

Online learning readiness in secondary education: validating the Online Learning Readiness Scale and examining the impact role of ICT familiarity

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Abstract

Online and blended learning have increased drastically during the pandemic, and their popularity has persisted as we emerge from this global crisis. This study aims to adapt and validate the Online Learning Readiness Scale (OLRS) to assess high school students. Secondary school students were recruited (n = 296) for the study. The OLRs scale included five components: Technology Readiness, Learner Control, Online Communication Self-efficacy, Self-directed Learning and Motivation for Learning. Results supported the OLRs scale in terms of reliability and internal construct validity in context of the study by confirmatory factor analysis and Rasch measurement with partial credit analysis. The differential item functioning analysis revealed no bias issues regarding gender, confirming the measurement invariance statistics achieved. The study also found that the majority of students (73.7%) engaged in online learning solely through their mobile phone. ICT familiarity, i.e., interacting with friends regularly, browsing online learning materials, and watching educational videos on YouTube, had a positive association with students' readiness for online learning. Students' access to social networks, online forums and online music did not have a significant effect on their readiness for online learning. The scale demonstrated the capacity to function as an assessment instrument for evaluating readiness for online learning in the context of secondary education. Educational implications were considered, including key requirements of supporting technology and pedagogical practice in online and blended learning environments.

KEYWORDS: Online Learning, Digital Readiness, Self-Directed Learning, ICT Familiarity, Secondary Education.

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1. Introduction

As online learning platforms developed suitable functionality and usability, researchers and educators have focused on the human factors that impact their effectiveness (Adedoyin & Soykan, 2020). Personal beliefs that impact engagement in online learning have

emerged as a critical factor that is the subject of considerable research attention across multiple levels of education (Redmond et al., 2018). This topic is especially important as it has been linked to engagement and retention within online learning environments (Joosten & Cusatis, 2020). Understanding readiness of students in online learning plays an essential role in optimizing teaching and learning. In this manner, it can be considered a critical issue, as no matter how well-developed online pedagogies systems may be, they cannot benefit those who do not engage.

COVID-19 led to a rapid expansion of online and blended learning techniques. Around the globe educators and students rapidly transitioned to online learning as lockdown orders were issued to curtail contagion. Although information and communications technology (ICT) are becoming an essential component of educational curricula and learning environments

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worldwide (Turgut & Aslan, 2021), numerous constraints, including disparities in digital resources, insufficient access to reliable internet, limited preparedness and technological proficiency both at university (Hunt et al., 2022) and secondary school level (Perifanou et al., 2022). For many high school students and teachers, this was their first exposure to online learning (Maheshwari, 2021). Though internet and app use has become ubiquitous within school aged children, this should not be conflated with a general capacity to use online learning systems (Creighton, 2018). This appears to be a false assumption and further highlights the need for educators to understand not only student capacities, but their perceptions of ability within these environments. A study by Power et al. (2022) found that, after a rapid transition to online learning, the cohort with greater levels of online learning experience reported lower perceptions of readiness. This reflects the naïve initial beliefs that being generally competent in terms of social app use and basic ICT had adequately prepared them for this new learning experience.

Research on readiness for online learning has typically been examined at university level (i.e., Alqabbani et al., 2020; Peechapol et al., 2018; Tang et al., 2021). However, there is a lack of research discussing how to examine secondary students' readiness to study online and whether the ICT familiarities impact their readiness in the online learning environments in secondary education contexts. The pandemic situation has opened a space for online learning research among younger students. This research is anticipated to provide valuable insights by validating the scale's structure in secondary schools in a Viet Nam context. As experience with ICT resources has been previously identified as critical to adequate engagement with online learning (Power et al., 2022), this study also considers prior experience alongside reports of learner readiness to identify the potential for optimization and to generate practice recommendations grounded in empirical evidence.

Readiness for Online Learning

Readiness for online learning is defined as multi-dimensional in previous studies. It may involve a two-factor structure: comfort with e-learning, linked to cognitive style and resource-based learning materials, and self-management of learning (Smith et al., 2003). Pillay et al. (2007) defined online learning readiness as a construct that includes the dimensions of technical skills, computer self-efficacy, learner preferences, and attitudes towards computers. Hung et al. (2010) created a scale to assess readiness for online learning, defining it as being comprised of self-directed learning, motivation, computer/internet self-efficacy, learner control, and online communication self-efficacy. Meanwhile, Dray et al. (2011) argued that readiness for online learning could be assessed via subscales of learner characteristics, digital divide, and ICT engagement. These instruments were originally designed for higher education students. The recent study

by Ramazanoglu et al. (2022) proposed an online learning readiness scale for high school students that involved three dimensions of internet self-efficacy, computer self-efficacy, and self-learning. Overall, the literature review (e.g., Farid, 2014; Tang et al., 2021; Yalley, 2022) revealed that the online learning readiness scale (OLRS) with five components (Technology readiness, self-directed learning, learner control, online communication self-efficacy, and motivation for learning) demonstrated suitable fit characteristics and was the most widely used.

Technology Readiness

Technological Readiness refers to the necessary skills and knowledge to use online learning platforms, tools, hardware (e.g., computers, tablets) and software to participate in online learning (Al-araibi et al., 2019; Singh & Thurman, 2019). Students' attitudes toward technology-based applications in learning contexts reflect their technical readiness (Farid, 2014; Shirahada et al., 2019).

Self-directed Learning

Self-directed learning requires students to manage their own engagement with various learning activities and also to consider their own performance within these activities (Farid, 2014). The Self-directed Learning subscale emphasizes student initiative in goal setting and decision-making (Geng et al., 2019). Self-directed learners actively seek knowledge and resources online (Geng et al., 2019). Suitably designed online systems and collaborative pedagogies can foster self-directed learning (Farid, 2014).

Learner Control

The Learner Control subscale measures students' ability to manage media systems in online learning (Scheiter & Gerjets, 2007). Well-designed online learning structures can enhance learner control, interest, motivation, and adaptive learning, while allowing customization to individual preferences (Scheiter & Gerjets, 2007). Lin and Chang (2011) found that higher learner control correlated with increased learning and more positive attitudes towards technology.

Online Communication Self-efficacy

The Online Communication Self-efficacy definition relates to students' capacity to establish unique and meaningful interactions, such as communicating successfully during group discussions (Alqurashi, 2016). Self-efficacy has been linked to successful learning outcomes across a wide range of learning settings and systems (Smith, 2003). Students' interpersonal skills help them connect with teachers and other students to achieve learning goals. Effective interaction in a technological environment has a significant impact on the success of the teaching process, as well as student learning outcomes (Farid, 2014).

Motivation for Learning

Learning motivation was crucial for student achievement and a predictor of learning outcomes and attitudes (Code, 2020; Nasir Ansari & Khan, 2020). Social settings influence whether individuals were proactive or passive in achieving goals (Ryan & Deci, 2000). Students' readiness to learn online significantly affected their class participation and interaction quality (Kauffman, 2015). Therefore, it is essential to examine factors influencing online learning readiness.

Students' ICT Familiarity and Online Learning

The rapid evolution of ICT, with widespread smartphone and internet access, reshaped how students study, communicate, and collaborate (Wright et al., 2022). Rangel-de Lazaro and Duarte (2023) found that 56% of reviewed studies reported mobile phone use in online learning activities. ICT resources enhanced communication and resource access in distance and blended learning environments (Madadi et al., 2011).

Familiarity with ICT positively influences its use in online learning (Madadi et al., 2011). However, students often lack the necessary technology or digital literacy for effective online learning (Wright et al., 2022). Peechapol et al. (2018) reviewed studies showing a strong impact of online learning experience and knowledge on self-efficacy. Computer experience significantly enhances computer self-efficacy (Kim & Park, 2018). Reychav et al. (2016) found that peer interactions in mobile collaboration leverage network reciprocity. Conversely, Power et al. (2022) revealed that students with more prior online learning experience had lower perceptions of readiness, indicating that basic social app and ICT skills are insufficient preparation for online learning.

Research questions

This study aimed to adapt and validate the OLRS scale to assess students in secondary education contexts. We examine the structure of the adapted OLRS scale with a focus on its psychometric properties. The study also investigated the influence of students' ICT familiarity on their readiness to learn online. Thus, the present study addresses the following research questions:

1. What is the structure of the adapted instrument to measure students' readiness for online learning?
2. Does the instrument demonstrate suitable validity and reliability in the given context?
3. Does the adapted scale achieve equal invariance regarding gender?
4. Does students' familiarity with ICT affect their readiness for online learning?

2. Procedures and methods

2.1 Adaption the Online Learning Readiness Scale

The suitability of the scale to the given unique context was considered in light of rigorous psychometric standards (Kane, 2016; Messick, 1995) for adapting educational research instruments. The OLRS is adapted from the original OLRS by Hung et al. (2010). The questionnaire measures five components of students' readiness to learn online: Technology Readiness, Learner Control, Online Communication Self-efficacy, Self-directed Learning and Motivation for Learning. The original questionnaire covered five components with 40 items (8 items for each). The questions are constructed in the 5-point Likert format, with anchors ranging from 1 (strongly disagree) to 5 (strongly agree). The questions are adjusted and translated into Vietnamese from the original English version following the standard translation procedure.

2.2 Validity of the adapted questionnaire

Initial content validity

The adapted questionnaire underwent a review process involving two education experts and two high school educators. Following this, an independent researcher back translated the Vietnamese version into English, which was then compared with the original English version to ensure accuracy. After resolving translation issues and assessing content validity, a revised version was piloted with five high school students. The objectives were explained, and the students completed the questionnaire with guidance. Post-survey, students were asked about language and content concerns.

Participants

The study assessed 296 students (girls: 62.5%, boys: 37.5%) in two public schools in the southern of Vietnam. There were 106 10th-grade students (35.8%), 103 11th-grade students (34.8%), and 87 12th-grade students (29.4%). Participants were provided with suitable information regarding the purpose of the project and their role, should they choose to participate. The voluntary nature of their participation and right to withdraw were clearly communicated in verbal and written form prior to participation.

Google Meet was the main platform for online teaching. Students who agreed to the survey received a Google Forms link from their school office. The online survey took 15 to 20 minutes and did not affect their school performance.

Questions related to students' familiarity with ICT were adapted from the ICT Familiarity Questionnaire (OECD, 2014), in which students were asked about three aspects related to digital devices, average times using the internet and activities using the internet on a typical day. The background questionnaire was adapted from PISA 2015 and translated into Vietnamese (OECD, 2014).

Statistical analysis

Confirmatory factor analysis (CFA) was employed to evaluate the construct validity of the adapted instruments as a criterion for further analysis. CFA was employed with Mplus 7 (Muthén & Muthén, 2017) to assess the fit of the model. The weighted root mean square residual (WRMR), the comparative fit index (CFI) and the root mean square error of approximation (RMSEA) were considered when evaluating model fit. In educational research, the cut-off criterion can be accepted with $RMSEA < 0.06$, $CFI > 0.90$ (Hu & Bentler, 1999). The Mplus manual (Muthén & Muthén, 2017) suggested values below .90 for the WRMR, Angeles (2002) recommends a slightly higher cutoff of 1.0 with categorical data for an acceptable model.

Rasch measurement is a psychometric modelling measurement based on the item response theory. In the present study, the Rasch model in ACER ConQuest software was employed for polytomous items with partial credit analysis (PCA) (Adams & Wu, 2010). An item in the Rasch model fits well if its infit index is between 0.77 and 1.30, according to Griffin (2010).

The differential item functioning (DIF) analysis was utilized to examine statistical characteristics of an item. To test measurement invariance for polytomous items, we used the R lordif package (Choi et al., 2011), after testing the presence of DIF under the logistic regression framework. Pseudo R^2 statistics were used as magnitude measures and classified DIF as negligible (< 0.13), moderate (between 0.13 and 0.26), and large (> 0.26).

In this study, we referred internal consistency measured through Cronbach's alpha (α) and omega (ω) to examine interitem reliability (Gliner et al., 2016). The common statistical tests such as Pearson's correlations were applied. To calculate and visualize the findings, we employed the R psych package (Revelle, 2019) and the ggplot2 package (Wickham, 2016).

3. Results

3.1 Confirmation of construct validity of the five-dimensional model

We employed CFA to weigh fit model for the readiness for online learning with a five-factor model, involving Technology Readiness (TR), Learner Control (LC), Online Communication Self-efficacy (OC), Self-directed Learning (SL) and Motivation for Learning (ML). The CFA identified two items that did not fit the model. The modified model with 38 items was used for further analyses. The results showed marginal cut-off indices ($CFI = .924$, $RMSEA = .066$, $WRMR = 1.470$), suggesting that the model fit is acceptable, but not excellent. Significantly high and identical correlations were found among pairs of the components, ranging from .678 to .901.

Furthermore, Rasch measurement with the PCA revealed that the adapted OLRS model fit the data well.

Generally, all items in the five subscales fit well to the present dataset. For the TR scale, the infit indices ranged from 0.91 to 1.11. All infit indices of the other subscales met quite well to the cut-off standards, excepting item of LC7. The highest means of person response were ML (Mean = 0.349, SD = 0.776), followed by SL (Mean = 0.294, SD = 0.692) and TR (Mean = 0.262, SD = 0.617), indicating that students have positive dispositions for these components. Students reported lowest scores in the OC and LC subscales.

The whole questionnaire results showed indicators of reliability with a Cronbach's alpha of .95 ($\omega = .95$). For individual subscales, alpha values were .75 ($\omega = .81$) for TR, .84 ($\omega = .88$) for LC, .86 ($\omega = .90$) for OC, .85 ($\omega = .89$) for SL and .86 ($\omega = .91$) for ML. According to Taber (2018), these levels of internal consistency reliability were satisfactory.

Readers can access supplementary materials at <https://doi.org/10.17605/OSF.IO/342NG>.

3.2 The DIF analysis for examining equal invariances

We implemented DIF analysis with respect to gender and grade levels by using logistic ordinal regression methods in R lordif package (Choi et al., 2011). The likelihood ratio χ^2 test is considered as the detection criterion at the α level of 0.01, while the change in McFadden's R^2 of 0.01 as a criterion for rejecting the null hypothesis of no DIF. All pseudo R^2 values were below 0.01, and p-values of the goodness-of-fit statistics above 0.05, indicating no item were flagged as DIF item regarding gender. Overall, these results suggest that the models were well supported by the empirical data.

3.3 Students' ICT familiarity and its effects on online learning readiness

Students can participate in online lessons via different devices such as desktop computers, laptops, tablets or smartphones. Regular use of these devices can affect the quality of learning in virtual space. Understanding the familiarity of using devices in online learning plays an important role in both designing lesson plans and practicing in an online environment. Figure 1 presents the proportion of technology devices that students were directly using for learning online lessons. Surprisingly, the desktop computer is almost absent from the students' homes in this survey. Tablets (i.e., iPads, Samsung Galaxy Tab or similar devices) were rarely used for online learning, with only about 5.0% of students using these kinds of electronic device, while about 16.1% of students used laptops to access the online courses. Up to 73.7% of students participated in online classes on mobile phones. The results showed that online learning seemed to be a big challenge for both teachers and students in the current condition where many students use mobile phones as their main means for joining online classroom activities.

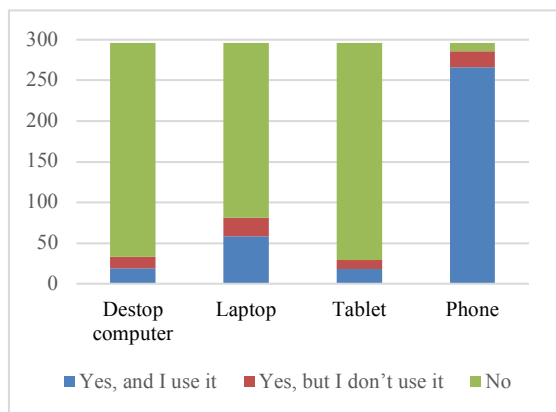


Figure 1 - Proportion of the common devices available for accessing online lessons.

To examine the familiarity of Internet usage, a question “How often do you use digital devices for the following activities?” was also conducted in the study. There were five levels of the frequency, which were coded as follows: 1: “Never or hardly ever”, 2: “Once or twice a month”, 3: “Once or twice a week”, 4: “Almost every day”, 5: “Every day”. In the study, we included Send or read email inboxes (Email), chat with friends (Chat), search and collect information via the Internet (Search), join social networks or online forums (Facebook), online call with friends (Call), access online documents (Docs), submit work on the school’s online learning management system (Assignment), watch videos or materials related to learning (Video), watching movies, listening to music and other recreational activities (Music).

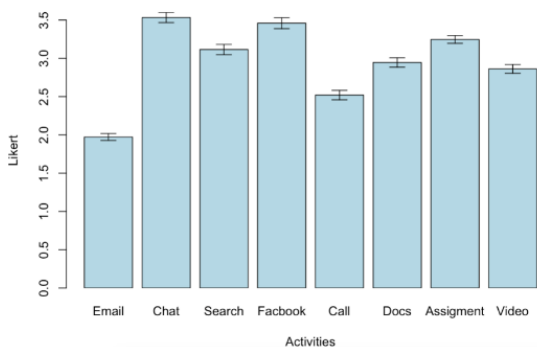


Figure 2 - The frequency of accessing online activities of students.

As depicted in Figure 2, students accessed the internet quite often for both daily life and recreational activities. In particular, Chat and Facebook variables were reported from “frequently” to “almost daily” in the majority of children surveyed. A positive finding is that Search and Docs (using online resources) were also considered by students as fairly regular activities. In general, students seemed to be quite proficient and experienced in using and exploiting the internet for learning and other leisure activities in life. This is a fundamental advantage as the basic understanding required for accessing the various learning systems appears to be adequately developed.

	TR	LC	OC	SL	ML	RO
Email	.05	.04	.09	.15**	.07	.10
Chat	.05	.05	.02	.10	.05	.07
Search	.13*	.13*	.06	.19**	.12*	.15*
Facebook	.13*	.08	.05	-.01	.01	.06
Call	.25***	.15**	.16**	.20***	.17**	.22***
Docs	.20**	.12*	.13*	.18**	.20***	.20***
Assignments	.17**	.12*	.11	.12*	.09	.14**
Video	.20***	.24***	.24*	.26***	.30***	.30***
Music	.05	.01	.02	.00	-.04	.01

Note. *p < .05, ** p < .01, ***p < .001.

Table 1 - Relationships between ICT familiarity and Readiness for Online Learning.

Furthermore, we investigated the relationship between ICT familiarity and the Readiness for Online Learning. Table 1 outlines Pearson’s correlation values for ICT Familiarity and the components of Readiness for Online Learning. Some activities were positively associated with online learning readiness, but not very strongly. These more formal uses of ICT also demonstrated significant correlations with the majority of Readiness for Online Learning components. ICT familiarity with activities that were typically more associated with casual and personal web use demonstrated small, and typically non-significant correlations with the components of Readiness for Online Learning.

4. Discussion and Conclusions

The majority of research examining online learner readiness to date has focused on university cohorts. In the context of a rapid and sustained increase in online learning at secondary schools, a clear need for research examining the role of individuals’ beliefs and associated impacts on online and blended learning within school age populations is evident. The current study offers a unique evaluation of the widely used the OLRS in secondary education settings. The psychometric properties of the adapted questionnaire appear to be acceptable. However, using the CFA, two items, were removed from the OLRS, while the Rasch measurement advised that one item in the LC scale was not fit the model. These items need to be revised for future studies. There are no gender-related bias concerns, which confirms the successful attainment of measurement invariance statistics. Generally, the findings demonstrate comparability with the results on the original scale development study by Hung et al. (2010). The OLRS demonstrated suitable levels of reliability within the current empirical data. This evaluation is presented as essential due to the markedly different socio-cultural context of the current study and the previous uses of this questionnaire (Farid, 2014; Hung et al., 2010; Tang et al., 2021). This implies that the OLRS could serve as an potential evaluation tool to assess students’ readiness for learning in a virtual setting, which is anticipated to become increasingly common in schools in the future. Researchers also anticipate that blended learning will be increasingly incorporated in schools, and global distance

learning programs will become more common (Sharadgah & Sa'di, 2021).

The results suggest that previous experience of ICT activities is linked to student perceptions of readiness for online learning in a secondary school context. The experience of ICT processes that are typically associated with personal or leisure use demonstrated small and mostly insignificant relationships with the components of OLRs. The factors related to Internet usage habits, social media use and online entertainment (e.g., listening to music, playing online games) did not have a significant effect on students' readiness for online learning. Conversely, interacting with friends regularly, browsing study materials, and watching videos of lectures had a positive association with students' readiness for online learning.

From a practical perspective, this has immediate consequences for the design of resources, accessibility considerations and platform selection. The results highlight the need for increased awareness among parents and teachers about social network usage among secondary school students. The students apparently spent much of their time chatting and networking on social platforms, which were indicated to have no impact on their online learning readiness. Teachers and parents should advise students on how to utilize the virtual environment in effective ways. Additionally, as students reported that they faced most challenges in their learning control and self-efficacy in online communication, it is essential for teachers and parents to provide assistance in these matters. Schools need to implement comprehensive strategies, including providing training for both students and teachers on digital tools, creating engaging and accessible online curricula, and offering resources and guidance to help students adapt to the virtual learning environment.

Moreover, the findings exposed that mobile phones were the primary means of accessing online learning for most students. The dominance of this electronic device selection aligns with previous studies (i.e., Arthur-Nyarko et al., 2020), which found that most students at university level accessed online learning courses via smartphones. Integrating mobile technology allows educational institutions to create distance learning systems that enable students to be highly flexible with their schedules and locations (Eom, 2022), but for students, displaying a lesson on a phone screen, especially during a long study session, is a significant challenge due to its size. This learning condition may lead to various undesirable long-term effects (e.g., eye strain), which should be considered more carefully in educational settings. This issue needs to be addressed not only by online educators and program designers but also by teachers who create online lectures to ensure that all students can access them suitably. Media and interaction platforms must be optimized for the platform on which it is consumed. While modern learning management systems and associated platform are designed at their core to be suitable for multiplatform

use, it is essential that educators consider the accessibility of the materials they create and use on these platforms in order to enhance the student learning experience.

The results and conclusions of this paper should be considered in light of its limitations. The data was drawn from a relatively limited population in the southern part of Viet Nam, so there is a possibility of a Type II error. Data sharing using Open Science principles has the potential to alleviate this issue and potentially build insights of variance across socio-culturally diverse settings and potentially support future meta-analytic studies (Power, 2021). Future research aiming to explore potential differences across grade or age groups should take into account power calculations appropriate for a medium effect size (McCrum-Gardner, 2010). This is the first application of the self-report adapted questionnaire in a secondary school context. Future research employing this modified scale should consider potential impacts of the translation process and associated content validity assessment. Most main psychometric indices of the adapted instrument were acceptable, but the WRMR value slightly greater than 1 typically indicated that the model's fit to the data was still poor, and next steps may be needed to improve model specification. Incorporating a parallel qualitative approach could potentially provide further insight in future. Additionally, this study used a self-report questionnaire to measure familiarity with various online activities, which may not fully capture digital proficiency. Future research needs a more comprehensive assessment consisting of items with interactive scenarios may provide deeper insights into students' preparedness for online learning.

Nevertheless, the current findings offer valuable insights for educators, stakeholders, and policymakers in enhancing online learning environments. As blended and fully online elements continue to be integrated into secondary education systems, it becomes increasingly crucial to deepen our understanding of the personal factors influencing student engagement and performance within these systems.

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