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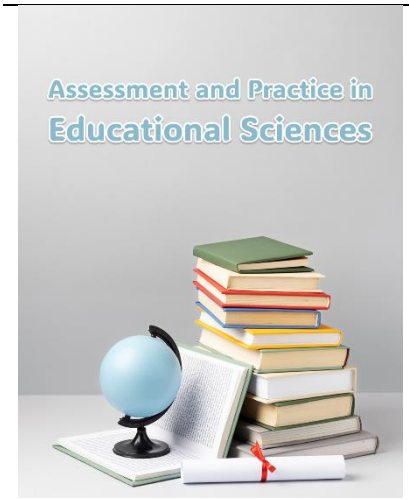

Investigation and Validation of the Scale of Students' Readiness for Online Learning

1. Abbas. Shayestehfar*: Assistant Professor, Department of Educational Sciences, Payame Noor University,Tehran, Iran. (Email : a_shayestehfar@pnu.ac.ir)
2. Nasibe. Pourasghar: Assistant Prof, Department of Educational Sciences, Payame Noor University , Tehran, Iran.
3. Marjan. Masoomifard: Associate Professor, Department of Educational Sciences, Payame Noor University , Tehran, Iran.
4. Ziba. Nouri: Assistant Professor, Department of Educational Sciences, Payame Noor University , Tehran, Iran.

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ABSTRACT

The objective of this study was to investigate university students' level of readiness for online learning and to validate the psychometric properties of the Online Learning Readiness Scale in the context of distance education. This correlational study employed confirmatory factor analysis to assess the structure and validity of the Online Learning Readiness Scale. The statistical population included 1,930 undergraduate students of educational sciences enrolled in online classes at Payam Noor University in Hormozgan Province during the 2021–2022 academic year. Based on the Krejcie and Morgan table and anticipating potential non-response in online surveys, 346 students ultimately completed the questionnaire distributed via WhatsApp and email. The instrument consisted of 18 items measuring five dimensions: internet/computer self-efficacy, self-directed learning, learner control, motivation to learn online, and online communication self-efficacy. Validity was assessed through face, content, convergent, discriminant, and concurrent validity procedures, and reliability was evaluated using Cronbach's alpha and composite reliability. Data analysis was performed using SPSS (chi-square, t-test, ANOVA) and PLS software. Confirmatory factor analysis supported the five-factor structure of the scale, with all factor loadings exceeding 0.48 and t-values surpassing ±1.96, indicating acceptable reliability and construct validity. AVE values were above 0.48 for all constructs, and discriminant validity was confirmed through the square root of AVE method. Students demonstrated high readiness in self-directed learning, motivation, and internet/computer self-efficacy, while showing lower readiness in online communication self-efficacy and learner control. No significant differences were observed in readiness across gender, age, academic year, employment status, daily internet use, or course type. Several structural paths were confirmed, particularly the relationships between internet/computer self-efficacy and self-directed learning, learner control, and motivation. The Online Learning Readiness Scale demonstrated satisfactory validity and reliability, and the findings highlight the need to strengthen students' communication self-efficacy and learner control for more effective online learning.

Keywords: Online learning readiness; scale validation; e-learning; self-directed learning; computer self-efficacy; confirmatory factor analysis.

Introduction

Rapid transformations in digital technologies have fundamentally reshaped the landscape of teaching and learning, compelling educational institutions worldwide to accelerate their integration of online learning systems. Over the past decade, the shift toward technology-mediated instruction has intensified, driven by advancements in network infrastructures, mobile devices, multimedia environments, and increasingly sophisticated virtual learning platforms. These shifts have positioned

online learning as a central modality of contemporary education rather than a peripheral supplement (1). As a result, universities globally are compelled to recognize that the success of online education depends not only on technological investment but also on learners' psychological, cognitive, and behavioral readiness for online learning environments (2).

Scholars have emphasized that online learning readiness is a multidimensional construct encompassing students' technical competencies, motivational states, emotional stability, communication efficacy, and capacity for autonomous learning. Readiness is considered a prerequisite for meaningful engagement, academic persistence, and successful online performance, particularly in systems that demand independent navigation, sustained attention, and the ability to manage learning without continuous physical presence of instructors (3). Research on the intellectual foundations of distance education further argues that readiness reflects broader epistemological and socio-cultural determinants of how individuals relate to digital learning environments, suggesting that readiness is a core component of the evolutionary trajectory of distance education as a knowledge domain (4).

The surge in virtual learning—particularly during global crises and the post-pandemic period—has magnified the importance of understanding students' preparedness for online education. In many contexts, a substantial gap exists between the availability of online instructional platforms and users' capacity to use them effectively. This gap is especially pronounced in developing educational systems, where students often face structural challenges such as unequal access to devices, unstable connectivity, limited digital literacy, and varying psychological readiness (5). National reports have warned that insufficient digital skills among younger generations may lead to significant social, educational, and workforce disadvantages, raising concerns about the long-term implications of underdeveloped technology competencies (6). Hence, evaluating learners' readiness has become an essential element in educational planning and instructional design.

At the core of online learning readiness is the notion that students must feel confident and competent in navigating digital platforms. Studies reveal that readiness reflects students' perceived technological proficiency, attitudes toward online interactions, and their ability to manage learning tasks in autonomous and interactive digital environments (7). Moreover, readiness integrates not only digital skills but also motivational and emotional aspects—students must be able to regulate their emotions, sustain motivation, and cope with the anxiety often associated with virtual communication and online participation (8). In environments characterized by asynchronous and synchronous interactions, students' perceived control over their learning process and their capacity for self-direction significantly influence learning engagement and performance. Thus, online readiness must be conceptualized comprehensively, extending beyond technical competence to include psychological, social, and pedagogical dimensions.

Recent empirical studies conducted in school, university, and professional contexts highlight the dynamic relationship between readiness and various academic outcomes. For instance, online learning readiness has been found to be closely linked to academic resilience, suggesting that students who are more prepared for online learning demonstrate better coping strategies, adaptability, and perseverance in challenging virtual learning contexts (9). Similarly, digital readiness has been associated with variations in access, digital skills, motivational dispositions, and patterns of online engagement among different student subgroups (10). These findings underscore the significance of readiness as a mediating factor shaping students' learning experiences and academic well-being in online environments.

Furthermore, students' satisfaction with online learning has been shown to correlate strongly with their readiness levels. Research involving medical students demonstrates that psychological distress, satisfaction with online courses, and perceived self-efficacy are interconnected constructs, reinforcing the need for institutions to monitor readiness to better support learners' mental health and academic continuity (11). Other studies indicate that challenges in online learning often arise from social isolation, cognitive overload, limited peer interaction, and difficulties in self-regulation—all of which are moderated by

learners' readiness traits (12). These findings demonstrate that readiness is not merely a predictor of educational success but also a buffer against the psychological pressures associated with digital learning.

In the post-pandemic era, scholars have identified an increased emphasis on emotional, social, and behavioral dimensions of readiness. For example, studies in Thai higher education revealed that online learning and related health behaviors significantly affected students' mental health, suggesting that adequate readiness may mitigate negative psychological outcomes and support learning continuity (13). Similarly, research in Iranian contexts emphasized the importance of integrating educational equity considerations into virtual learning frameworks, highlighting that readiness must be approached through a holistic lens that accounts for structural inequalities and diverse learning needs (14). These perspectives underline that online readiness is not merely an individual characteristic but also an equity-related issue, shaped by institutional policies, cultural norms, and socio-economic conditions.

In terms of learning behaviors, readiness has been shown to influence self-regulated learning strategies, student engagement, and personality-driven learning tendencies. For instance, research examining self-regulated behaviors demonstrated that readiness mediates the relationship between students' personality traits and their level of engagement in virtual learning environments, thereby strengthening the theoretical link between learner characteristics and online learning behaviors (15). From another perspective, studies on institutional adoption of e-learning—particularly in emerging economies—highlight that readiness is shaped by institutional support systems, infrastructural adequacy, and cultural acceptance of digital education (16). These findings suggest that readiness is not solely an individual phenomenon but is embedded within institutional ecosystems.

Scholars have also explored specific psychological barriers that impede readiness. Communication anxiety, for example, is a recurring factor that negatively influences students' willingness to participate in synchronous online learning, restricting opportunities for interaction and collaborative knowledge construction (17). Similarly, interventions such as digital storytelling have been shown to reduce speaking anxiety and facilitate more positive engagement with online learning, indicating the potential for instructional strategies to strengthen readiness (18). These findings highlight the role of pedagogical design in shaping emotional readiness and reducing affective barriers.

Moreover, readiness is also influenced by students' cognitive and metacognitive capacities. Studies examining academic procrastination and cognitive flexibility have demonstrated that psychological preparedness for ambiguity and mental imagery training may enhance students' readiness to cope with the self-regulatory demands of online learning (19). Such research underscores that readiness extends beyond digital competencies and includes deeper layers of cognitive and psychological preparedness.

In technological terms, the digital tools used to mediate online learning also shape the readiness landscape. For instance, the use of avatars in synchronous video-based online learning environments has been shown to buffer students' negative emotions and reduce fears related to interaction, suggesting that innovative digital interfaces can enhance emotional and social readiness for online learning (20). Similarly, research in Malaysian contexts indicates that readiness is closely linked to learners' technological self-efficacy and perceived ability to navigate digital learning platforms effectively (21). Interactive and well-structured online systems foster more positive learning experiences, thereby strengthening readiness.

In parallel, structural, pedagogical, and interactional dimensions of online learning environments have been found to influence students' readiness as well. The degree of interaction between students, the perceived structure of online courses, and the clarity of instructional design significantly contribute to how prepared students feel to manage online learning tasks (22). The rise of virtual learning during the pandemic has shown that poorly structured learning environments can undermine readiness, while supportive and interactive designs enhance it. This is especially relevant in contexts where learners have limited prior exposure to online or blended learning.

Finally, broader global and cultural shifts toward digitalization have reinforced the significance of studying online readiness across diverse populations. Comparative studies show that readiness varies across cultural groups, socio-economic backgrounds, and educational systems, highlighting the need for context-specific measurement and validation of readiness scales. For example, research among high school students suggests that high levels of academic resilience and socio-emotional competencies strengthen readiness for online learning, while students with limited access or psychological resources may experience greater challenges (9). These variations demonstrate the necessity of validating readiness scales within local educational contexts to ensure reliable and meaningful assessment. Therefore, the aim of the present study is to investigate the level of students' readiness for online learning and to validate the Online Learning Readiness Scale among university students.

Methods and Materials

This research employed a correlational design using confirmatory factor analysis. The statistical population consisted of all students of educational sciences who were enrolled in online classes at Payam Noor University in Hormozgan Province during the fall semester of the 2021–2022 academic year. The questionnaire included 18 items, and according to recommendations for validation and construct reliability studies, the sample size should be at least 10 times the number of items. Considering the total population of 1,930 students and based on the Krejcie and Morgan table, an estimated sample size of approximately 322 students was required. Because electronic questionnaire distribution often results in non-response or incomplete data, the questionnaire link was disseminated via WhatsApp with two reminder messages. Ultimately, 346 students completed the questionnaire. The inclusion criterion for this study was being an undergraduate student in the field of educational sciences at Payam Noor University in Hormozgan Province. The exclusion criterion was leaving more than 20% of the questionnaire items unanswered. Data collection was conducted through an electronic questionnaire distributed via social networks—especially WhatsApp—and completed responses were received through WhatsApp and email.

The Online Learning Readiness Scale used in this study was originally developed by Hung, Chou, Chen, and Owen (2010). The scale measures five dimensions: internet/computer self-efficacy (3 items), self-directed learning (5 items), learner control in the online space (3 items), motivation to learn online (4 items), and online communication self-efficacy (3 items). Responses were scored using a five-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree). Reported reliability coefficients for the original instrument are 0.73, 0.87, 0.72, 0.84, and 0.86 for the five dimensions, respectively. The scale was translated for use in this study and then administered to students. The data collection instrument was a standardized questionnaire whose validity and reliability were evaluated and confirmed by field experts. Convergent validity in the PLS model was assessed using the Average Variance Extracted (AVE), which exceeded 0.48 for all variables. During the preliminary validation process, factor loadings ranged from 0.6 to 0.7, indicating acceptable values. In the main study, after full administration of the instrument, factor loadings of 0.48 or higher were obtained, again indicating acceptable measurement quality. Face validity was evaluated through qualitative feedback and quantitative impact scores, resulting in revisions to several items based on student input. Content validity was established using the Content Validity Ratio (CVR) and Content Validity Index (CVI), calculated through evaluations provided by 10 experts in psychology, educational sciences, and computer science. Construct validity was examined using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), both demonstrating acceptable model fit. Concurrent validity was verified by correlating scores from this scale with those from the (23), confirming the instrument's effectiveness in measuring the intended construct. The reliability of the questionnaire exceeded 0.48 according to Cronbach's alpha coefficients. Given that composite reliability (CR) values were all greater than 0.6, the measurement model demonstrated acceptable composite reliability (Table 1).

Table 1. Cronbach's Alpha Coefficients

Variables	Number of Items	Cronbach's Alpha	AVE	CR	CV Com	CV Red
Motivation to learn online	4 questions	0.52	0.39	0.71	0.03	0.02
Online communication self-efficacy	3 questions	0.69	0.62	0.83	0.25	0.12
Internet/computer self-efficacy	3 questions	0.48	0.49	0.74	0.04	0
Learner control online	3 questions	0.43	0.47	0.72	0	0.07
Self-directed learning	5 questions	0.28	0.30	0.58	0	0.06

For statistical analysis, chi-square tests, independent-samples t-tests, and ANOVA were performed using SPSS software. PLS software was employed for examining relationships between variables.

Findings and Results

Demographic analysis indicated that among the 346 respondents, 303 (88%) were women. Most students were between 18 and 20 years old (n = 225, 66%), were first-year students (n = 208, 60%), and were enrolled in the "Basics and Principles of Educational Planning" course (n = 203, 59%). Additionally, 287 participants (83%) were unemployed, and 328 (95%) reported using the internet for more than two hours per day.

The chi-square statistic for the final model was 378.882, indicating a poor model fit. However, the p-value of Bartlett's test was below 0.05, demonstrating significant correlations among items and confirming the suitability of factor analysis. Factor loadings for all indicators exceeded 0.50, indicating sufficient reliability. All t-values exceeded ±1.96, demonstrating statistically significant coefficients.

Table 2 illustrates the correlations among constructs along with the square root of AVE values. Each construct exhibits a higher AVE square root (diagonal values) than its correlations with other constructs, demonstrating acceptable convergent and discriminant validity.

Table 2. Correlation Coefficients

Variables	1	2	3	4	5
Motivation to learn online	*79.0*				
Online communication self-efficacy	*46.0*	*88.0*			
Internet/computer self-efficacy	*26.0*	*19.0*	*83.0*		
Learner control online	*38.0*	*40.0*	*43.0*	*82.0*	
Self-directed learning	*41.0*	*32.0*	*49.0*	*51.0*	*74.0*

Figures 1 and 2 illustrate the modified measurement model and significant coefficients model.

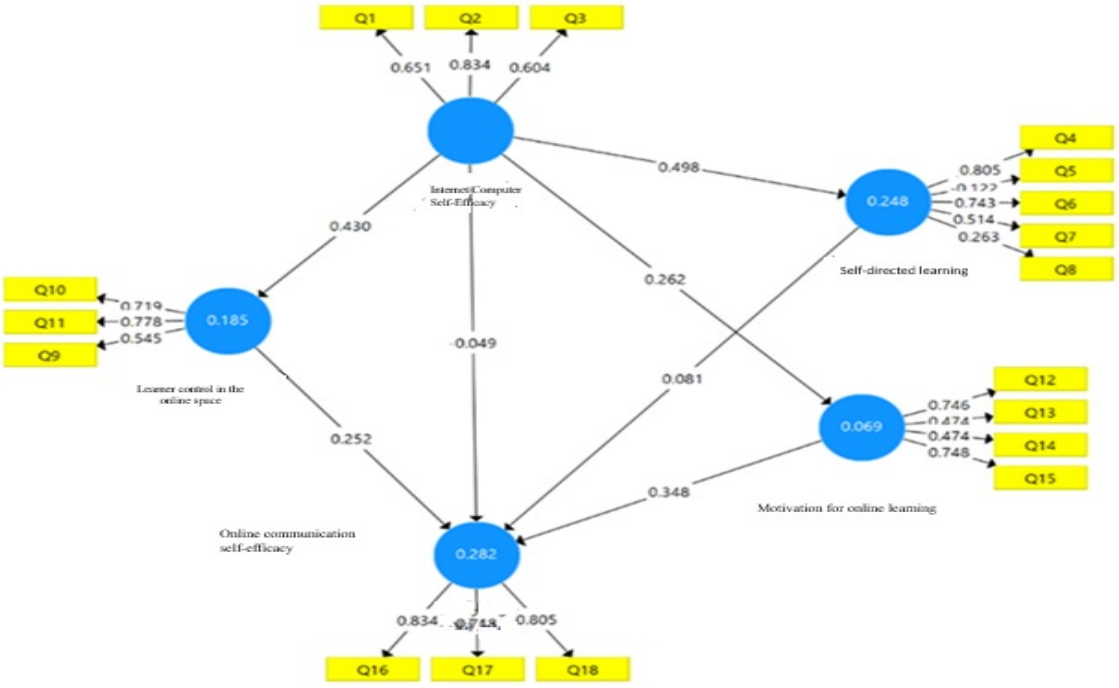

Figure1. Modified Measurement Model with Standard Coefficients

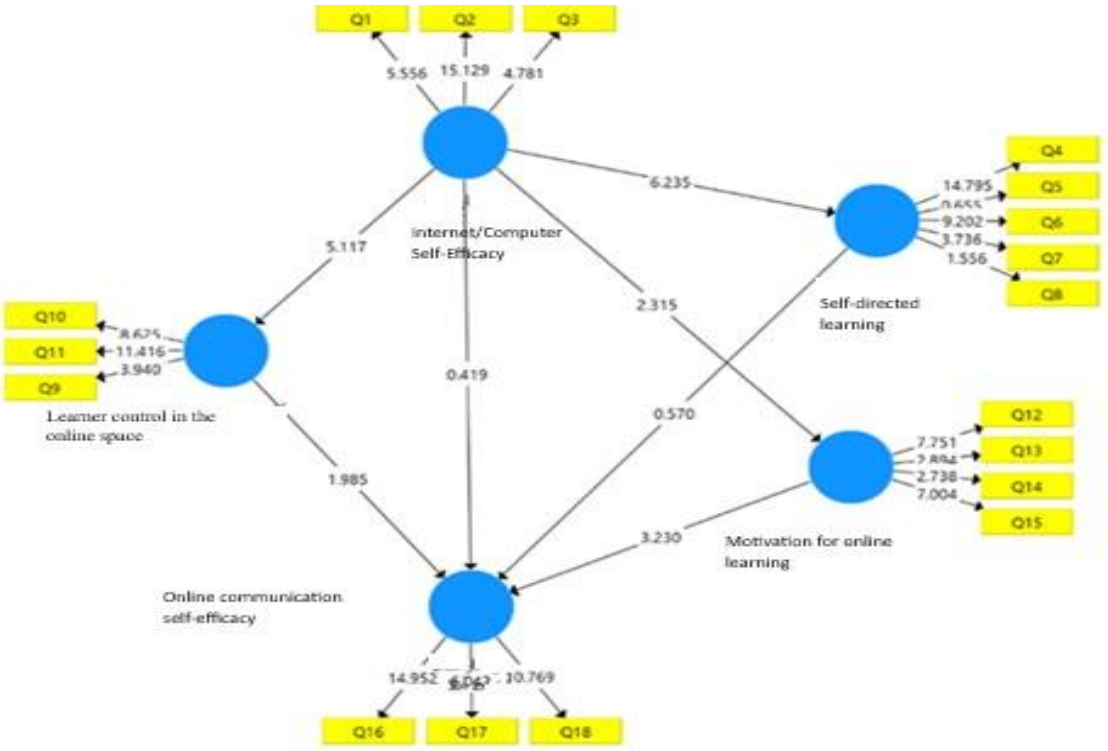

Figure 2. Modified Measurement Model with T-values.

To examine structural relationships among variables, the path coefficients and t-values were analyzed. Table 3 summarizes these results.

Table 3. Summary of Relationships Between Variables

Predictor → Outcome	Path Coefficient	t-value	Result
Internet computer self-efficacy → Learner control online	0.43	11.5	Confirmed
Internet self-efficacy → (Learner control → Online communication)	0.68	10.0	Rejected

Learner control → Online communication self-efficacy	0.25	98.1	Confirmed
Internet self-efficacy → Self-directed learning	0.49	23.6	Confirmed
Internet self-efficacy → (Self-directed learning → Communication)	0.57	04.0	Rejected
Self-directed learning → Online communication self-efficacy	0.08	57.0	Rejected
Internet self-efficacy → Motivation to learn online	0.26	31.2	Confirmed
Internet self-efficacy → (Motivation → Communication)	0.61	09.0	Rejected
Motivation → Online communication self-efficacy	0.34	23.3	Confirmed
Internet self-efficacy → Online communication self-efficacy	–0.04	41.0	Rejected

Discussion and Conclusion

The findings of this study revealed that the Online Learning Readiness Scale demonstrated acceptable psychometric properties when applied to a large sample of university students, confirming that the instrument provides a meaningful representation of the key dimensions associated with successful engagement in virtual learning environments. The confirmatory factor analysis supported the structural integrity of the five readiness dimensions—self-directed learning, motivation to learn online, internet/computer self-efficacy, learner control in the online space, and online communication self-efficacy—indicating that these constructs remain theoretically coherent and empirically robust in contemporary digital learning contexts. These results align with prior literature suggesting that online learning readiness is a multidimensional phenomenon shaped by the interplay of technical, psychological, social, and behavioral attributes (7). The strong performance of the dimensions related to self-directed learning, motivation, and technology-related self-efficacy suggests that learners today possess higher baseline competencies for navigating digital platforms than earlier cohorts, reflecting global trends of increased exposure to digital environments, expanded internet access, and greater reliance on mobile technologies for academic interaction (2). This is consistent with the argument that technological readiness has become increasingly embedded in younger generations' educational and social experiences, thereby enhancing their perceived self-efficacy and willingness to engage in online learning environments (3).

The finding that students displayed lower levels of readiness in online communication self-efficacy and learner control within virtual spaces points to persistent challenges in online interaction and autonomy — dimensions that are often overshadowed by technical readiness. Although students may be capable of using digital tools, they do not necessarily feel confident expressing themselves, initiating communication, or maintaining control over their learning in the absence of structured, face-to-face support. This pattern has been documented in similar studies, where learners' technical competence was found to outpace their interpersonal or communication competence, contributing to anxiety and reduced participation in synchronous or asynchronous discussions (17). Indeed, communication apprehension in virtual settings continues to be a major barrier to meaningful engagement, reinforcing the notion that readiness is not merely a cognitive or technical capacity but also a socio-emotional one shaped by confidence, perceived social presence, and comfort with digitally mediated interaction (20). Studies show that students with enhanced readiness for digital communication experience fewer negative emotions when interacting online, suggesting that targeted interventions addressing emotional and communication readiness may produce measurable improvements in participation and satisfaction (12).

The absence of significant differences in readiness based on demographic characteristics such as age, gender, employment status, daily internet use, and academic year suggests that online learning readiness may be becoming more homogeneous across university student populations. This trend differs from earlier findings that demographic variables, particularly gender, significantly predicted readiness outcomes (7), or that employment status and heavier internet use correlated with higher readiness levels (3). The current results may reflect broader structural changes in digital exposure, such as widespread smartphone penetration, routine use of social media for communication, and standardized institutional requirements for digital

literacy. These shifts imply that contemporary university students—regardless of background—are increasingly immersed in digital environments, supporting the argument that digitalization has narrowed historical gaps in technology access and use across student groups (5). Likewise, recent research indicates that digital inequality is now driven more by qualitative factors (e.g., skill depth, task-specific confidence, motivational dispositions) than by quantitative access differentials (10). The absence of gender differences in the present study is also consistent with research suggesting that as digital interaction becomes more normalized, traditional gender disparities in computer-related self-efficacy may diminish (21).

The findings further demonstrate that while students show considerable confidence in their internet/computer abilities, this competence does not uniformly translate into higher readiness for communication or self-regulation. The rejection of several mediating pathways in the structural model—particularly those linking internet self-efficacy to communication self-efficacy through learner control or motivation—suggests that although digital skill is a foundational component of readiness, its influence on other dimensions is neither linear nor deterministic. This reinforces previous observations that readiness must be conceptualized as a constellation of interdependent but distinct competencies (22). For example, digital storytelling interventions have been shown to increase communication comfort without necessarily altering technical skill levels, indicating that emotional and communicative readiness may require targeted pedagogical interventions (18). Similarly, personality traits and self-regulated learning strategies have been shown to mediate engagement behaviors in online courses, suggesting that readiness operates at the intersection of personality, motivation, and environment rather than simply reflecting technical expertise (15).

Students' high levels of self-directed learning observed in this study align with findings from contexts where learners have developed strong adaptive behaviors through prolonged exposure to digital instruction, especially during periods of widespread online migration in education systems (16). Self-directed learning is essential in virtual environments where learners must exercise autonomy, time management, self-monitoring, and goal setting without continuous instructor oversight. The current results correspond with the argument that today's undergraduates, shaped by ubiquitous technology use, exhibit stronger tendencies toward autonomous learning behaviors, which complement their digital competencies (9). However, despite this readiness for autonomy, the lower levels of learner control indicate that students may still depend on structured guidance when navigating complex online tasks, illustrating the persistent gap between conceptual autonomy and functional autonomy in digital learning environments. This gap is especially critical in low-support or poorly scaffolded online courses, where a mismatch between perceived readiness and actual task performance may emerge (14).

The favorable outcomes associated with motivation to learn online also reflect broader findings that motivational readiness significantly predicts persistence and academic success in virtual learning settings (19). Motivation plays an essential role not only in sustaining engagement but also in regulating learners' affective responses, especially when confronting challenges related to navigation, information processing, and communication anxiety. Previous research has shown that motivational states can buffer the negative impacts of emotional distress and enhance overall academic well-being in online contexts (13). Given the dynamic interplay between motivation, self-efficacy, and communication behavior, the presence of high motivational readiness in this sample may partially explain the overall favorable readiness profile, despite noted weaknesses in communication-related dimensions.

Moreover, this study's results align with broader international findings demonstrating that online readiness is strongly tied to learners' beliefs about their digital abilities, perceived ease of use of online platforms, and emotional resilience when facing the uncertainties of virtual engagement (12). Communication anxiety, for example, can inhibit synchronous and asynchronous participation, but students with higher emotional regulation and digital confidence navigate these challenges more effectively

(17). The cumulative evidence indicates that readiness is not static; rather, it evolves as students gain exposure to new technologies, participate in digitally mediated interactions, and internalize strategies to manage the demands of online learning.

Overall, the findings of this study contribute to the emerging theoretical understanding that online learning readiness is shaped by both technological and psycho-social factors, consistent with prior conceptualizations in the global literature (4). While students demonstrate strong core competencies in self-regulation, motivation, and digital proficiency, more attention is needed to support communication self-efficacy and learner control, which remain comparatively underdeveloped. This distinction highlights the importance of designing instructional structures that not only provide accessible technologies but also cultivate supportive, interactive, and emotionally safe learning spaces that nurture communication confidence and learner autonomy.

This study relied on self-reported data, which may be subject to response biases, including social desirability and overestimation of abilities. The sample was drawn from a single academic field and geographic region, limiting generalizability to broader or more diverse populations. Additionally, while the study employed confirmatory factor analysis, it did not incorporate longitudinal data, meaning that changes in readiness over time or across academic transitions could not be captured. Finally, the study did not compare the scale with alternative readiness models, which may have strengthened construct validation further.

Future studies should examine readiness across multiple academic disciplines and institutions to better evaluate the scale's generalizability. Longitudinal research is needed to track changes in readiness as students progress through their academic programs or receive targeted digital literacy interventions. Researchers should also consider integrating qualitative methods to explore the deeper motivational and emotional experiences underlying readiness. Comparative validation studies involving multiple readiness instruments could provide a more comprehensive assessment of construct stability and cross-cultural applicability. Finally, studies should investigate how instructional design features directly influence the development of communication self-efficacy and learner control.

Educational institutions should implement structured orientation programs that develop digital communication confidence and online interaction skills alongside technical training. Instructors should integrate active, collaborative, and socially rich tasks to encourage student participation and reduce communication anxiety. Course designers should scaffold learning activities to support learner autonomy gradually, ensuring that students acquire the skills needed to regulate their learning effectively. Universities should also provide continuous digital literacy support services and ensure that online learning environments are user-friendly, accessible, and equipped with mechanisms for timely feedback and student–instructor interaction.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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