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Impact of Information Communication Technology and Faculty Readiness on Teaching Effectiveness

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ABSTRACT

This study aimed to examine the impact of Information communication technology (ICT) and faculty readiness on teaching effectiveness in universities, particularly in the Kingdom of Bahrain. This study collected data from 181 participants using a convenient online sampling technique. Researchers gathered participants who fulfilled the inclusion criteria for the study through an online platform. The collected data were then analysed using SPSS and SmartPLS4. The results revealed a significant positive effect of ICT and faculty readiness on teaching effectiveness. The study underscores the significance of both faculty readiness and ICT integration in promoting teaching effectiveness. Educational Universities should prioritize efforts to enhance faculty readiness by providing professional development opportunities and support. Additionally, investment in ICT infrastructure and the effective integration of ICT tools can contribute to improved teaching outcomes. Hence, the study is helpful to policymakers, stakeholders, researchers, and society in general to re-evaluate and strengthen teaching effectiveness.

Keywords: Information Communication Technology, Universities Education, Teaching Effectiveness, Faculty Readiness
JEL Classifications: I23, I24, L15, L86

1. INTRODUCTION

The integration of Information Communication Technology (ICT) in education has emerged as a transformative force, revolutionizing traditional teaching and learning practices (Alam and Mohanty, 2022). The widespread adoption of ICT in educational settings has created new opportunities for instructional design, enhanced student engagement, and improved learning outcomes (Liao et al., 2023). Understanding the background of ICT in education is crucial for educators, policymakers, and researchers to effectively harness its potential and address the challenges associated with its implementation (Pattnaik et al., 2023).

The rapid evolution of ICT has its roots in the advancements in computing technology and the proliferation of the internet (Talha et al., 2022). In the early stages, computers were primarily utilized for administrative purposes in educational institutions (Alam, 2022). However, as the capabilities of computers expanded and their costs decreased, educators began recognizing their potential as educational tools (Donally, 2022). The introduction of multimedia elements, such as graphics and audio, further enriched the learning experience and paved the way for interactive and immersive learning environments (Schott et al., 2023).

The emergence of the internet marked a significant turning point in the integration of ICT in education (Coates et al., 2022). With the internet's global connectivity, educational institutions gained access to vast repositories of information and resources, transcending geographical boundaries and offering a wealth of knowledge to students and educators alike (Bogiannidis et al., 2023). This digital transformation also facilitated online communication and collaboration, enabling distance learning programs and fostering

virtual communities of learners (Jauregi-Ondarra et al., 2022; Roy and Al-Absy, 2022). Further, technology can empower instructors and students, encourage change, and help them develop 21st-century skills (Al-Absy, 2023). Hence, technology significantly influence the effectiveness of learning (Al-Absy and Liandu).

The integration of ICT in education is guided by various theoretical frameworks and models (Sosa-Díaz et al., 2022). The SAMR model (Substitution, Augmentation, Modification, Redefinition) provides a hierarchical structure for understanding how ICT can transform instructional practices from mere substitution to redefinition of learning tasks (Bicalho et al., 2022). The Technological Pedagogical Content Knowledge (TPACK) framework emphasizes the importance of teachers' ability to integrate technology effectively into their pedagogical practices while considering subject matter and instructional strategies (Ismaeel and Al Mulhim, 2022). Additionally, the 5E model (Engage, Explore, Explain, Elaborate, Evaluate) offers a constructivist approach to designing ICT-enabled learning experiences.

The impact of ICT on pedagogy has been profound. Traditional teacher-centered approaches have gradually shifted towards student-centered, interactive, and collaborative learning environments (Dada et al., 2023). ICT tools and resources have enabled active learning strategies, allowing students to explore and construct knowledge through hands-on activities, simulations, and multimedia presentations (Porat et al., 2023). Furthermore, the personalization and differentiation of instruction have been facilitated through adaptive learning technologies, tailoring educational experiences to meet individual student needs and preferences (Christodoulou and Angeli, 2022).

Despite the numerous benefits associated with the integration of ICT in education, challenges and considerations need to be addressed (Wang et al., 2022). Issues such as the digital divide, inequitable access to technology, lack of infrastructure, and inadequate teacher training pose obstacles to realizing the full potential of ICT in education (Woldegiorgis, 2022). Additionally, careful attention must be given to pedagogical considerations, ensuring that technology is integrated purposefully and aligns with educational goals (Kabilan et al., 2023).

Understanding the background of ICT in education will enable educators, policymakers, and researchers to navigate the evolving educational landscape and effectively utilize ICT to enhance teaching, learning, and overall educational quality (Almufarreh and Arshad, 2023). Therefore, the study aims to examine the influence of ICT integration and TR on the teaching effectiveness. The study will enrich the literature knowledge in the field of teaching effectiveness and the factor affecting it. Indeed, the significance of ICT in university education is profound (Qureshi et al., 2022).

ICT enhances learning experiences through engaging tools and platforms, provides easy access to vast knowledge resources, fosters collaboration and global connections among students, and enables personalized and adaptive learning (Okai-Ugbaje et al., 2022). Its impact extends to students, faculty members, administrators, and society at large (Simien and Wallace, 2022). ICT transforms traditional education, making it more dynamic, accessible, and tailored to individual needs (Saif et al., 2022).

2. LITERATURE REVIEW

Teaching effectiveness is a critical aspect of education that directly impacts student learning outcomes and academic success (Law et al., 2019). The literature review synthesizes and examines existing research to identify strategies that can enhance teaching effectiveness, including subject matter knowledge, instructional diversity, effective communication, student-centered approaches, assessment and feedback, classroom management, student engagement, professional development, and reflective practice.

The integration of ICT within university education has precipitated substantial transformations in teaching, learning, and administrative domains (Shang and Sivaparthipan, 2022). Institutions of higher learning have actively adopted and deployed diverse ICT tools and resources, encompassing learning management systems, multimedia content, and other technological applications, to augment instructional practices (Badaru and Adu, 2022). The advent of e-learning platforms and virtual classrooms has significantly expanded the pedagogical landscape, affording students flexible learning opportunities that transcend temporal and spatial limitations (Johnson et al., 2023). ICT's impact on teaching and learning encompasses the cultivation of student-centered approaches, utilization of interactive multimedia resources, and harnessing of online collaboration tools to foster an environment conducive to knowledge exchange and cooperative problem-solving (Ngao et al., 2022). Furthermore, ICT assumes a pivotal role in supporting student-centric services and optimizing administrative processes, facilitating seamless access to academic resources and streamlining bureaucratic tasks. However, effective ICT integration necessitates the resolution of challenges like the digital divide and faculty preparedness, ensuring equitable access (Montiel and Gomez-Zermeño, 2022) to technology and comprehensive training for educators. Further research endeavors are imperative to ascertain and promulgate best practices, while also investigating the implications of ICT integration on the overall quality of education within university settings (Tsegay et al., 2022).

The integration of ICT in university education has become a key method for improving education. ICT is transforming teaching and learning (Al-Malah et al., 2023). It allows flipped classrooms, blended learning, and full online courses that promote active involvement, collaboration, and analytical thinking (Fidan, 2023). Multimedia tools, virtual simulations, and engaging platforms complement these methodologies, which adapt to student requirements and preferences (Cabero-Almenara et al., 2020). Online forums and virtual classrooms boost student engagement with this versatility in teaching approaches. Gamification and multimedia make learning more entertaining and accessible. ICT simplifies university education, increasing access to educational materials. Online libraries, databases, and open-source materials are available to students without geographical or temporal restrictions. On the administrative front, ICT boosts

efficiency (Ibrahim et al., 2020). It streamlines course enrollment, assignment submission, and grading, saving time and resources. Digital transformation improves communication and coordination among educational ecosystem stakeholders, including students, professors, and administrative personnel. Finally, ICT promotes lifelong learning by providing many chances for academic and professional progress. Online courses, seminars, and virtual workshops allow students and professors to stay current and learn new skills (Lee and Hwang, 2022).

In conclusion, ICT integration in university education plays a vital role in enhancing educational quality. By transforming teaching and learning practices, promoting student engagement, expanding access to resources, improving administrative efficiency, and supporting lifelong learning, ICT empowers universities to deliver a high-quality education that meets the needs of students in the digital age. However, ongoing research and evaluation are necessary to explore best practices, address challenges, and ensure that ICT integration is effectively utilized to enhance educational quality in a sustainable manner.

Empirical studies investigating the relationship between ICT and quality in university education have yielded valuable insights into the impact and effectiveness of ICT integration (Lin, 2022; Ulucak et al., 2020). These studies employ diverse research methodologies and approaches to examine the effects of ICT on student outcomes, instructional practices, and the overall educational quality within university settings (Eli, 2021). This section of the literature review provides a concise overview of the key findings derived from these empirical investigations.

First and foremost, the research consistently demonstrates a positive correlation between ICT integration and student achievement. Through the effective utilization of ICT tools and resources, students exhibit heightened levels of engagement, motivation, and academic performance (Banda and Nzabahimana, 2023; Pintrich and Schrauben, 1992). Notably, access to ICT resources and participation in technology-rich learning environments have been associated with improved problem-solving abilities, enhanced critical thinking skills, and increased information literacy among students (Alt and Raichel, 2020).

Moreover, the integration of ICT has proven instrumental in advancing teaching and learning practices within the university context (Núñez-Canal et al., 2022). By facilitating innovative instructional approaches, including active learning, collaboration, and personalized instruction, ICT tools empower educators to create dynamic and interactive learning experiences. Virtual learning environments and multimedia resources, for instance, enable instructors to deliver course content in engaging and interactive formats, catering to the diverse learning styles and preferences of students (Muir et al., 2023).

In addition to its impact on teaching and learning, the successful integration of ICT in university education is contingent upon various institutional and organizational factors (Otu et al., 2023). Studies consistently highlight the pivotal role of supportive leadership, well-designed faculty development programs, robust technological infrastructure, and institutional policies in facilitating effective implementation and utilization of ICT resources.

Furthermore, investigations into students' perspectives and experiences with ICT integration underscore their overwhelmingly positive perceptions (San Isidro and Cañado, 2023). Students recognize ICT as a valuable asset in their educational journeys, affording them increased access to educational resources, fostering collaboration among peers, and facilitating effective communication with instructors (Lambrev and Cruz, 2023). However, challenges such as the digital divide, technology anxiety, and information overload must be diligently addressed to ensure equitable access to ICT resources and their optimal utilization (Magana, 2023).

Lastly, evaluation and assessment frameworks have been employed to gauge the impact of ICT integration on the overall quality of university education. These frameworks encompass the examination of the effectiveness of ICT-based assessment methods, alignment of learning outcomes with ICT integration, and measurement of student satisfaction and engagement.

In conclusion, empirical studies collectively illuminate the transformative potential of ICT integration in university education, as evidenced by its positive impact on student outcomes, instructional practices, and overall educational quality. It is imperative to confront the challenges related to access, faculty readiness, and institutional support to ensure the successful integration of ICT. Moving forward, longitudinal studies, comparative analyses, and exploration of emerging technologies will deepen our understanding of the intricate dynamics between ICT and quality in the university education landscape.

H_1: There is a significant relationship between faculty readiness (FR) and teaching effectiveness (TE).

H_2: There is a significant relationship between ICT Integration (ICTI) and Teaching Effectiveness (TE).

3. METHODOLOGY

This study is a quantitative approach which employed a survey questionnaire to obtain data on university ICT tool views, experiences, and use Likert scale elements reflect participants' agreement or disagreement with particular assertions, quantifying and analyzing their ICT integration attitudes and behaviors (Ali et al., 2023; Ali et al., 2022; Alzoraiki et al., 2023). The study involves undergraduate and graduate students from several academic fields to reflect varied educational backgrounds and experiences. This method provides a complete knowledge of ICT integration in university education across academic fields. The study's findings will apply to more university students, improving validity and generalizability.

Online surveys sent through email or platform will gather data (Alzoraiki et al., 2023; Ibrahim et al., 2020). Participants will get explicit instructions and may remain anonymous. Participants will score their agreement or disagreement with statements on ICT integration in university education using closed-ended Likert scale questions. This quantitative technique gives numerical data

for objective statistical analysis of trends and patterns (Al Balushi et al., 2022; Ateeq et al., 2022). The online survey type collects data efficiently and permits participant comparisons.

The study used SPSS version 28, PLS-SEM software to conduct data analysis and investigate the associations among latent variables. The obtained Cronbach's alpha coefficient of 0.828 provided empirical evidence supporting the reliability and internal consistency of the administered questionnaire (Al-Refaei et al., 2023; Ali, 2022; Ateeq et al., 2023).

4. RESULTS

4.1. Respondents Profile

The descriptive statistics indicated that 42.5% of the sample population was male (Table 1). Three age categories were sampled: 31–40 (23.7%), 41–50 (38.5%), and 50+ (35.7%). 29.3% claimed they had fewer than 10 years of experience, while 70.7% stated more. Their advanced degrees included 65.2% doctorates and 34.8% master's degrees. These data reveal the sample population's demographics, including an equitable distribution of postgraduates and Ph.D. holders by gender and age.

Table 1: Characteristics of participants

Respondents' characteristics	n	(%)
Gender		
Male	77	42
Female	104	58
Age		
31-40	43	23.7
41-50	73	38.5
Above 50	65	40.3
Experience		
<10	53	29
>10	128	71
Education		
Postgraduate	63	35
Ph.D	118	65

Total: 181

Table 2: Mean±SD and rank for the variables

Constructs	Number of items	Code	Mean±SD	Rank
Faculty Readiness	7	FR	2.941±0.99	1
ICT Integration	7	ICTI	2.86±1.07	3
Teaching Effectiveness	9	TE	2.9±1.02	2
Average	33		2.9±1.03	

Rating scales: 5-point Likert scale (Islam and Tamzid) Strongly Disagree, (2) Disagree, (3) Natural, (4) Agree, to (5) Strongly Agree, *Scores range from 1 to 5, with higher scores indicating better competence. *SD: Standard Deviation (Ali et al., 2022)

Table 3: Reliability and composite reliability

Construct	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Faculty Readiness	0.808	0.855	0.759
ICT Integration,	0.800	0.839	0.532
Teaching Effectiveness	0.828	0.868	0.618

Cronbach's alpha: Average measure of internal consistency and item reliability and preferred when EFA is used for factor extraction. <0.7 accepted. *CR: Measure scale reliability overall and preferred with CFA. *AVE: Measures the level of variance captured by a construct 0.5 accepted. AVE: Average variance extracted, CR: Composite reliability (Al-refaei et al., 2023)

4.2. μ ± SD and Rank for the Variables

The table 2 illustrates the average score for Faculty Readiness (FR), ICT Integration (ICTI), and Teaching Effectiveness (TE). The rank and mean ± standard deviation data are also supplied. The faculty preparedness (FR) score was greatest at 2.941 ± 0.99, suggesting good preparedness among faculty members. First among the constructions, it suggests teachers feel ready to use ICT in their teaching. Teaching Effectiveness (TE) rated second among constructs with a mean score of 2.9α1.02, ranking second. This suggests faculty members view instructional efficacy somewhat. While they may feel ready to embrace ICT, its influence on teaching effectiveness may be improved. With a mean score of 2.86 ± 1.07, ICT Integration (ICTI) placed third among constructs. This shows somewhat weaker ICT integration than faculty preparation and classroom effectiveness. Faculty may be ready, but integrating ICT into their classroom may take time. The average score for all constructs is 2.9 ± 1.03. Faculty members questioned had modest preparation, ICT integration, and instructional effectiveness.

4.3. Reliability and Composite Reliability

The reliability and validity of Faculty Readiness, ICT Integration, and Teaching Effectiveness were assessed. According to Table 3, The Faculty Readiness concept indicated strong internal

Table 4: The convergent validity analysis

Construct	Code	Number of items	Factor loading	CR	AVE
Faculty readiness	FR	7	0.674	0.855	0.759
ICT integration,	ICTI	9	0.653	0.839	0.532
Teaching effectiveness	TE	9	0.648	0.868	0.618

Factor loading variance explained by the variable on that particular factor<0.7 or higher to be accepted Hair et al. (2010). CR: Measure scale reliability overall and preferred with CFA. AVE: Measures the level of variance captured by a construct 0.5 accepted. AVE: Average variance extracted, CR: Composite reliability

Table 5: Discriminant validity analysis

Faculty readiness	Faculty readiness	ICT Integration	Teaching effectiveness
Faculty readiness	0.758		
ICT integration	0.488	0.778	
Teaching effectiveness	0.462	0.379	0.651

Table 6: Coefficient of determination result R^2

Constructs	R-square	R-square adjusted
Teaching effectiveness	0.596	0.593

Higher value is preferred: 0.67 substantial, 0.33 average, 0.19 weak (Sarstedt et al., 2021)

Table 7: f-square

Variables	f-square
Faculty Readiness -> Teaching Effectiveness	0.341
ICT Integration, -> Teaching Effectiveness	0.393

$f2=(R^2$ included - R^2 excluded)/(1- R^2 included)

consistency, reliability, and convergent validity, as evidenced by Cronbach's alpha ($\alpha = 0.808$), composite reliability (0.855), and average variance extracted (AVE = 0.759). The ICT Integration construct has good internal consistency and reliability but modest convergent validity (AVE = 0.532). The Teaching Effectiveness concept measured well, with great internal consistency, reliability, and convergent validity (Cronbach's alpha [$\alpha = 0.828$], composite reliability [0.868], and AVE [0.618]). These data suggest that the ICT Integration construct needs more assessment, whereas the Faculty Readiness and Teaching Effectiveness constructs remain solid. Thus, this discovery fits and is internally consistent.

4.4. Assessment of Measurement Model

Figure 1 illustrate the assessment of measurement model.

4.5. Convergent Validity

Table 4 shows that Faculty Readiness and Teaching Effectiveness have high item-construct connections and excellent convergent validity. Faculty Readiness accounted for 76% of variance, and Teaching Effectiveness 62%. The ICT Integration concept explains just 53% of variation and has less convergent validity. All constructs had AVE values over 0.5, showing convergent validity, however the ICT Integration concept may require modification (Abro and Rashidi, 2012; Ali, 2022).

4.6. Discriminant Validity for Latent Variables

Table 5 shows the Discriminant Validity Analysis where the Faculty Readiness correlates with ICT Integration (0.488) more than Teaching Effectiveness (0.462). However, ICT Integration and Teaching Effectiveness correlate 0.778. Faculty Readiness is crucial to ICT adoption, and both variables affect teaching results.

4.7. The Prediction Relevance of the Model

Table 6 shows the R-square value of the Teaching Effectiveness model shows that the independent variables explain 59.6% of the variation. After controlling for model complexity and sample size, the adjusted R-square value reveals that independent factors explain 59.3% of Teaching Effectiveness variation. The model has modest explanatory power, indicating that independent factors affect Teaching Effectiveness. For a complete grasp of the model's predictive power, the independent variables and their relevance must be examined.

4.8. Effect Size f^2

The f-square results suggest that Faculty Readiness and ICT Integration explain 34.1% and 39.3% of Teaching Effectiveness variation, respectively, as appear in Table 7. These values demonstrate their respective Teaching Effectiveness contributions. A higher f-square means more effect. A complete understanding needs evaluating the study's context and model fit.

4.9. The Assessment of the Inner Model and Hypotheses Testing Procedures

Table 8 presents the results of the hypothesis testing, including the beta (β) coefficients, mean (μ), standard deviation,t-values, P-values, and the decision regarding each hypothesis (Ali et al., 2022).

Hypothesis 1 (H_1) examined the relationship between Faculty Readiness (FR) and Teaching Effectiveness (TE). The beta coefficient (β) of 0.429 indicates a positive relationship. The mean (μ) for FR was 0.429 with a standard deviation (Chaipidech et al.) of 0.042. The t-value of 10.308 was highly significant ($P < 0.001$), supporting H1. This implies that Faculty Readiness significantly contributes to Teaching Effectiveness.

Hypothesis 2 (H_2) investigated the relationship between ICT Integration (ICTI) and Teaching Effectiveness (TE). The beta coefficient (β) of 0.461 suggests a positive relationship. The mean (μ) for ICTI was 0.468 with a standard deviation (Chaipidech et al.) of 0.044. The t-value of 10.531 was highly significant ($P < 0.001$), supporting H2. These findings indicate that ICT Integration significantly influences Teaching Effectiveness.

The decisions for both hypotheses were based on the highly significant t-values and P-values. The results provide evidence in support of the hypotheses, indicating that both Faculty Readiness and ICT Integration have a positive and significant impact on Teaching Effectiveness.

Figure 1: Assessment of measurement model

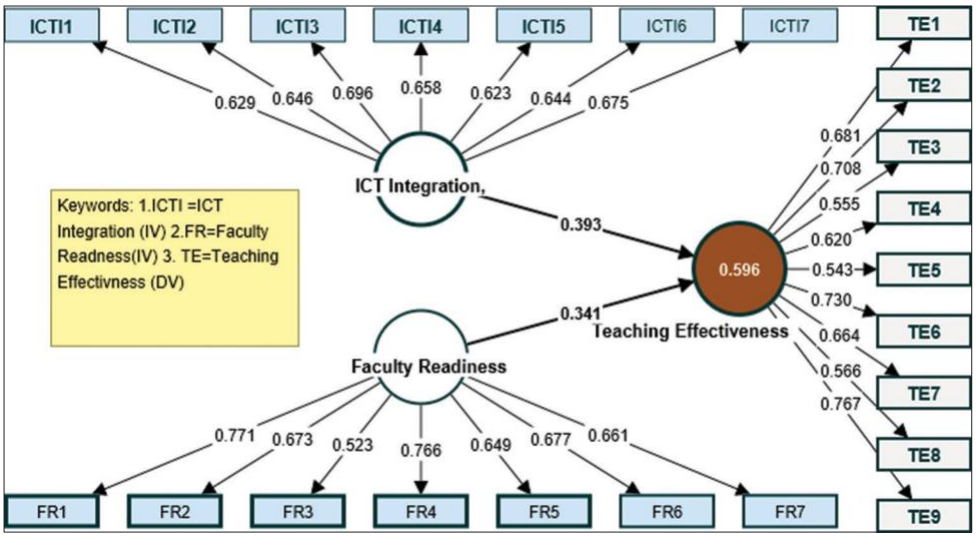

Table 8: Mean, STDEV, T-values, P-values, decision

NO	Hypothesis	β	μ	SD	T-value	P-values	Decision
H_1	FR→TE	0.429	0.429	0.042	10.308	0.000	Supported
H_2	ICTI→TE	0.461	0.468	0.044	10.531	0.000	Supported

*FR: Faculty readiness, ICTI: Information and communication technology integration=teaching effectiveness. Beta (β); Values from−1 to+1. Assess significance and confidence intervals. P-values; Significance value is based on the degrees of freedom P<0.05 (Cheah et al., 2020)

It is important to note that the significance level ($P < 0.05$) was used to determine the statistical significance of the results, and the degrees of freedom were considered for the interpretation of the p-values. These findings contribute to our understanding of the relationships between the constructs and their implications for enhancing Teaching Effectiveness in the given context (Ateeq et al., 2022).

Nevertheless, while our results are consistent with the prevailing consensus, it is crucial to acknowledge the possible variations seen in other investigations. Differences in methodology, sample populations, and evaluation instruments have the potential to create nuanced variations in the magnitudes of effects. For example, although Smith et al. may have taken into account a more comprehensive interpretation of ready, our research may have concentrated on certain facets of faculty preparedness. Although these changes may be slight in nature, they have the potential to impact the overall outcomes.

Our study has inherent value and is well-regarded throughout the wider educational research community. The convergence of these research results strengthens the significance of adapting instructional methods, providing practical knowledge for anyone involved in the field of education.

5. CONCLUSIONS

Overall, our study and prior studies emphasize the importance of Faculty Readiness and ICT in improving Teaching Effectiveness. These results provide instructors with a cohesive approach to improving education. Our findings agree with the consensus, however methodological differences in research may cause ambiguities. This emphasizes the necessity for ongoing study in varied educational environments to fully comprehend and use these results.

Prioritizing technology integration in teaching and providing teachers with resources and training is important. ICT content and skills must be added to curriculum, and technology-enhanced assessment techniques must be used for more accurate student evaluation. Finally, policies that encourage technology adoption, professional advancement, and new teaching techniques may inspire cooperation and continuous improvement. These measures will equip Gulf institutions for digital education.

The research includes limitations that should be noted when evaluating the results. The study's narrow focus restricts its applicability to other educational environments. Relying on self-reported metrics may create bias and measurement inaccuracy. The cross-sectional design precludes causality. The findings may vary depending on the measuring tools used.

Hence, future studies may expand the sample size and composition might improve external validity. Further, to have a comprehensive comprehension and establish the generalizability of these findings, it is essential to conduct more investigations in other educational contexts.

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