Evaluating generative AI integration in Saudi Arabian education: a mixed-methods study

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Incorporating Generative Artificial Intelligence (GAI) in education has become crucial in contemporary educational environments. This research paper thoroughly investigates the ramifications of implementing GAI in the higher education context of Saudi Arabia, employing a blend of quantitative and qualitative research approaches. Survey-based quantitative data reveals a noteworthy correlation between educators' awareness of GAI and the frequency of its application. Notably, around half of the surveyed educators are at stages characterized by understanding and familiarity with GAI integration, indicating a tangible readiness for its adoption. Moreover, the study's quantitative findings underscore the perceived value and ease associated with integrating GAI, thus reinforcing the assumption that educators are motivated and inclined to integrate GAI tools like ChatGPT into their teaching methodologies. In addition to the quantitative analysis, qualitative insights from in-depth interviews with educators unveil a rich tapestry of perspectives. The qualitative data emphasizes GAI's role as a catalyst for collaborative learning, contributing to professional development, and fostering innovative teaching practices.

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Abstract:

Incorporating Generative Artificial Intelligence (GAI) in education has become crucial in contemporary educational environments. This research paper thoroughly investigates the ramifications of implementing GAI in the higher education context of Saudi Arabia, employing a blend of quantitative and qualitative research approaches. Survey-based quantitative data reveals a noteworthy correlation between educators' awareness of GAI and the frequency of its application. Notably, around half of the surveyed educators are at stages characterized by understanding and familiarity with GAI integration, indicating a tangible readiness for its adoption. Moreover, the study's quantitative findings underscore the perceived value and ease associated with integrating GAI, thus reinforcing the assumption that educators are motivated and inclined to integrate GAI tools like ChatGPT into their teaching methodologies. In addition to the quantitative analysis, qualitative insights from in-depth interviews with educators unveil a rich tapestry of perspectives. The qualitative data emphasizes GAI's role as a catalyst for collaborative learning, contributing to professional development, and fostering innovative teaching practices.

Keywords: Generative AI, Emerging Technologies, Computer Education, Statistics, Mix method.

1. Introduction

Since the 1980s, the emergence of artificial intelligence in education has signaled a transformative period in the field. It reflects the growing fascination among scholars with the fusion of technology and pedagogy (Sleeman & Brown, 1982). According to contemporary perspectives, artificial intelligence (AI) extends beyond mere technology, encompassing machine learning, neural networks, natural language processing, and various methods for replicating human cognitive functions (Baker & Smith, 2019; Akgun, 2022). Luckin et al. (2016) delve into the potential of Artificial Intelligence in Education (AIEd), emphasizing its capacity to enhance learning outcomes through personalized, flexible, and engaging educational experiences. AIEd not only benefits students but also aids educators in offering tailored support (Dolmark et al. 2021; Dolmark et al. 2022).

Machine learning, often abbreviated as ML, forms the foundation for both categories of artificial intelligence (AI). When integrated with other technologies, it can augment its capabilities and

42 reduce its dependence on human guidance, as noted by Akgun and Greenhow (2022). ML
43 algorithms have found diverse applications, such as delivering product or service
44 recommendations, recognizing faces, predicting academic performance, and detecting diseases
45 (Kabudi et al., 2021; Zhai et al., 2021). Furthermore, Luckin et al. (2016) stress the significance
46 of AI in real-world learning materials, as it provides assessments, insights into student progress,
47 and addresses achievement gaps. Ultimately, Luckin et al. (2016) assert that the benefits of AI in
48 education outweigh the challenges, making it a worthwhile pursuit.
49
50 Various capabilities have gradually evolved in artificial intelligence-driven by machine learning.
51 Among these capabilities is generative AI (GAI), whose roots trace back to the 1960s. However,
52 it was not until approximately 2014 that researchers notably focused on exploring GAI, as Gui et
53 al.'s (2023) research findings underscored. GAI is broadly defined as AI that can generate new
54 content based on input (Pavlik, 2023). Previous studies emphasize the significance of gaining
55 insights into teachers' viewpoints regarding implementing emerging technologies (Qahl and
56 Sohaib, 2023), as exemplified by extended reality (Kaplan-Rakowski et al., 2023b) and virtual
57 reality (Kaplan-Rakowski et al., 2023c). However, General Artificial Intelligence (GAI)
58 integration has received limited attention in the literature, with a few exceptions (Kuleto et al.,
59 2022). Despite the increasing popularity and accessibility of GAI tools, which could be attributed
60 to their relatively recent emergence, there remains a dearth of knowledge concerning teachers'
61 perceptions of integrating GAI, such as Chat GPT, into educational settings (Celik et al., 2022;
62 Wang et al., 2021). Previous research suggests that the adoption and proliferation of technology
63 heavily hinge upon teachers' perspectives (Kaplan-Rakowski et al., 2023a; Ismail et al., 2010).
64 Omitting the initial exploration of teachers' attitudes towards GAI technology could jeopardize the
65 successful incorporation of such technology in education. Therefore, this study proposes that AI
66 in education (AIEd) can bolster teacher preparedness. Consequently, this research builds upon the
67 work of Kaplan-Rakowski et al. (2023a) and is driven by the following research questions:
68 - What are the Saudi educators' perceptions regarding integrating GAI (General Artificial
69   Intelligence) in the Saudi education system?
70 - Does the level of educator integration with GAI technology significantly predict the
71   frequency of GAI utilization in educational settings?
72
73 The paper follows a structured format, with Section 2 providing a comprehensive literature review
74 to establish the theoretical background and context. Section 3 outlines the methodology employed
75 in the research. In Section 4, both quantitative and qualitative results are presented and analyzed,
76 shedding light on the empirical findings. Section 5, the Discussion, delves into the interpretation
77 and discussion of the results, offering insights, implications, and potential future research
78 directions. Finally, the paper concludes in the last section, summarizing the essential findings and
79 their significance within the broader field of study. This structured approach ensures a clear and
80 systematic presentation of the research process and outcomes.
81

2. Literature Review

2.1 AI in Education

As noted by Popenici and Kerr (2017), AI holds the potential to usher in transformative changes within the realm of education. Its capacity to revolutionize both the learning process for students and the teaching methods employed by educational institutions is particularly noteworthy. For example, Georgia Tech in the United States introduced a virtual teaching assistant powered by IBM's Watson platform, earning acclaim from students (Maderer, 2016). This instance underscores the potential of AI to enhance the teaching process, especially when dealing with student populations and facilitating personalized student interactions. Furthermore, the Artificial Intelligence in Education (AIEd) field, as highlighted by Schiff (2021), is rapidly evolving to leverage innovative software and hardware tools to enhance the quality and effectiveness of teaching and learning. AIEd encompasses a range of application areas, including intelligent tutoring systems, educational agents, adaptive assessments, educational robots, and lifelong intelligent mentors (Schiff, 2021). It is widely believed that modern AIEd has the potential to bridge the quality gaps exposed by previous educational technologies, as it aspires to replicate the role of educators. Through AIEd tools, teachers can shift their focus to higher-level tasks such as curriculum design and assessment while students receive tailored instruction tailored to their needs and learning styles (Schiff, 2021).

Nonetheless, integrating artificial intelligence into the classroom poses several challenges. Researchers have raised ethical concerns regarding data use, algorithm transparency, and potential biases, including worries about data privacy, transparency in algorithmic decision-making, and inherent biases within algorithms (Southgate et al., 2019; Sohaib & Olszak 2021; Akgun & Greenhow, 2021). Another significant issue is algorithmic transparency, a known challenge in the AI community, as many AI systems operate as "black boxes," rendering their decision-making processes inscrutable to humans (Burrell, 2016). The absence of transparency can lead to trust issues for educators and students, mainly if their assessments or recommendations are influenced by AI system decisions (Burrell, 2016). Extensive research on integrating AI into education, as emphasized by Popenici and Kerr (2017), suggests that it can significantly influence the governance and structure of academic institutions.

Furthermore, there are potential risks associated with using AIEd in the classroom, including privacy concerns, biases, and the possibility of technology entirely replacing human educators (Schiff, 2021). Therefore, responsible research is crucial to address these risks, as Schiff (2021) underscores. Integrating social responsibility into processes and cultures is also imperative in addressing these concerns. Additionally, AI can perpetuate biases, leading to unfair or discriminatory outcomes stemming from biases in training data and inherent AI biases (Benjamin,

121 2019). For instance, some AI systems may inadvertently favor students from specific
122 socioeconomic backgrounds, raising equity and fairness concerns in education (Benjamin, 2019).
123 Consequently, adopting AI in educational settings must be cautiously and carefully considered to
124 mitigate these concerns (Zawacki-Richter et al., 2019). AI can provide tailored solutions to cater
125 to the support requirements of a diverse range of students (Popenici & Kerr, 2017). Additionally,
126 AIEd aids in fostering learning and helping students overcome challenges related to
127 communication and teamwork, skills vital for their holistic growth (McLaren et al., 2010).
128
129 Artificial Intelligence in Education (AIEd) is increasingly recognized as a solution to teaching and
130 learning challenges. One of the educational approaches it offers is individualized tutoring,
131 providing flexibility, personalization, inclusivity, and effectiveness similar to one-on-one
132 instruction (Zanetti et al., 2019). These innovative tools aim to engage students and improve
133 lessons by integrating practical, attentive, and perceptual user interfaces (Bevilacqua et al., 2009).
134 AIEd tools can even analyze students' facial expressions and reactions (Chaudhri et al., 2013), a
135 valuable capability, particularly in primary education, where understanding and responding to
136 students' emotional responses can be beneficial, especially during challenging times (Zanetti et al.,
137 2019). Moreover, AIEd offers Intelligent Tutoring Systems (ITS) that simulate a personalized one-
138 on-one tutoring experience, considering learners' specific needs (McLaren et al., 2010). These
139 systems provide activities and feedback, allowing learners some control over their learning process
140 and fostering the development of self-regulation skills ((McLaren et al., 2010). This is particularly
141 advantageous in education, where nurturing self-regulation skills is an essential learning objective.
142
143 In summary, the literature review provides an in-depth exploration of Artificial Intelligence in
144 Education (AIEd), offering a comprehensive understanding of its potential benefits and associated
145 challenges. Popenici and Kerr (2017) and Schiff (2021) highlight AI's transformative capacity in
146 revolutionizing learning and teaching methods, showcasing innovative tools for personalized
147 instruction. Ethical concerns, algorithm transparency challenges, and potential biases are raised by
148 multiple researchers (Southgate et al., 2019; Sohaib & Olszak, 2021; Akgun & Greenhow, 2021).
149 The need for responsible research and social responsibility integration in AIEd is emphasized by
150 Schiff (2021). McLaren et al. (2010) and Zanetti et al. (2019) underscore the role of AIEd in
151 fostering learning, overcoming challenges, and providing individualized tutoring experiences.
152 Bevilacqua et al. (2009) and Chaudhri et al. (2013) discuss the engaging and perceptual user
153 interfaces of AIEd tools. The literature collectively points to the potential risks and rewards
154 associated with AIEd, emphasizing the need for careful consideration and responsible adoption in
155 educational settings.
156
157 **2.2 Generative AI - What is ChatGPT?**
158
159 The availability of AI tools like ChatGPT in 2022 has brought AI into the spotlight, making society
160 more aware of its existence and its possible consequences on how we go about our daily activities

161 (Lampropoulos et al., 2023). Stable Diffusion and DALL-E have enabled the generation of images
162 and videos from text inputs. ChatGPT, a Generative Pre-trained Transformer, is capable of text
163 generation, language translation tasks and summarization. Furthermore, ChatGPT can provide
164 detailed responses to user queries like text and code. The advanced results generated by AI have
165 prompted users to recognize generative AI tools as valuable assistants in problem-solving and
166 content creation. However, they have also voiced apprehensions regarding potentially diminishing
167 human creativity and academic integrity (Ali in 2021; Schiff in 2021; Cope et al., 2021; and
168 Sharples, 2022).
169

3. Methodology

171 This study employs a mixed-method approach, combining quantitative data collection through
172 surveys and qualitative data collection through interviews to gather insights from educators in
173 Saudi institutions. The Triangulation Design, depicted in Figure 1, is the most prevalent and widely
174 recognized approach to integrating research methods (Creswell et al., 2003).
175

176   Figure 1: Triangulation Research Design

177

3.1 Quantitative Method

179

180 This study utilized an online survey instrument partially derived from a previously validated
181 survey developed by Kaplan-Rakowski et al. (2023a) and Wozney et al. (2006). Participants were
182 required first to review and acknowledge the consent form, confirming their eligibility as educators
183 who had utilized ChatGPT at least once. Initially, participants were tasked with selecting the
184 technology integration stage (out of six options: awareness, learning, understanding, familiarity,
185 adaptation, and creative application) that best described their progression with General Artificial
186 Intelligence (GAI). Following this, participants were required to rate their level of agreement,
187 using a scale from 1 (strongly disagree) to 6 (strongly agree), in response to statements related to
188 their perceptions of GAI implementation in education. To suit the specific context of this study on
189 GAI technology, 15 items and certain statements were adapted from Kaplan-Rakowski et al.
190 (2023a) and Wozney et al. (2006).
191 Also, experts in Saudi higher education specializing in educational technology assessed and
192 provided feedback on the survey items' operationalization. After making necessary revisions based
193 on their input, the expert panel confirmed the instrument's content validity. In evaluating
194 Generative AI Integration in Saudi Arabian Education, participants were systematically chosen
195 and recruited to ensure a representative sample reflective of the targeted educational context. The
196 recruitment process involved reaching out to educators within Saudi higher institutions through
197 collaboration with educational authorities and institutions. The specific criteria for determining
198 participation eligibility included individuals actively engaged in teaching roles within Saudi higher
199 education settings. This criterion aimed to capture insights from educators directly involved in the
200 learning and instructional processes impacted by Generative AI integration.

201 Additionally, participants were required to have a minimum level of familiarity with AI
202 technologies to provide meaningful perspectives on the subject matter. 140 participants responded
203 to the survey. The participants were educators in Saudi higher institutions. After removing
204 incomplete or missing data, 125 were used for the analysis.

205
206

207 **3.2 Qualitative Method**

208

209 A thorough and nuanced research approach is necessary to understand how artificial intelligence
210 (AI) in education (AIEd) is implemented in the Saudi education system. This study employs the
211 qualitative phenomenological method in our study, a method recommended by Creswell in 2013,
212 which delves into individuals' experiences and perceptions. This study uses a qualitative
213 phenomenological approach to uncover the intricate layers of experiences and perceptions held by
214 primary school teachers in Saudi concerning the incorporation of AIEd into their teaching
215 practices. More specifically, this study employed the thematic analysis method alongside the
216 phenomenological approach. This combination helps us carefully scrutinize the data we have
217 collected during our research. The thematic analysis enables us to explore, identify, articulate, and
218 structure the underlying themes and patterns within our data, as suggested by Nowell et al. 2017.
219 In this study, qualitative data was collected by conducting detailed interviews with three
220 experienced educators in higher education in Saudi Arabia, referred to as P1, P2, and P3. This
221 study gathered qualitative data through in-depth interviews with three highly experienced
222 educators in Saudi Arabia, identified as P1, P2, and P3, all holding Ph.D. degrees and offering
223 diverse perspectives from their respective specializations in higher education. P1 brings expertise
224 in education technology, P2 contributes insights from computer science, and P3, a recognized
225 leader in the academic community, offers perspectives on engineering. These educators were
226 selected to provide a comprehensive understanding of the implications of Generative AI
227 integration in Saudi Arabian higher education, bringing a wealth of knowledge and diverse
228 experiences to enrich the study's qualitative findings. Our goal with these interviews was to gain
229 insight into educators' perspectives, observations, and insights regarding integrating artificial
230 intelligence in education. The interviews were carried out in the English language and were
231 meticulously transcribed verbatim to facilitate further analysis.

232

233 ## 4. Results

234

235 **4.1 Educators' Perceptions of GAI Integration in Education**

236

237 *4.1.1   Quantitative Findings*

238 To answer the first research question: What are the Saudi educators' perceptions regarding
239 integrating GAI (General Artificial Intelligence) in the Saudi education system? Fifteen questions
240 assessed educators' perspectives regarding applying General Artificial Intelligence (GAI) in

241 education. Survey participants were tasked with expressing their degree of agreement or
242 disagreement with these statements on a 6-point scale, where a score of 1 denoted "strongly
243 disagree," and a score of 6 indicated "strongly agree." To ensure the reliability of this new
244 measurement tool, its internal consistency was assessed using the Spearman-Brown stepped-up
245 coefficient, which was found to be satisfactory ($\alpha = 0.78$). Table 1 shows the results.

246

247 Table 1: Educators' Perceptions of GAI Integration in Education (Kaplan-Rakowski et al., 2023a).

248

249

250 The assessment outcomes demonstrate a range of perspectives from the participants regarding
251 technology's role in education. Participants generally expressed favorable views regarding its
252 impact on academic progress (with an average score of 3.79 and a standard deviation 1.30).
253 However, there was some diversity in their feedback. Conversely, concerns about technology
254 potentially diverting students from traditional learning methods received a less favorable average
255 rating (2.82, with a standard deviation of 1.21), indicating reservations among the respondents.
256 However, participants generally exhibited confidence in the effectiveness of technology,
257 particularly when they believed they could implement it successfully (with an average score of
258 4.15 and a standard deviation of 1.18). The influence of technology on student collaboration
259 (average score of 3.00 and standard deviation of 1.24) and the development of communication
260 skills (average score of 3.14 and standard deviation of 1.41) generated mixed feedback, reflecting
261 varying perspectives on their impact. Overall, participants perceived technology as a valuable
262 instructional tool (average score of 4.10 and standard deviation of 1.10) and believed it contributed
263 to their professional development (average score of 4.25 and standard deviation of 1.23). However,
264 concerns arose regarding potential increases in student stress and anxiety (average score of 3.80
265 and standard deviation of 1.29) and additional planning time (average score of 3.58 and standard
266 deviation of 1.36). While technology was seen as a means to motivate student engagement in
267 learning activities (average score of 3.71 and standard deviation of 1.26), the notion of it potentially
268 impacting the number of educators in the future (average score of 4.15 and standard deviation of
269 1.42) was approached with careful consideration. The data reveals a multifaceted portrayal of
270 technology's part in education, acknowledging both prospects and challenges from the participants'
271 perspectives.

272

273 ### *4.1.2   Qualitative Findings*

274

275 Findings from the Interviews show similar themes, such as P1: *"I believe there are both positive*
276 *and negative aspects of using GAI in education. Sometimes, I find it extremely beneficial; it's truly*
277 *an incredible tool. However, when it comes to university-level work, I have concerns. In the recent*
278 *term, I observed many university students utilizing AI technology like Excel for their writing,*
279 *leading to potential plagiarism issues".*

280

281　P2 teacher expressed, "*I've seen a noticeable improvement in students' academic performance*
282　*since we introduced GAI in our curriculum. It provides personalized assistance and feedback,*
283　*helping students grasp concepts better and ultimately leading to higher grades.*" P3 shared
284　concerns: "*I've noticed that some students tend to rely solely on GAI for information, neglecting*
285　*valuable resources like library books. It's essential to strike a balance and encourage them to use*
286　*traditional and AI-based sources.*" A different perspective came from a P1 who said, "*GAI has*
287　*been a catalyst for collaborative learning in my classroom. Students are working together on*
288　*projects, discussing their findings from AI tools, and it's fostering a sense of teamwork and*
289　*knowledge sharing that I hadn't seen to this extent before.*"
290
291　P2 reflected on the impact of GAI on their growth, saying, "*Personally, I've found that integrating*
292　*GAI into my teaching has been a significant boon for my professional development. It has forced*
293　*me to adapt, learn new technology, and explore innovative teaching methods, which has been a*
294　*fulfilling and intellectually stimulating journey.*" P3 shared his perspective on the potential
295　implications, stating, "*I'm a bit concerned that the increasing use of GAI might reduce the number*
296　*of teaching positions. While it can be efficient in some tasks, it can't replace human educators'*
297　*guidance and mentorship. We need to be cautious about striking the right balance.*"
298
299　Participants shed light on their perspectives and experiences, providing valuable qualitative
300　insights into their views on various aspects of the subject matter. Participant P1 articulated a
301　generally positive stance regarding the integration of GAI in education. They emphasized the
302　effectiveness of technology when it aligns with their belief in successful implementation. This
303　participant exhibited enthusiasm for technology's potential to enhance academic achievement.
304　However, they also expressed concerns about the impact on traditional learning resources,
305　indicating reservations about students potentially neglecting these valuable sources of knowledge.
306　Moreover, P1 acknowledged the role of technology in promoting student collaboration but noted
307　mixed feedback on its effectiveness in developing communication skills. Their responses
308　suggested that technology is viewed as a valuable instructional tool, contributing to professional
309　development and student engagement motivation.
310
311　In contrast, Participant P2 presented a more cautious perspective regarding technology's role in
312　education. While acknowledging its potential to enhance academic achievement, P2 expressed
313　reservations about the potential consequences of technology's integration, particularly concerning
314　students needing to pay more attention to traditional learning resources. This participant was
315　optimistic about the value of GAI as an instructional tool but voiced concerns about increased
316　stress and anxiety among students and the additional time required for planning. P2 held a balanced
317　view regarding technology's potential to reduce the number of teachers in the future,
318　acknowledging the topic with caution.
319

320 The examination of interviews with educators in Saudi Arabia unveils several central themes
321 associated with incorporating Generative Artificial Intelligence (GAI) in educational settings.
322 Respondents generally recognized the positive aspects of GAI, emphasizing advantages such as
323 enhanced academic performance, personalized support, and collaborative learning opportunities.
324 However, concerns were voiced regarding potential adverse outcomes, including issues related to
325 plagiarism, overreliance on GAI for information by students, and the potential reduction of
326 teaching positions. A recurring theme underscored the necessity for a balanced approach,
327 promoting utilizing both traditional and AI-based sources. Additionally, participants deliberated
328 on GAI's impact on professional development, emphasizing the need to adapt and acquire
329 proficiency in new technologies within the educational landscape. In summary, the identified
330 themes encompass the dual nature of GAI's impact, addressing both its benefits and challenges
331 within the realm of higher education in Saudi Arabia.
332
333 In summary, the qualitative analysis of interviews with participants highlights a diversity of views
334 on integrating GAI in education. While P1 leans towards optimism and emphasizes the positive
335 aspects, P2 adopts a more cautious stance, emphasizing potential drawbacks and challenges. These
336 interviews reveal the complexity of the subject and the varied experiences and perspectives of the
337 participants. These responses show a range of opinions and experiences, indicating the
338 multifaceted impact of GAI in education, from positive academic outcomes to concerns about
339 overreliance and the promotion of collaboration among students.
340
341 **4.2 The Relation between GAI Integration and Educators' Frequency of GAI Use**
342
343 To answer the second research question: Does the level of educator integration with GAI
344 technology significantly predict the frequency of GAI utilization in educational settings? The
345 participant's educators' level of GAI integration was analyzed from a range of six categories, as
346 adapted from the work of Wozney et al. (2006) and Kaplan-Rakowski et al. (2023a).
347 • Awareness: Acknowledging the existence of GAI technology but still needing to utilize it,
348   perhaps due to apprehension.
349 • Learning: Actively acquiring foundational knowledge about GAI, occasionally
350   experiencing frustration and lacking confidence.
351 • Understanding: Understanding how to use GAI like ChatGPT and identify specific
352   applications.
353 • Familiarity: Gaining self-assurance in using GAI for particular tasks and feeling
354   comfortable with it.
355 • Adaptation: Consider GAI a valuable instructional tool and no longer consider it a
356   technological challenge.
357 • Creative application: Proficiently integrate ChatGPT into the curriculum and use it as an
358   instructional aid.
359

360 Analysis of the quantitative data revealed that the majority of participants (approximately 62%)
361 fell into the third stage (Understanding) and fourth stage (Familiarity) of GAI integration.
362 Approximately 10% of participants reported being at the fifth stage (Adaptation), and about 15%
363 were at the most advanced stage (Creative Application). The two initial phases of integration
364 (Awareness and Learning) were represented by approximately 14% of participants. The frequency
365 of GAI utilization in teaching among the respondents is categorized as follows: never
366 (approximately 40%), rarely (about 25%), when necessary (roughly 15%), often (approximately
367 15%), and always (around 5%).
368
369 A linear regression is used to predict GAI utilization based on educator level of integration.
370 *GAI Utilization = a + b * Educator Level of Integration*
371
372 Table 2 shows how the "educator level of integration" influences GAI utilization.
373 Table 2: Linear Regression results
374
375
376 The regression analysis results indicate a statistically significant relationship between the two
377 variables under investigation. The moderate Multiple R-value of 0.52 suggests this relationship.
378 The R Square value of 0.279 implies that roughly 27.9% of the variation in GAI Utilization can be
379 attributed to the independent variable, which appears to influence GAI Utilization. The ANOVA
380 table reaffirms the significance of the regression, with a high F-statistic of 26.03 and an extremely
381 low p-value (2.9719E-06). The coefficient for GAI Utilization is 0.628, with a very low p-value
382 (2.97E-06), indicating its strong positive impact on the dependent variable. In summary, these
383 findings suggest a substantial and positive relationship between the independent variable and GAI
384 Utilization, with the model being a good fit for the data.
385

386 ## 5. Discussions

387

388 **5.1 Quantitative Insights**

389

390 With the integration of AI, the educational landscape is on the brink of a significant transformation
391 characterized by enhancing personalized learning experiences and automating administrative tasks
392 (Southgate et al., 2019; Zulkarnain & Yunus, 2023). It is essential to recognize that AI holds
393 substantial potential in bridging achievement gaps and furnishing students and educators with
394 customized support that aligns with their specific requirements (Luckin et al., 2016). However, it
395 is imperative to acknowledge the existence of challenges and apprehensions alongside these
396 promising prospects, which necessitate attention. Among the vital areas that educators and
397 policymakers must contend with are ethics, data privacy, and the imperative need for effective
398 collaboration with artificial intelligence (Akgun & Greenhow, 2021). As we advance in integrating
399 AI into education, it is crucial to exercise caution, ensuring that the advantages of AI are fully

400 harnessed while conscientiously addressing any potential challenges (Kang et al., 2023; Alammari
401 et al., 2022; Baker et al., 2019).
402
403 Academics' favorable stance toward GAI contradicts specific research findings on incorporating
404 technology in education. A systematic review conducted by Celik et al. (2022) indicated that
405 educators typically need more support to adopt emerging technologies in their teaching due to the
406 complex nature and wide variety of these new tools. The contrasting outcomes observed in our
407 present study may be attributed to the fact that ChatGPT faces fewer external obstacles. Notably,
408 over 50% of the participants we surveyed had gained some experience with ChatGPT in less than
409 six months after its launch in November 2022 (Lampropoulos and team, 2023). Furthermore, the
410 rapid rise and widespread adoption of ChatGPT have motivated educators to closely evaluate this
411 AI tool, as noted by Firat (2023) and Lampropoulos et al. (2023). The frequent media coverage of
412 ChatGPT and other AI tools, along with their swift progress, may lead to increased utilization and
413 integration by educators.
414
415 The findings suggest a positive connection between teachers' awareness of GAI and their usage,
416 aligning with the research of Kaplan-Rakowski and others in 2023. This correlation supports prior
417 research emphasizing the link between teachers' exposure to AI, their trust in the technology (as
418 demonstrated by Nazaretsky and team in 2022), and their willingness to incorporate AI into their
419 teaching practices (as shown by Kuleto and others in 2022). The findings also showed that most
420 participants already contemplate specific AI applications (representing the understanding stage) or
421 feel comfortable using AI (reflecting the familiarity stage), increasing awareness and utilization.
422 It's reasonable to expect a shift towards greater integration levels over time, specifically in the
423 adaptation and creative application stages.
424
425 Teachers' perceptions of AI support the reported understanding and familiarity stages of
426 integration as an instructional tool and their expectations of easy implementation. In these stages,
427 teachers actively consider how to confidently employ GAI for specific tasks. The perceived value
428 and comfort of integrating GAI, like ChatGPT, into educational settings contribute to the positive
429 attitudes observed. ChatGPT is web-based and easily accessible through account creation without
430 additional equipment. It appears that teachers are ready to embrace GAI, which is a welcome
431 departure from earlier studies where teachers often expressed unpreparedness for AI integration,
432 as found in the studies by An et al. (2022), Alharbi & Sohaib (2021); Celik et al. (2022), and
433 Nazaretsky et al. (2022).
434
435 The study reveals that Generative Artificial Intelligence (GAI) holds transformative educational
436 potential, offering personalized learning experiences and streamlining administrative tasks.
437 Policymakers and educators should acknowledge the positive impact and address ethical, data
438 privacy, and practical collaboration challenges. The link between teachers' awareness and usage
439 of GAI suggests a promising trend for integration, requiring supportive policies.

440

441 **5.2 Qualitative Insights**

442

443 The interviews with participants shed light on a spectrum of viewpoints and experiences, offering
444 valuable qualitative insights into incorporating GAI in education. A common theme emerged
445 regarding the dual nature of GAI, encapsulated in P1's statement, which found both benefits and
446 drawbacks in its use. While acknowledging its incredible utility, concerns surfaced regarding its
447 potential for facilitating plagiarism, especially at the university level. On the other hand, P2's
448 perspective was notably optimistic, emphasizing the substantial improvement in academic
449 performance due to GAI's introduction. This participant attributed the success to personalized
450 assistance and feedback, which enhanced students' understanding and improved grades. P3 voiced
451 concerns about students leaning heavily on GAI at the expense of traditional resources like library
452 books, emphasizing the importance of striking a balance and encouraging the use of both sources.
453 P3's viewpoint mirrored a cautious stance.

454

455 A contrasting perspective emerged from a different P1, highlighting the role of GAI in fostering
456 collaborative learning. Here, students' engagement in projects and knowledge sharing was seen as
457 a positive outcome of GAI implementation, fostering teamwork and collaboration. P2 shared their
458 personal growth due to GAI integration, emphasizing its impact on their professional development.
459 It forced them to adapt, embrace new technology, and explore innovative teaching methods,
460 leading to a fulfilling and intellectually stimulating journey. Regarding implications, P3 expressed
461 concerns about the potential reduction in teaching positions due to increased GAI use. They
462 underscored the irreplaceable role of human educators in providing guidance and mentorship,
463 advocating for a cautious approach to striking the right balance. The participants' responses
464 collectively portray a nuanced and multifaceted landscape of GAI's role in education. While P1
465 expresses optimism, P2 offers a balanced perspective, and P3 underscores caution. The interviews
466 emphasize the need for a comprehensive understanding of the multifaceted impact of GAI in
467 education, encompassing academic outcomes, concerns of overreliance, and promoting
468 collaboration among students.

469

470 Qualitatively, educators exhibit diverse views on GAI, with some emphasizing its benefits and
471 others expressing caution. Policymakers should consider nuanced guidelines to balance traditional
472 and AI-based sources, promoting comprehensive integration. Educators' positive attitudes indicate
473 readiness, suggesting the need for policies supporting responsible GAI adoption in education. In
474 conclusion, a more detailed discussion with specific recommendations would enhance the study's
475 contribution to guiding future GAI integration policies and practices in education.

476

477 **6. Conclusion**

478

479 The convergence of quantitative and qualitative findings offers a comprehensive perspective on
480 integrating GAI (Generative AI) in education. Both sets of data contribute valuable insights into
481 the multifaceted impact of this technology on educators and learners. The quantitative data,
482 primarily derived from surveys and statistical analyses, illuminates essential trends and patterns.
483 Increased awareness of GAI correlates with more frequent utilization among teachers, with trust
484 and confidence playing pivotal roles. This aligns with prior research indicating that exposure to
485 AI technologies fosters trust and integration into educational practices. Approximately half of the
486 surveyed educators already find themselves at the understanding and familiarity stages of GAI
487 integration, suggesting a readiness for its adoption. Moreover, the perceived value and ease of GAI
488 assimilation among educators encouraged and likely to incorporate GAI into their teaching
489 methods. GAI tools' user-friendly and web-based nature, like ChatGPT, enhances their
490 accessibility and implementation.

491

492 The qualitative analysis of interview responses complements the quantitative findings by offering
493 a deeper understanding of individual experiences and perceptions. These interviews revealed a
494 diversity of viewpoints and experiences among educators. While some, like P1, expressed
495 optimism and enthusiasm for GAI's potential in enhancing academic achievement, others, like P2,
496 approached the technology cautiously, recognizing its benefits but emphasizing potential
497 drawbacks. P3 highlighted the need to balance traditional and AI-based resources and expressed
498 concerns about students needing to catch up on GAI. Notably, the interviews unveiled a range of
499 experiences, from GAI serving as a catalyst for collaborative learning to fostering professional
500 growth, as emphasized by P2.

501

502 In conclusion, the convergence of quantitative and qualitative findings underscores the complex
503 and evolving landscape of GAI integration in education. While quantitative data reveal the trends
504 in awareness and adoption, qualitative insights emphasize individual nuances and concerns. GAI
505 offers promising opportunities for improving academic achievement, fostering collaboration, and
506 encouraging professional development among educators. However, challenges such as potential
507 overreliance, plagiarism concerns, and the need for a balanced approach have also come to the
508 fore. The results highlight the importance of careful consideration and ongoing research to strike
509 the right balance in harnessing GAI's potential in education. Ultimately, the findings suggest that
510 educators are ready to embrace GAI, but it is essential to navigate this integration thoughtfully,
511 recognizing the duality of its impact on teaching and learning.

512

513 **6.1 Limitations and Future Work**

514

515 This study acknowledges several limitations. Firstly, it predominantly centers on the viewpoints
516 and encounters of educators. A more encompassing understanding of GAI integration in education
517 could be achieved by broadening the scope to include student and stakeholder perspectives.
518 Moreover, the research relies on cross-sectional data, and a longitudinal approach could provide

519 insights into the evolution of GAI adoption over time. Furthermore, the study needs to delve deeper
520 into the specific types of GAI tools or applications, which could vary significantly in their impact
521 on education. Acknowledging these limitations is essential for interpreting the findings and
522 guiding future research in this evolving field.
523
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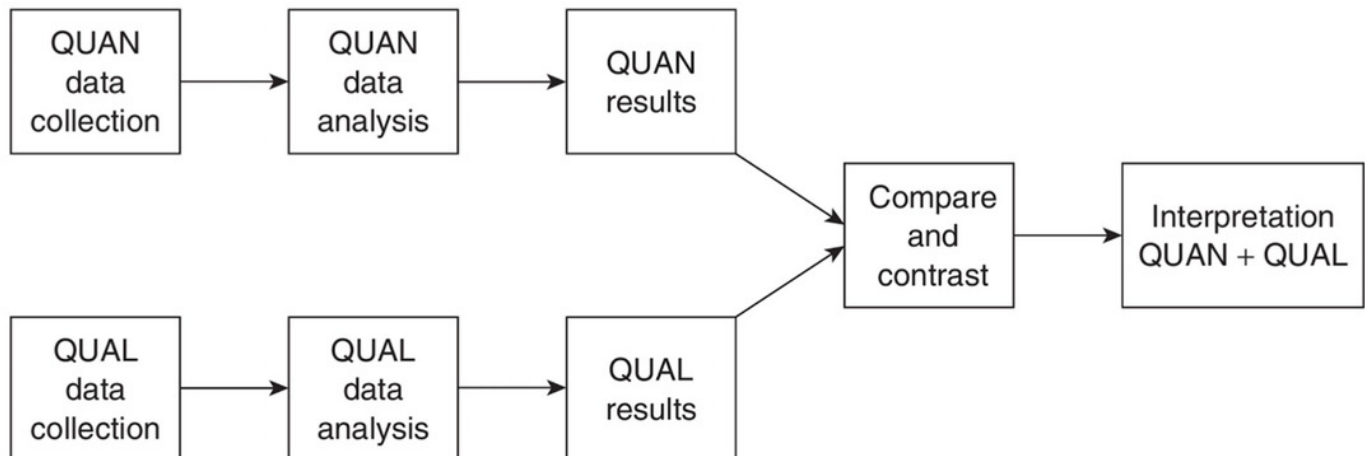604 immersive virtual reality. Education and Information Technologies. https://doi.org/10.1007/s10639-023-
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Figure 1

Research Design

Triangulation Research Design

Table 1(on next page)

Educators' Perceptions of GAI Integration in Education

Educators' Perceptions of GAI Integration in Education (average score and standard deviation), first column of the table presents statement, second column presents average score, third column presents standard deviation

1   Table 1: Educators' Perceptions of GAI Integration in Education (Kaplan-Rakowski et al., 2023a).

2

Statement	M	SD
1. Increases academic achievement (e.g., grades).	3.79	1.30
2. Results in students neglecting important traditional learning resources (e.g., library books).	2.82	1.21
3. Is effective because I believe I can implement it successfully.	4.15	1.18
4. Promotes student collaboration.	3.00	1.24
5. Promotes the development of communication skills (e.g., writing skills, presentation skills).	3.14	1.41
6. Is a valuable instructional tool.	4.10	1.10
7. Makes teachers feel more competent as educators.	3.62	1.25
8. Is an effective tool for students of all abilities.	3.74	1.34
9. Enhances my professional development.	4.25	1.23
10. Eases the pressure on me as a teacher.	3.67	1.40
11. Motivates students to get more involved in learning activities.	3.71	1.26
12. Should reduce the number of teachers employed in the future.	4.15	1.42
13. Will increase the amount of stress and anxiety students experience.	3.80	1.29
14. Requires extra time to plan learning activities.	3.58	1.36
15. Improves student learning of critical concepts and ideas.	3.68	1.32
Average:	3.60	1.30

3

Table 2(on next page)

Linear Regression results

Results shown present how the "educator level of integration" influences GAI utilization

1   Table 2: Linear Regression results

Regression Statistics	
Multiple R	0.52
R Square	0.279
Adjusted Square	0.26
Standard Error	1.24

ANOVA

	df	SS	MS	F	Significance F
Regression	1	40.522	40.52	26.03	2.9719E-06
Residual	67	104.28	1.554		
Total	68	144.81			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	1.575	0.420	3.749	0.00033	0.732	2.41
GAI Utilization	0.628	0.123	5.1165	2.97E-06	0.389	0.847

2