use in the classroom and increased creativity. For example, pupils' ability to think creatively was found to rise dramatically in a study conducted by Al-Fadalat and Al-Azhari, (2022) in which AR was employed during a lecture. Students had a more thorough understanding of complex topics and were inspired to explore those topics imaginatively thanks to the interactive and immersive nature of augmented reality environments. Catala et al., (2022) also investigated the impact of augmented reality on linguistic imagination. The study found that students who participated in language challenges aided by augmented reality were more likely to display linguistic creativity than those who did not. AR applications' dynamic and interactive features encouraged students to express themselves in new ways and improved their language skills by involving them in language activities. Moreover, in the AR-creativity nexus, the notion of "flow," as put forward by Arulanand et al. (2020) becomes significant. AR environments can encourage a state of flow that fosters creative thinking by providing tasks and feedback that are appropriate for the ability levels of its students. Students are encouraged to fully immerse themselves in the learning process in this state of optimal engagement, which fosters increased creativity.

H1: *Augmented Reality has a significant and positive impact on creativity.*

2.3. Augmented Reality and Student Behavior

Augmented Reality has received a lot of interest in education because of its potential to influence not just learning outcomes but also student behavior in the classroom. AR apps, due to their interactive and immersive nature, provide a unique route for developing good behaviors and engagement. Qiu and Luo (2022) study investigated how AR affected students' motivation and engagement. According to their findings, AR treatments improved student behavior by raising motivation levels and encouraging a more engaged and dynamic learning environment. Increased student engagement was found to be mostly attributed to the dynamic and interactive elements of augmented reality content. Goo et al. (2020) integrated augmented reality into a science curriculum. Students' conduct changed, according to the researchers, and they showed a stronger preference for exploratory and collaborative learning. Students' interpersonal behaviors and sense of collective responsibility were positively impacted by the use of augmented reality in group activities and cooperative problem-solving. Moreover, López-Faican and Jaen (2023) research has shown that the concept of gamification, when applied to augmented reality applications, has a notable impact on student conduct. Gamification elements that support motivation and attention span include rewards, challenges, and progress tracking. Students who receive educational content in an augmented reality context that has been gamified are more likely to exhibit behaviors that point toward active involvement.

H2: *Augmented Reality has a significant and positive impact on student behavior.*

2.4. Augmented Reality and Pedagogical Strategies

With its ability to provide fresh methods for involving students and enhancing the learning process, augmented reality has shown itself to be a promising instrument for transforming educational processes. de Giorgio et al. (2023), and Radu and Schneider (2023) have examined the integration of augmented reality (AR) in many educational contexts, providing insights into its influence on pedagogy. Kok et al. (2022) created interactive learning environments for scientific education through the use of augmented reality. The researchers found that AR-enabled pedagogical strategies helped students shift from traditional, lecture-based instruction to more student-centered, inquiry-based learning approaches, in addition to improving their understanding of complex scientific subjects. The concept of situational learning proposed by Garzón et al. (2020) is congruent with AR's ability to improve pedagogical approaches. AR applications can provide contextually rich learning opportunities that allow students to apply their theoretical knowledge in real-world circumstances. This supports the premise that learning occurs most effectively in the context in which it will be applied. AR also encourages experiential learning concepts (Arulanand et al., 2020). AR promotes active learning and hands-on experiences by allowing students to interact with digital content that is overlaid on top of the physical world. This instructional technique allows students to develop their understanding by direct participation, resulting in a richer and more meaningful learning experience. Yang and Yang (2022) investigated the impact of augmented reality on collaborative learning. The research found that AR-enabled collaborative activities not only improved cooperation but also promoted knowledge exchange and peer engagement. These findings highlight the potential of augmented reality to support collaborative instructional practices, allowing educators to move beyond standard classroom arrangements. Moreover, differentiated instruction is in line with AR's capacity to adjust to diverse learning styles (Radu et al., 2023). Because AR apps may be customized to a user's choices, teachers can design individualized learning programs that meet the requirements and skill levels of a wide range of students.

H3: *Augmented Reality has a significant and positive impact on pedagogical strategies.*

2.5. Technology Acceptance as a Mediator

The successful implementation of Augmented Reality in educational settings is dependent not only on AR's technological capabilities, but also on user acceptance of this technology. Understanding the function of technological acceptability in mediating AR's influence on creativity in educational contexts is critical (McLean & Wilson, 2019). Perceived usefulness and simplicity of use have a big influence on how well users accept a technology, according to TAM (Cabero-Almenara et al., 2019). Regarding augmented reality in the classroom, these variables operate as a moderator in the connection between the application of AR and the development of creativity. Catala et al. (2022) research has looked into the role of technological acceptability in mediating the AR-creativity nexus. Matsika and Zhou (2021) discovered that students' positive judgments of the ease of use and utility of AR applications in the learning process mediated the association between AR use and greater creativity. Students were more inclined to engage creatively with AR when they regarded it to be user-friendly and helpful for learning. Faqih (2022) investigated the influence of augmented reality on creativity within a higher education context, stressing the intermediary function of technology adoption. According to the study, students were more likely to demonstrate improved creative thinking if they embraced augmented reality technology. AR use and creativity have a favorable connection, however this relationship is influenced by perceptions of usefulness and ease of use, which operate as mediators.

H4: *Technology acceptance mediate the relationship between augmented reality and creativity.*

Ronaghi and Ronaghi (2021) evaluated the impact of augmented reality on student engagement and collaborative behaviors. Positive opinions of AR's simplicity of use and utility were found to moderate the association between AR use and higher student involvement in the study. Students who considered AR useful and useful were more likely to participate actively in collaborative learning activities. In a similar vein, Grodotzki et al. (2023) investigated the mediating function of technology adoption in relation to AR-enhanced language acquisition. The study indicated that students' positive views of AR's utility and convenience influenced its effect on language acquisition. Augmented reality-using students had better language learning habits. The mediating role of technological acceptance helps explain student behavior and AR (Radu et al., 2023). Positive AR perceptions improve students' attitudes, which affects their behavior. If augmented reality is user-friendly and beneficial for learning, students are more likely to participate actively and cooperatively.

H5: *Technology acceptance mediate the relationship between augmented reality and student behavior.*

Teo et al. (2022) researchers investigated the impact of augmented reality on instructors' practices in the classroom. Teachers' perceptions of AR's usability and convenience were found to influence the relationship between AR adoption and its incorporation into instructional activities. If they found augmented reality to be useful and simple to implement, educators were more likely to incorporate technology into their lessons (O'Connor & Mahony, 2023). Similarly, Bursali and Yilmaz (2019) explored the role of technological adoption as a moderator in the context of AR-enhanced science education. According to the findings, teachers' positive opinions of the ease of use and utility of AR mediated the association between AR use and the adoption of inquiry-based pedagogical practices. Teachers who saw AR as a helpful tool were more likely to use innovative and student-centered teaching techniques (Nortvig et al., 2020). Teachers' competence to adopt and use new teaching methods is influenced by their positive opinions of augmented reality, according to the mediating function of technological adoption in the interaction between pedagogical tactics and AR (Dai et al., 2022). Teachers are more likely to incorporate augmented reality into their pedagogical practices and create a more dynamic and engaging learning environment when they believe that AR is user-friendly and good for students' learning.

H6: *Technology acceptance mediate the relationship between augmented reality and pedagogical strategies.*

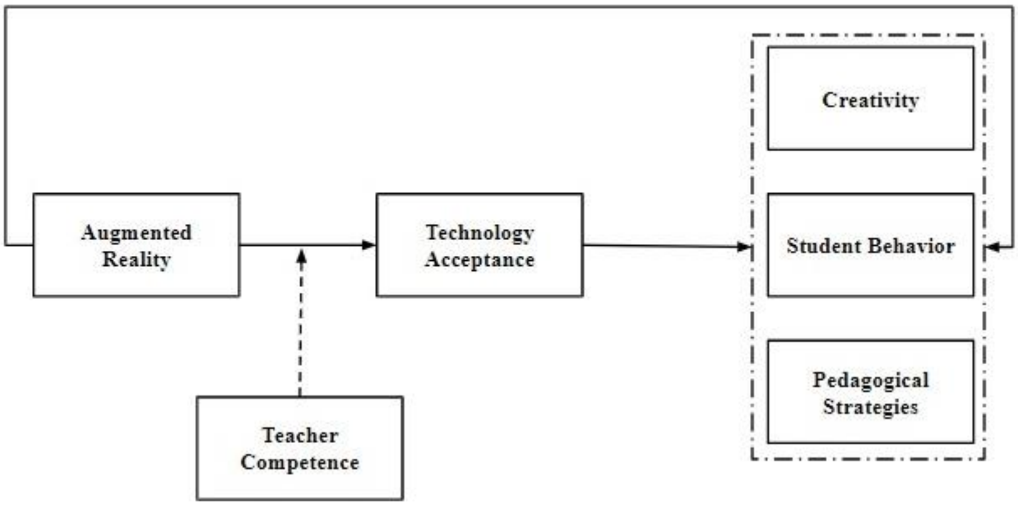
2.6. Teacher Competence as a Moderator

Catala et al. (2022) examined the use of augmented reality in the classroom and the moderating effect of teacher competency. According to the study, educators who possess a higher degree of technological proficiency have a greater probability of surmounting certain obstacles related to using augmented reality, hence promoting greater use of technology. In this instance, the relationship between the adoption of AR technology and its utilization was tempered by teacher competence (Antonietti et al., 2022). Teachers' competencies and knowledge are critical in influencing their views about augmented reality, as evidenced by the moderating impact of teacher competency in the relationship between AR and technological acceptability (Silva et al., 2023). Instructors who possess greater degrees of competency are probably going to feel more comfortable utilizing augmented reality technologies, overcoming obstacles along the way, and ultimately enjoying a higher level of technology acceptance.

H7: *The relationship between Augmented Reality, creativity, student behavior and pedagogical strategies is moderated by teachers' technological competence and this moderating effect is mediated by the technology acceptance.*

Based on above literature we developed the following conceptual framework as shown in Figure 1.

Figure 1
Conceptual Framework



3. Methodology

This study adopted a quantitative research design to systematically explore the multifaceted impact of Augmented Reality on creativity, student behavior, and pedagogical strategies within the context of technology-infused education management. The research population encompassed educators and students engaged in diverse educational settings where AR integration was plausible, reflecting a broad spectrum of experiences. The sample size determination adhered to the rule of thumb for large-scale studies, ensuring statistical robustness, and was established at 444 participants to achieve a representative and reliable dataset. To ensure a representative sample, a random sampling technique was employed, drawing participants from various educational institutions and levels. This approach enhanced the generalizability of the findings and captured the diversity inherent in educational contexts. Participants were selected based on their involvement in AR-enhanced learning experiences, ensuring relevance to the study's objectives. Data collection was conducted through an online questionnaire, leveraging the accessibility and efficiency of digital platforms. The questionnaire was meticulously designed to gather comprehensive insights into participants' perceptions of AR, examining its impact on creativity, student behavior, and pedagogical strategies. The survey instrument incorporated validated scales to measure creativity, student behavior, technology acceptance, and teacher competence. The collected data underwent rigorous analysis using Advanced Structural Equation Modeling (AMOS) software version 25.0. This robust statistical approach enabled a sophisticated examination of the relationships between variables, allowing for the exploration of direct and indirect effects. Specifically, AMOS facilitated the testing of structural models, offering insights into the mediating role of technology acceptance and the moderating influence of teacher competence.

3.1. Instrument

The items of variables were adopted from previous research: Technology acceptance and teacher competence has 5 items taken from Silviyanti and Yusuf (2015), and Cattaneo et al. (2022) respectively. The four items for Pedagogical Strategies were taken from S.-H. Liu (2011). Student behavior and Creativity also has 5 items adopted from Abbas et al. (2019) and AlMarwani (2020) studies respectively and finally 6 items for augmented reality were adopted from Campo et al. (2023) research.

4. Results

We utilized AMOS 25.0 software to conduct structural equation modeling (SEM) in order to validate the proposed measurement and structural model of the study. The motivation for utilizing AMOS SEM stems from its robust capabilities in conducting concurrent factor analysis and regression analysis, as highlighted by (Sarstedt et al., 2017). Initially, we performed confirmatory factor analysis [CFA] using AMOS 25.0 software to validate the adequacy of fit indices for the suggested measurement model. In order to accomplish this, six factors, namely augmented reality [AR], creativity [C], student behavior [SB], pedagogical strategies [PS], technology acceptance [TA], and teacher competence [TC], were interconnected and examined using confirmatory factor analysis. The findings of CFA demonstrated that the proposed measurement model is deemed acceptable and produced an outstanding fit. Furthermore, the model's fitness values align with the cut-off criteria established by Hair et al. (2014). The CFA results for the current investigation validate the model fit indices, as shown in Table 1.

4.1. Reliability and Validity of the Constructs

In addition to this, we followed the recommendations made by Hair et al. (2014), and Fornell and Larcker (1981) regarding how to determine the validity and reliability of scales. For the purpose of conducting a reliability and validity analysis, we examined Cronbach's alpha [CA], composite reliability [CR], average extracted variance [AVE], and item loading [IL]. The findings indicate that all of the variables have reached the minimum value requirements for reliability and validity. The fact that the values of IL (0.601–0.926), CA (0.781– 0.923), CR (0.784–0.925), and AVE (0.582–0.742) are all higher than their respective cut-off thresholds is evidence that all of the measurements are reliable (see Table 2 for more information). In addition to that, the method developed by Fornell and Larcker, (1981) was applied in order to examine the discriminating validity of the scales. The findings showed that the square root for AVE is larger than the values of intercorrelations of the research variables, which demonstrates that the scales have outstanding discriminant validity. This was found to be the case for each of the constructs. There are two methods that are used in AMOS for measuring the validity of the instruments. We determined the measurement model by conducting a test of the convergent validity proposed by Sarstedt et al. (2016). Specifically, we looked at the values of average variance obtained (>.5) and composite reliability (>.7). As can be seen in Table 2, each of the transactions satisfied the specified minimum, and as a result, the convergent validity of the data was confirmed.

Table 1
Model Fit Indices

Fitness Indices	*Measure*	*Measurement Model*	*Structural Model*	*Threshold Values*
Chi-square/df [CMIN/DF]	CMIN/DF	2.632	1.963	<3.00
Comparative fit index	CFI	0.953	0.983	>0.95
Standardized root mean square residual	SRMR	0.067	0.063	<0.08
Root-mean-square error of approximation	RMSEA	0.072	0.068	<0.06
p-value	*p*-Close	0.052	0.058	>0.05

Table 2
Properties of Measurement Model

Latent Construct	*Items Range*	*CA*	*CR*	*AVE*
AR	0.675-0.757	0.923	0.925	0.587
C	0.684-0.819	0.910	0.912	0.732
SB	0.675-0.823	0.781	0.784	0.582
PS	0.696-0.862	0.863	0.865	0.682
TA	0.601-0.753	0.868	0.869	0.714
TC	0.862-0.926	0.895	0.898	0.742

Note: AR: Augmented Reality; C: Creativity; SB: Student Behavior; PS: Pedagogical Strategies; TA: Technology Acceptance; TC: Teacher Competence.

4.2. Hypotheses Testing Results

The findings of the Confirmatory Factor Analysis for the structural model indicate that the model fits well and meets the required criteria for model fitness, as suggested by Hair et al., (2014). The findings from the confirmatory factor analysis validate that the model fit indices match the established criteria (see Table 1). The standardized path values were estimated in the subsequent stage, after the verification of the goodness of fit indices of the structural model using the maximum likelihood approach in AMOS 25. Prior to examining the mediation effects, we evaluated the direct associations. The findings indicate a favorable correlation between augmented reality and creativity ($\beta = 0.480$, $p < .01$), therefore providing support for hypothesis H1. Similarly, the findings indicate a favorable correlation between augmented reality and student behavior ($\beta = 0.288$, $p < .01$), as well as pedagogical strategies ($\beta = 0.531$, $p < .01$), providing support for hypotheses H2 and H3, respectively. Furthermore, our model encompasses four inherent constructs: creativity, student behavior, educational tactics, and technological adoption. The coefficient of determination (R2) for creativity was 0.221 (Q2 = .375), for student behavior it was 0.121 (Q2 = .316), for pedagogical strategies it was 0.246 (Q2 = .264), and for technological acceptance, it was 0.309 (Q2 = .259). These values imply that the predictors can account for 22%, 12%, 26.1% and 30.9% of the variation in the relevant variables. Values of Q2 greater than zero suggest that there is enough predictive relevance.

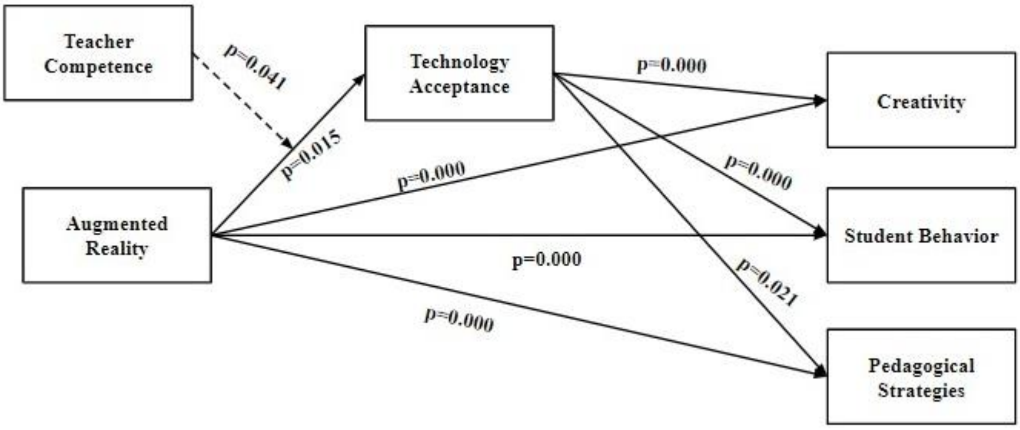
Furthermore, in order to evaluate the mediating connections, three mediating interactions were suggested. The purpose of these links was to examine the mediating impacts of technological acceptability on the interactions between augmented reality, creativity, student behavior, and educational techniques. The mediation testing results are displayed in Table 3. In order to examine the mediation impact, we employed the bootstrapping technique to assess the indirect effect (Preacher et al., 2008). We conducted 5,000 resamples to validate the mediation hypotheses H4, H5, and H6. The statistical analysis reveals that the indirect effects of AR → TA → C ($\beta = 0.147$, $p = .000$), AR → TA → SB ($\beta = 0.374$, $p = .000$), and AR → TA → PS ($\beta = 0.285$, $p = .000$) are all statistically significant. This provides evidence for H4, H5, and H6, as indicated in Table 3. In addition to this, the result of moderation analysis shows that teacher competence significantly moderates the relationship between augmented reality and technology acceptance ($\beta = 0.101$, $p = .041$). Hence H7 is supported.

Table 3
Path Analysis

		Estimates	*SE*	*p*	*Decision*
H1	AR → C	0.480	0.054	.00	Accepted
H2	AR → SB	0.288	0.047	.00	Accepted
H3	AR → PS	0.531	0.053	.00	Accepted
H4	AR → TA → C	0.147	0.035	.00	Accepted
H5	AR → TA → SB	0.374	0.048	.02	Accepted
H6	AR → TA → PS	0.285	0.048	.00	Accepted
H7	TC *x* AR → TA	0.101	0.049	.04	Accepted
Endogenous Variables		*C*	*SB*	*PS*	*TA*
R2		0.221	0.121	.261	0.309
Q2		0.375	0.316	.264	0.259

Note: AR: Augmented Reality; C: Creativity; SB: Student Behavior; PS: Pedagogical Strategies; TA: Technology Acceptance; TC: Teacher Competence.

Figure 2
Path Model



5. Discussion

Through the discussion, we explore creativity, student behavior, and pedagogical strategies, resulting in immersive and engaging learning experiences that blur the boundaries of traditional education. AR's throbbing heartbeat resonates not only with technological marvel, but also with the promise to alter how we think about, engage with, and impart knowledge. This conversation weaves together the threads of innovation, acceptance, and instructor competence in the fabric of a shifting educational landscape.

The results of this study provide strong evidence in favor of H1, which states that integrating augmented reality into learning environments significantly and favorably affects creativity. The discovered positive association is consistent with the body of literature that highlights AR's ability to foster students' critical thinking and problem-solving abilities. In Tzima et al.'s (2020)study, for example, students used augmented reality in a lesson, and the results showed a significant improvement in their capacity for creative thought. Students can visualize abstract topics thanks to the immersive and interactive nature of augmented reality environments, which promotes deeper learning and encourages creative inquiry (Arulanand et al., 2020). AR produces a state of flow favorable to creative thinking by presenting dynamic and interactive challenges. This result supports the notion that AR settings provide a unique platform for students to immerse themselves in the learning process, resulting in increased creative expression.

The study's findings firmly confirm hypothesis 2, showing that augmented reality has a major and beneficial influence on students' behavior in learning environments. The present discovery aligns with the research conducted by Bursali and Yilmaz (2019), who found that AR treatments had a significant positive impact on student motivation and engagement. AR content's dynamic and interactive elements have been found to be important factors in increasing student engagement, which results in more dynamic and participatory learning environments (Qiu & Luo, 2022). The observed favorable influence on student conduct is consistent with the gamification methods used in AR apps. Gamification components like incentives, challenges, and progress tracking help to enhance motivation and attention (Stammler et al., 2023). When educational content is provided in a gamified AR environment, students are more likely to display active involvement behaviors. Moreover, Heller et al.'s (2023) description of the behaviorist theory is congruent with the positive correlation between AR and student behavior. Applications for augmented reality can be made to offer quick feedback, rewarding good behavior and pointing students in the direction of a more proactive and involved approach to learning (O'Connor & Mahony, 2023). AR's built-in real-time feedback systems improve the learning environment and have a favorable behavioral impact on students.

The outcomes of this study substantially support H3, indicating that Augmented Reality has a significant and favorable impact on the instructional tactics used by educators. This finding is consistent with the findings of Radu & Schneider (2023), who discovered that AR-supported pedagogical strategies not only improved students' understanding of complex scientific concepts, but also aided in the transition from traditional, lecture-based teaching to more student-centered, inquiry-based learning approaches. Because AR adheres to the principles of contextual learning, it has a favorable effect on instructional practices (de Giorgio et al., 2023). Through contextually rich learning experiences offered by AR applications, students can apply their theoretical knowledge to real-world situations (Garzón et al., 2020). This supports the notion that learning happens best in the setting in which it will be applied, which promotes a move toward pedagogical approaches that are more experiential and applied. Furthermore, AR encourages active discovery and hands-on experiences by allowing students to interact with digital content layered on the physical world (Eswaran & Raju Bahubalendruni, 2023). This pedagogical approach enables students to construct their understanding by direct participation, resulting in a more profound and meaningful learning experience.

The study's findings strongly support hypothesis H4, suggesting that the relationship between augmented reality and creativity is significantly mediated by technology acceptability. This result is consistent with the Technology Acceptance Model, which suggests that users' acceptance of a technology is highly influenced by perceived utility and simplicity of use (Liu et al., 2017). In a classroom where augmented reality is seen favorably, both teachers and students are free to explore new avenues of thought. This confirms the findings of Ronaghi and Ronaghi, (2022), who discovered that the favorable associations between AR use and increased creativity were mediated by students' positive ratings of AR's ease of use and utility. The mediation of technological acceptance suggests that students are more likely to use AR creatively in classrooms where the technology has been implemented, underscoring the importance of addressing acceptability in fostering innovative thinking in AR-enhanced classrooms.

The study's findings firmly corroborate H5, which emphasizes the moderating effect that technology adoption has in the relationship between student conduct and augmented reality. This is consistent with the TAM's tenets, which emphasize that users' perceptions of a technology's usability and utility play a mediating role in their decision to adopt it Cabero-Almenara et al., (2019). The favorable effects of augmented reality on student behavior are examined via the perspective of technology adoption. Positive assessments of AR's advantages and usability are found to induce more engaged and participative behaviors. The results of Faqih (2022), who found that favorable assessments of AR's usability and convenience of use mediated the relationship between AR use and improved language learning practices, are in line with this finding. The relevance of user perceptions in affecting students' behavioral responses to AR technology in educational environments is highlighted by the mediation impact of technological acceptance.

The results show that technology adoption has a major mediating role in the relationship between instructional practices and Augmented Reality, and they firmly support H6. Based on the TAM, which suggests that perceived utility and ease of use mediate users' acceptance of a technology, the study shows that favorable perceptions of AR's usability and utility mediate its impact on educators' adoption of cutting-edge pedagogical strategies (Alyoussef, 2022). This is consistent with the findings of (Cabero-Almenara et al., 2019), who discovered that teachers' opinions of AR's ease of use and usefulness influenced the association between AR acceptability and AR incorporation into instructional practices. The technological acceptance mediation effect demonstrates that educators are more inclined to include AR into their teaching techniques when they consider it to be accessible and valuable, influencing the adoption of innovative pedagogical approaches (Catala et al., 2022).

The results of the study firmly corroborate H7, showing that teacher competency does, in fact, affect the relationship between students' adoption of technology and augmented reality in classroom settings. This supports the idea that teachers' comfort level with AR has a big impact on how they see and embrace the technology. Koutromanos and Kazakou, (2023) study indicates that teachers with higher levels of technological competence are better positioned to overcome potential challenges associated with AR implementation, leading to enhanced technology acceptance. This is in line with the TAM and is supported by (Scherer et al., 2019). This research emphasizes how important it is for teachers to be competent in influencing students' perceptions of augmented reality. Higher-level educators are more likely to negotiate the intricacies of AR integration effectively, positively affecting their acceptance of AR (Sorko et al., 2020). As AR evolves as an educational tool, emphasizing teacher competence becomes critical for cultivating a supportive environment in which educators are more open to the integration of innovative technologies, ultimately influencing the successful adoption and acceptance of AR within educational settings.

6. Conclusion

Within the context of technology-infused education management, this study has offered thorough insights into the complex effects of Augmented Reality on creativity, student behavior, and instructional practices. The theories are solidly supported by the empirical data, which shows that AR has a good impact on student behavior, creativity, and educational approaches. It has been demonstrated that technological acceptance plays a mediating function, emphasizing the importance of user perceptions in influencing the connections between AR and creativity, student conduct, and instructional practices. The study also demonstrates the significant moderating impact of teacher competency, highlighting the critical role that teachers' expertise plays in influencing students' adoption of AR technology. These findings add to the increasing body of knowledge on the use of augmented reality in educational settings, with important implications for educators, policymakers, and academics looking to improve technology-infused learning environments. Recognizing and addressing the characteristics revealed in this study will be critical for building a suitable educational landscape that harnesses AR's revolutionary potential in generating new and effective teaching methods as it evolves.

7. Implications

7.1. Practical Implications

The results of the current study have important practical implications for educators, administrators, and policymakers involved in technology-enhanced education administration. To begin with, the documented favorable impact of Augmented Reality on creativity shows that incorporating AR tools into the curriculum can serve as a powerful catalyst for encouraging creative thinking among students. AR applications can be used by educators to provide interesting learning experiences that inspire imagination and problem-solving skills. Recognizing the mediating function of technology acceptance also highlights the significance of professional development programs targeted at increasing educators' comfort and familiarity with AR tools. Putting investment into programs that train teachers can make it easier to incorporate augmented reality into the classroom, which will eventually affect how well AR technology is used. Recognizing the moderating influence of teacher competence also highlights the necessity of continuous assistance and resources to improve teachers' technical competence. It is recommended that educational institutions and policymakers integrate AR-oriented training modules and resources into professional development frameworks to enable teachers and guarantee the successful integration of AR in classrooms.

7.2. Theoretical Implications

This study contributes to the current literature by validating and expanding the applicability of the Technology Acceptance Model in the context of Augmented Reality in education. The established role of technological acceptance in mediating the relationship between AR and creativity, student behavior, and instructional practices expands our understanding of the complex dynamics impacting users' acceptance of AR. This increases TAM's importance in clarifying the interaction of user perceptions in the adoption of developing technologies in educational settings. Furthermore, by highlighting the complex role that teachers play in shaping students' adoption of technology, the moderating effect of teacher competency that has been shown enhances the theoretical frameworks that already exist. The study emphasizes how important it is to include teacher competency in technology acceptance models because it recognizes that teachers' knowledge and expertise have a big impact on how they feel about new technologies like augmented reality. These theoretical ramifications aid in the development and extension of existing models, providing a more thorough comprehension of the variables affecting the adoption and integration of AR in educational settings.

8. Limitations

While this study gives useful insights into the impact of Augmented Reality on creativity, student behavior, and instructional practices, numerous limitations should be acknowledged. To begin, the generalizability of the findings may be limited by the study's specific setting and sample characteristics. The study was done in a specific educational setting, and alterations in institutional circumstances or student demographics may affect the findings' application. Furthermore, the study relied on self-report measures, which may include response bias and social desirability effects. To give a more thorough grasp of the links studied, future study could benefit from utilizing a wider variety of assessment techniques, such as direct observation or objective performance measurements. Moreover, the research concentrated on immediate results; further investigation is needed to determine the long-term consequences of integrating AR in educational environments.

8. Future Directions

Several prospective research directions appear from the findings of this study. To begin, researching the long-term effects of Augmented Reality on creativity, student behavior, and pedagogical practices can provide a more thorough knowledge of AR's long-term influence in educational contexts. Longitudinal studies could follow the evolution of students' creative thinking skills and behavioral patterns over a long period of AR integration. Furthermore, investigating the significance of individual variations, such as learning preferences or technological readiness, could contribute to a more nuanced understanding of the elements driving AR acceptance and impact. Future studies could also focus on the development and assessment of particular augmented reality apps suited to various academic fields, taking into account the needs and goals of each subject. Furthermore, a more internationally informed viewpoint on the incorporation of AR technology in education would result from investigating the effects of AR in various cultural and socioeconomic contexts. Lastly, studies examining the best approaches for professional development and teacher training in integrating AR technology may offer useful information to educational establishments and legislators who wish to improve teachers' proficiency and use of this new medium.

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