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Research Article

Technological self-efficacy and mindfulness ability: Key drivers for effective online learning in higher education beyond the COVID-19 era

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ABSTRACT

During the COVID-19 outbreak, Israel's higher education system swiftly transitioned to emergency-adapted online distance learning. Yet, limited research has assessed effectiveness of online learning (EOL) for Arab students in Israel. This study delves into Arab students' EOL perceptions, focusing on cognitive and emotional aspects. Using a quantitative method, it explored the link between technological self-efficacy (TS), mindfulness ability (MA), and EOL during the pandemic among students from three Israeli academic institutions (N=378). Results showed a positive association between TS and EOL. Further, MA moderated TS-EOL relationship. Men demonstrated higher TS than women. There were noticeable EOL differences between undergraduate (pre-service teachers) and graduate (in-service teachers) students, with the latter exhibiting an advantage. This research contributes to the evolving discourse on post-pandemic online learning, shedding light on potential gender disparities and highlighting the importance of both TS and MA for successful online learning. The findings have implications for instructional designers, educators, policymakers, and academic programs.

Keywords: COVID-19 crisis, online learning effectiveness, technological self-efficacy, gender differences, mindfulness ability

INTRODUCTION

The COVID-19 pandemic dramatically altered global education, pushing schools and higher education institutions to switch to online learning swiftly (Zhang et al., 2020). Although online education was previously a supplementary route, the pandemic underscored its crucial role in continuous learning (Masry-Herzallah & Stavissky, 2023).

This study focuses on online learning in higher education, probing the relationship between technological self-efficacy (TS), mindfulness ability (MA), and the perceptions of Arab students in Israeli academic institutions about the effectiveness of online learning (EOL) during the pandemic. This subject remains under-researched both in regular circumstances and amidst the COVID-19 crisis.

Historically, online learning was an alternative, particularly for adult learners in higher education (Lockee, 2021). However, the pandemic's onset prompted a swift shift to virtual learning across educational tiers, coining the term "emergency remote teaching" (Hodges et al., 2020). To counteract COVID-19, education systems globally, including Israel, embraced online remote learning to maintain academic continuity (Altbach & De Wit, 2020).

Pandemic-induced online learning significantly varies from its conventional asynchronous counterpart (Tzafilkou et al., 2021). This sudden transition posed unique challenges for many students, some of whom were unprepared mentally (Carter Jr et al., 2020) or lacked prior technological exposure (Naji et al., 2020).

The efficacy debate of online learning during the pandemic versus traditional times remains open-ended (Zhao et al., 2021; Zheng & Zheng, 2023). Therefore, this study emphasizes student perceptions in this context, as their EOL insights can offer a deeper understanding of online instruction quality (Bolliger & Wasilik, 2009). With the rise of digital skills and ed-tech tools, the role of online and blended learning is set to grow, especially in the artificial intelligence (AI) era (Amzalag & Masry-Herzallah, 2021; Lockee, 2021; van Laar et al., 2020).

Literature indicates that EOL, both during regular and crisis periods, is associated with student preparedness (Atkinson & Blankenship, 2009; Bernard et al., 2004; Smith et al., 2003). This preparedness is connected to personal attributes (Faize & Nawaz, 2020; Shapiro et al., 2020), such as TS. Stemming from the broader concept of self-efficacy (Bandura, 1977), TS represents an individual's confidence in their capability to effectively use the internet and related platforms (Chu & Tsai, 2009).

TS plays a crucial role in influencing students' perceptions of EOL (Jokisch et al., 2020; Masry-Herzallah, 2022a) and is also affected by factors like previous technological experience, age, and gender (Masry-Herzallah & Stavissky, 2021; Zeng et al., 2022). While gender differences in technology usage and online learning perceptions are acknowledged (Scherer et al., 2017; Zeng et al., 2022), their specific impact on EOL of Arab students during the pandemic era is not extensively studied.

Alongside to TS, recent research has identified MA as a beneficial personality trait. MA, which encompasses active information processing, continuous category formation, self-awareness, and recognition of alternatives (Langer, 2004), is essential for students navigating online learning environments (Atoy Jr et al., 2020; Chang et al., 2019; Miller et al., 2020).

While interdisciplinary studies have delved into MA and its moderating effects (Hsieh et al., 2021), there is a research gap concerning the influence of MA on students' perceptions of emergency online learning in both typical and crisis situations. Recognizing the importance of these factors, this study explores their impact on EOL during the COVID-19 pandemic. The insights derived aim to contribute to the literature on post-pandemic online learning and provide valuable insights for educators, instructional designers, policymakers, and researchers.

Research Questions

1. How do students' TS levels relate to their EOL perceptions during the COVID-19 pandemic?
2. Does MA influence the relationship between TS and EOL?
3. Are there significant gender and academic stage-based (bachelor's vs. master's degree) differences in students' TS and EOL perceptions?

LITERATURE REVIEW

Effectiveness of Online Learning During the COVID-19 Period

The pandemic notably propelled synchronous online learning, where participants interact in real-time, contrasting with the traditionally favored asynchronous online learning available through course websites and learning management systems (Masry-Herzallah, 2022b).

Platforms like ZOOM became instrumental, offering an interactive space that mirrored traditional classroom dynamics. These platforms facilitate lectures, group tasks, individual assignments, and diverse social interactions. They also support a range of teaching approaches, from conventional teacher-centric models to collaborative, student-led paradigms (Aliyyah et al., 2020). Conversely, asynchronous learning, which links educators and students irrespective of time or location, is deeply rooted in technology (Shamir-Inbal & Blau, 2021).

Research indicates that EOL is contingent upon students' readiness, encompassing comfort with resources, technological skills, and the capacity for self-directed learning (Faize & Nawaz, 2020; Shapiro et al., 2020; Zainuddin et al., 2020). Diverse studies present nuanced interpretations of "readiness." For instance,

Masry-Herzallah and Dor-Haim (2023) conceptualize readiness as a combination of belief in online education, fundamental skills, self-direction, and willingness to engage with peers and instructors. The technological component is pivotal for influencing EOL (Hung et al., 2010), with students' past experiences molding their adaptability (Altbach & De Wit, 2020; Savitsky et al., 2020). Some demographics, particularly undergraduates with limited online experience, expressed apprehensions about synchronous online formats (Altbach & De Wit, 2020). Age also impacts EOL perceptions, as suggested by Kalman et al. (2020).

Gender dynamics in online learning during the pandemic yield varied results. While some studies suggest male students exhibit more positive EOL perceptions (Chang et al., 2019; Masry-Herzallah & Stavisky, 2021), others emphasize challenges faced predominantly by women (Olmos-Gómez, 2020). Still, some research indicates a neutral gender impact (Malkawi et al., 2021). Specifically, within the Arab student and educator in Israel, data from the COVID-19 period reveals that men generally held more favorable views towards online learning compared to women (Masry-Herzallah & Stavisky, 2021).

Considering these diverse findings, scholars highlight the importance of assessing students' receptivity towards online learning (Sharma et al., 2020). Given that online methods require both technological proficiency and innovative teaching strategies (Gurley, 2018), it's vital to establish a comprehensive readiness framework that includes students' TS.

Technological Self-Efficacy & Its Impact on Online Learning Effectiveness During COVID-19

Bandura's (1977) concept of self-efficacy revolves around an individual's confidence in their capability to succeed, suggesting that individuals base their engagement and persistence on these efficacy beliefs. TS reflects users' confidence in using online platforms, systems, and content. It represents an individual's belief in their ability to proficiently use the Internet, deeming it essential for successful online learning (Jokisch et al., 2020).

In correlating TS with online learning, scholars offer varied interpretations of technological capability (Hodges, 2008). For example, Chu and Tsai (2009) propose a two-fold model: Internet self-efficacy and Internet self-communication. The former refers to proficiency in using the Internet, while the latter emphasizes online communication skills. Within online learning, a student's TS is evidenced in their ability to engage with online systems and content, and to interact with peers and educators (Chu & Tsai, 2009; Hodges, 2008). Research, like that by Alqurashi (2016), shows how TS enhances students' efficiency in sourcing information within online curricula. Similarly, Chang et al. (2014) found that students with robust TS exhibited better academic performance in online learning settings compared to their less technologically adept peers.

Recent studies from the COVID-19 era emphasize the relationship between TS and EOL within the student population (Alzahrani & Seth, 2021; Masry-Herzallah, 2022b). A student's TS often arises from their preparedness for digital learning, encompassing aspects such as their ICT competencies (Jiang et al., 2021). However, some students may be technologically disadvantaged, lacking the skills required for synchronous and asynchronous learning during the pandemic, or even essential resources like a computer or reliable Internet connection (Aboagye et al., 2020).

Furthermore, TS is pivotal in determining individuals' resilience to the changes brought about by COVID-19 (Masry-Herzallah & Dor-Haim, 2021). Online learning self-efficacy, synonymous with TS, reflects an individual's adaptability and resilience in digital learning scenarios (Zimmerman & Kulikowich, 2016).

Given the limited research exploring the relationship between TS and students' perceptions of EOL during COVID-19, it's crucial to explore how students' TS affects their online learning experiences during this period. Based on this, the study postulates:

H1. A positive correlation will exist between TS and the effectiveness of students' online learning.

Previous research has highlighted gender disparities in TS within online learning contexts (Masry-Herzallah, 2022a). Studies indicate male students generally display higher TS compared to females, attributed to historically constrained tech opportunities for women (Savitsky et al., 2020). Other findings show male students often demonstrate greater innovation when handling technology-driven academic tasks and tend to have a more positive emotional outlook in these contexts than females (Dogru, 2020; Kaleli, 2020).

Regarding Arab students, both before and during the COVID-19 pandemic, studies suggest higher TS among males relative to females, spanning both higher education learners and educators (Masry-Herzallah, 2022b). Based on existing data, this study hypothesizes:

H2. Significant gender differences will exist in students' perceptions of EOL during the COVID-19 pandemic.

Cultivating technology-related self-efficacy and dismantling gender barriers will be vital for students and teachers to thrive with novel instructional technologies in the post-pandemic digital era.

Mindfulness Ability & Online Learning

MA is multifaceted, encompassing active information search and processing, continuous creation of new categories, and awareness of personal needs and alternative perspectives (Sun & Fang, 2010). Recognized as a positive trait (Marzabadi et al., 2021), MA signifies psychological consciousness, emphasizing awareness and attentive listening (Brown & Ryan, 2003). It plays a pivotal role in informed decision-making (Sun & Fang, 2010).

Research consistently underscores the myriad benefits of MA across various life domains. In educational contexts, MA emerges as a foundational element that fosters successful learner navigation. Specifically, MA in learning emphasizes continuous category creation, receptiveness to novel information, and an understanding of diverse perspectives (Brown & Ryan, 2003; Langer, 2004). Studies have linked increased MA levels among students with reduced stress (Van Dam et al., 2014), test anxiety (Galante et al., 2018), and depression (Haukaas et al., 2018). Additionally, it boosts self-efficacy, self-leadership, academic performance (Corti & Gelati, 2020), emotional intelligence (Charoensukmongkol, 2014), motivation, memory (Brown & Green, 2016), cognitive functioning (Moore & Malinowski, 2009), and emotional regulation (Van Dam et al., 2018), all fundamental to learning and achievement (Tang et al., 2015).

In online learning contexts, learners actively seek information aligning with their objectives (Wu & Xie, 2018). This search requires sustained attention to learning tasks, making attention during tasks involving cognitive control correlate with processing current information. Recent research affirms the significant role MA plays in internet usage (Atasalar & Michou, 2019) and positions it as a mental tool that assists users in consciously and effectively addressing challenges (Zha et al., 2015). Moreover, MA has been identified as instrumental in enhancing online information search strategies among students (Atoy Jr et al., 2020).

Given the prominence of online learning during the COVID-19 era, which often requires concentration, the ability to listen emerges as a crucial precursor for student participation. Enhanced listening skills invariably lead to better performance outcomes (Hollis & Was, 2016). Elevated MA among students can potentially aid them in managing emotions and thoughts non-judgmentally, fostering self-awareness, and focusing on academic tasks. This facilitates adaptive responses, enriches interactions with educators and peers, and equips them to multitask (Miller et al., 2020). Based on this understanding, the current study hypothesizes:

H3. MA will have a positive correlation with OLE.

Past research has delved into the moderating role of MA across diverse arenas. For instance, Zha et al. (2015) found that MA moderates the influence of information quality, system quality, and service quality on perceived utility, subsequently impacting information seeking in virtual communities. Hsieh et al. (2021) showed that MA moderates the connection between teacher burnout and online teaching during the COVID-19 crisis, enabling educators to effectively handle work demands and respond positively to stressful environments. In light of this, it's essential to assess the impact of MA on students within online learning environments during the COVID-19 period. Consequently, this study hypothesizes:

H4. MA will moderate the relationship between TS and EOL during the COVID-19 era.

While this study anticipates MA to function as a moderating variable, such a relationship may not be consistent for students across different TS levels. The research aims to determine if elevated MA is essential for students with either low or high TS, or both.

This study introduces a fresh perspective for both research and practice, emphasizing EOL in the post-COVID-19 digital age.

METHODOLOGY

Participants

A total of 378 Arab students from three higher education institutions, chosen randomly from a pool of six, participated in this study. Among them, approximately 85.0% were female, and 15.0% were male. The average age of the students was 31.5 years (standard error [SE]=9.41). Approximately 68.0% of these students were pursuing an MA in education (all of whom were teachers), while the remaining 32.0% were enrolled in a BA program for pre-service teaching across various educational disciplines.

Measures

The study adopted a quantitative approach, gathering data through the following instruments.

Technological self-efficacy questionnaire

Influenced by the work of Bandura (2006) and Kao and Tsil (2009), this questionnaire consisted of seven statements. Participants rated each statement on a Likert scale ranging from one ("strongly disagree") to five ("strongly agree"). Statements included phrases like "I always succeed in dealing with new technologies" and "I have full control over Zoom". The reliability coefficient for this section was α=.87, indicating high internal consistency.

Mindfulness questionnaire

Based on Langer (2004), this instrument featured 18 items spread across four dimensions. Students expressed their agreement with each statement on a Likert scale ranging from one ("strongly disagree") to five ("strongly agree"). The questionnaire's overall reliability was α=.90, reflecting a high level of consistency among the items.

Online learning effectiveness questionnaire

Adapted from Bernard et al. (2004), it contained 19 statements, with participants rating each on a Likert scale from one ("strongly disagree") to five ("strongly agree"). The reliability for this part was α=.87, suggesting good internal consistency

Demographic questionnaire

This section consisted of questions about the students' age, gender, course of study, and year of study.

Data Analysis

The collected quantitative data were analyzed using SPSS. Techniques employed included descriptive statistics, Pearson's correlation, hierarchical regression, and simple slopes analysis.

Research Process

The study commenced following approval from the college's ethics committee. Initially, a pilot study among 35 students was conducted to validate the questionnaire's effectiveness. Insights from this stage were crucial for refining the questionnaire to improve clarity and relevance and minimize biases in question phrasing. After revising the questionnaire, it was disseminated in Arabic via Google Forms, with links circulated to students through email and WhatsApp. To reduce response bias, participants were guaranteed complete confidentiality and anonymity regarding their responses. Where possible, random sampling methods were used to select participants, aiming to decrease selection bias. These initial steps laid the groundwork for the research.

The response collection period spanned April to June 2021. Students received information about the study objectives and researcher contact details and were asked for informed consent. They were reassured about data anonymity and confidentiality, with a clear statement that data would only be used for research purposes.

Table 1. Descriptive statistics & correlations between research variables

Variable	Mean	ST	1	2	3	4	5	6	7	8	9
1.Gender[1]	-	-	-	-	-	-	-	-	-	-	-
2.Study course[2]	-	-	-.13*	-	-	-	-	-	-	-	-
3. TS	4.11	0.67	-.13*	.03	-	-	-	-	-	-	-
4. Search for innovations	3.93	0.55	-.03	.07	.44**	-	-	-	-	-	-
5. Creation of innovations	3.79	0.66	-.08	.04	.42**	.63**	-	-	-	-	-
6. Flexibility	3.93	0.57	-.07	.08	.47**	.68**	.63**	-	-	-	-
7. Involvement	3.80	0.64	-.01	.14**	.35**	.57**	.60**	.63**	-	-	-
8. MA (inclusive grade)	3.86	0.51	-.06	.01	.49**	.84**	.85**	.86**	.83**	-	-
9. EOL	3.44	0.58	-.03	.14**	.35**	.25**	.22**	.27**	.26**	.29**	-

Note. p<.05; **p<.01; & [1]n=349~376

Table 2. Hierarchical regression results (Effectiveness of online learning)

Variable	Stage 1	Stage 2	Stage 3
Gender[1]	-.5	-.1	-.1
TS	.14*	.12*	.11*
MA		.26**	.23**
TS×MA			-.13
R^2	.02*	.14**	.16**
F (df)	4.13 (2,346)*	14.25 (4,344)**	12.75 (5,343)**
F_{change}		23.82**	5.93*

Note. n=348; *p<.05; & **p<.01

FINDINGS

Table 1 presents the descriptive statistics for the research variables and the Pearson correlations among them.

As illustrated in **Table 1**, there's a significant correlation between EOL and most of the variables, including TS and MA. Moreover, all four dimensions of MA, including the overall score, demonstrate a positive and significant association with EOL. The data further indicates that men consistently report a higher TS, while master's degree students show a higher EOL, both of which are statistically significant.

In the next stage, a hierarchical regression was conducted to ascertain whether TS and MA could predict EOL and to explore any potential interaction between these variables. Given their association with some of the research variables, the demographic factors of gender and course of study were also integrated into the model. The outcomes of this analysis can be found in **Table 2**.

Table 2 demonstrates that the course of study consistently predicts EOL at all stages, with master's students indicating a higher perceived effectiveness. In the second stage, both TS and MA surfaced as significant predictors of EOL. The third stage identified an interaction between TS and MA. To elucidate this interaction, a simple slopes analysis was conducted. This assessment showed that the relationship between TS and EOL is more pronounced for individuals with lower MA (16^{th} percentile), b=0.26, SE=.05, p<.001 compared to those who are high in MA (84^{th} percentile), b=0.13, SE=.06, p=.04. **Figure 1** graphically represents this interaction, which was constructed following the methodology recommended by Aiken and West (1991). As depicted in **Figure 1**, MA is especially relevant for individuals with low TS, whereas its impact is less significant for those with high TS.

DISCUSSION & CONCLUSIONS

This study investigated the relationship between TS, MA, and perceptions of EOL among Arab students in three higher education institutions in Israel during the COVID-19 crisis. The study emphasized the moderating roles of MA. Findings revealed a positive correlation between TS and EOL and between high MA and EOL. Men exhibited higher TS, while master's degree students reported stronger perceptions of EOL. Notably, MA played a moderating role in the relationship between TS and EOL. The association between TS and online learning was more pronounced for students with lower TS levels than those with higher levels.

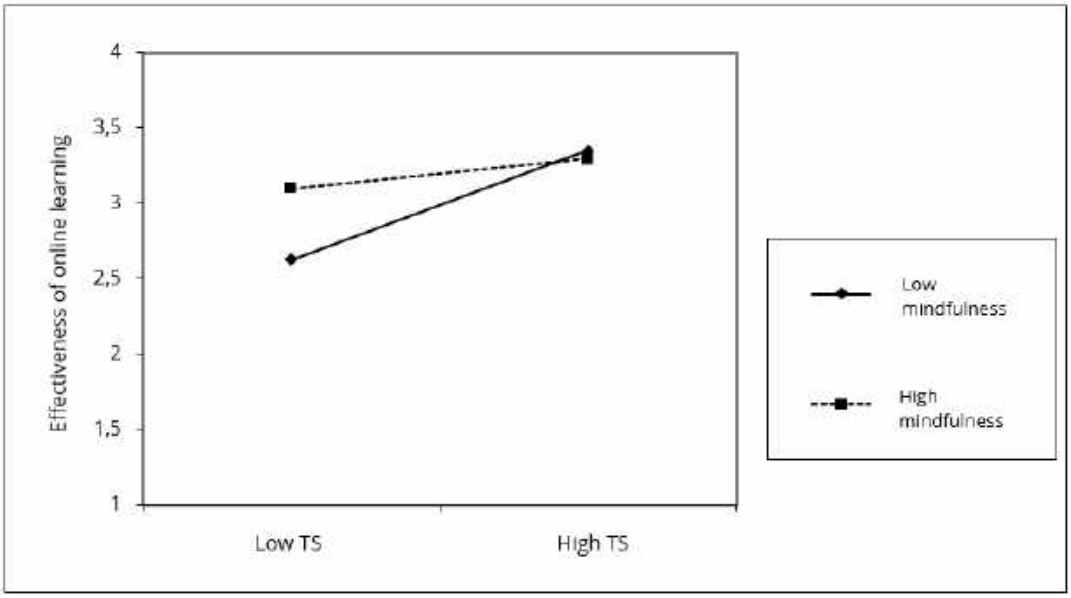

Figure 1. Interaction between TS & MA in predicting EOL (Source: Authors' own elaboration)

Results indicated that TS positively predicted online learning effectiveness for specific groups, and all hypotheses were validated. This research deepens the understanding of the dynamics between TS, MA, gender, and online learning effectiveness amid the challenges of the COVID-19 pandemic.

Aligned with the initial hypotheses, the study underscores the pivotal role of students' TS in EOL perceptions, particularly during the abrupt transition to online education at the pandemic's onset. Such findings are congruent with prior research (Alzahrani & Seth, 2021; Bernard et al., 2004) emphasizing students' TS in EOL. Additionally, this study resonates with past research suggesting students with higher TS are better equipped for online communication and interactions (Chu & Tsai, 2009). Moreover, TS influences students' academic motivation (Chang et al., 2014).

Furthermore, our study highlights the positive moderating role of MA between students' low TS and their EOL perceptions, especially during challenging times. This observation is consistent with prior studies (Hsieh et al., 2021; Zha et al., 2015). In online environments, where students have limited TS, MA aids in internet utilization and information retrieval. Given its importance, online course designers should consider strategies that foster this cognitive skill in students.

Studies from various cultures, such as Raphiphatthana and Jose (2020), have demonstrated that the efficacy of MA is not limited to a specific cultural context. Consequently, higher education institutions should consider integrating MA courses or practices into their curricula.

This study's novelty lies in its demonstration of how MA moderates TS-EOL relationship. This insight underscores the importance of developing both technological skills and MA for optimal online learning.

The disparity in EOL perceptions between undergraduate and graduate students, with the latter being more positive, could stem from their field of study and prior online education exposure. As most master's degree students in this study–many of whom are practicing educators–had prior online teaching experience, it positively influenced their EOL perceptions.

The gender disparities observed, particularly the higher TS among men, align with previous studies (Masry-Herzallah & Stavissky, 2021; Savitsky et al., 2020). Considering these findings, there's a compelling case for integrating mindfulness workshops into online courses, especially given the pronounced role of MA for students with low TS.

A salient finding is the moderating role of MA in the relationship between TS and EOL. Cultivating MA in students could significantly enhance their online learning experiences. Even for students with lower TS levels, robust MA can equip them with the cognitive and self-regulatory skills essential for navigating new learning technologies effectively.

This research provides vital insights for education during pandemics and the integration of technologies like AI. It offers pivotal knowledge about the tailored support required to foster TS and MA in a post-COVID-19 world, where online learning is increasingly standard. By illuminating gender discrepancies, it also suggests avenues for more equitable training approaches.

Theoretical and Practical Implications

This study offers significant theoretical and practical insights into EOL and TS in the context of the AI era. Theoretically, the research extends frameworks pertaining to TS and MA. Notably, it validates the role of TS during the abrupt shift to online learning amid the COVID-19 pandemic. The findings also bolster Bandura's (2006) self-efficacy theory, underscoring how TS prepares students for online education. While previous research has examined the relationship between TS and EOL, our study uniquely unveils the gender-dependent dynamics between TS and MA during the pandemic. The interrelation of TS and MA suggests a symbiotic connection, broadening theoretical models linking student and teacher competencies with instructional efficacy in digital environments.

Practical Implications

From a practical standpoint, the research sheds light on the pandemic's influence on online learning. These insights can guide future preparedness efforts, emphasizing the need for policies, professional growth, and resources that bolster students' TS (Masry-Herzallah & Dor-Haim, 2021). Given the likely persistence of online education post-pandemic, our findings can aid stakeholders in refining virtual pedagogical strategies.

The participant demographic, predominantly women, mirrors the significant female representation in Arab e educational society in Israel. Per the Central Bureau of Statistics (2022), in 2022 Arab public education had significant female teacher representation at 75.6%. In 2021, Arab female students constituted 68.7% of all Arab higher education students, 66.1% of second-degree students, and 73.8% of Arab doctoral candidates (Haddad Haj-Yahya et al., 2022). This observation underscores the need for technology training specifically tailored for women, challenging prevailing gender-based technological stereotypes, promoting female academic role models, and addressing gender disparities through well-informed policies and curricular revisions. As the integration of AI into schools and higher education becomes more pronounced, initiatives aimed at addressing technological gaps become essential to ensure gender inclusivity.

For Arab academic institutions transitioning into the post-pandemic, AI-centric era, the results underline the necessity for policies that emphasize technology integration, competency-building training, curricula that merge technology and pedagogy, and initiatives that tackle gender imbalances. Enhancing both technological and mindfulness competencies can elevate student engagement in digital instruction. Stakeholders must leverage these insights to usher in a seamless shift to AI-powered, data-driven, personalized educational paradigms.

Research Limitations & Future Studies

Despite its novel contributions, this study has limitations. The reliance on survey-based, self-reported data may introduce biases, potentially leading to common method variance (CMV). Although strategies from Podsakoff et al. (2000) were employed to minimize CMV, future research could benefit from a mixed-methods approach, incorporating qualitative narratives for a richer understanding. While the study emphasized certain personality determinants of OLE, other influential variables, both intrinsic and extrinsic, merit exploration. The current research focus on Arab students in teacher education or practicing teachers could be broadened in subsequent studies to include a more diverse student demographic. The study's cross-sectional design, capturing a singular temporal snapshot, limits longitudinal insights and causal inferences. Future research could delve deeper, monitoring students' online learning trajectories over extended durations.

In conclusion, the COVID-19 pandemic has precipitated profound shifts in educational paradigms, underscoring the importance of TS and effective online learning experiences. This study illuminates the intricate interplay of gender and MA within this evolving landscape. As the educational realm continues to transform, addressing these facets is paramount to ensuring robust and equitable digital education. Future research should delve into targeted interventions that synergize technology skill enhancement with mindfulness training, catering to diverse student profiles and requirements.

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Data availability: Data generated or analyzed during this study are available from the authors on request.

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