

## Empowering E-Learning: Navigating Readiness and Engagement through ICT Mastery and Self-Directed Learning



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**Abstract:** *The purpose of this study was to look at the relationship between middle and late teenage students' e-learning readiness and engagement and their ICT self-efficacy and self-directed learning. Using a practical sampling technique, data were gathered from a broad set of students at schools, colleges, and universities in Rawalpindi and Islamabad. There were 300 students in the sample overall, 156 girls and 144 boys, ages 15 to 21. Participants in this study answered to the following measures: student engagement scale (Lee, Song, & Hong, 2019), e-learning readiness scale (Alem et al., 2016), self-directed learning with technology scale (Teo et al., 2010), and ICT self-efficacy scale (Alahakoon & Somaratne, 2020). The results of this study showed that the relationship between ICT self-efficacy and preparation for e-learning, as well as student engagement, was considerably mediated by self-directed learning. Nonetheless, there was no discernible moderating influence of ICT self-efficacy on the association between student involvement and e-learning preparedness.*

**Keywords:** ICT, student engagement, mediation and moderation analysis, E learning readiness, Self-directed learning

### Introduction

Nowadays, information and communication technology (ICT) plays a significant role in various aspects of our lives. Its growing importance and widespread use in the academic field cannot be ignored. With the global closure of educational institutions due to the ongoing COVID situation, students face numerous challenges. However, the advancement of ICTs in the educational sector has provided a solution for educators and policymakers. E-learning has emerged as a beneficial alternative to traditional classroom learning during these times of quarantine. While e-learning has been extensively adopted in many countries, it was not widely recognized as a formal part of education in Pakistan until the outbreak of COVID. This study aims to assist students in

developing their ICT self-efficacy and self-learning skills, enabling them to effectively transition from face-to-face learning to e-learning. Ultimately, increased engagement in e-learning will contribute to lower dropout rates and greater academic success.

ICT self-efficacy, also known as perceived ICT competence, refers to an individual's perception of their own knowledge and abilities in using ICT (Goldhammer et al., 2016). Studies conducted by Celik and Yesilyurt (2013) and Teo et al. (2018) have shown that individuals with high perceived computer self-efficacy are more successful in utilizing technologies and taking on responsibilities compared to those with low perceived computer self-efficacy. Therefore, it is important to consider the role of task-specific self-efficacy, specifically ICT self-

efficacy. In our local context, only one study by Kanwal and Rehman (2017) suggested that computer self-efficacy significantly influences e-learning adoption.

Self-directed learning refers to the intentional psychological processes through which learners acquire knowledge and problem-solving skills (Long, 1994). Tan et al. (2011) emphasized the importance of self-directed learning as a key component of 21st-century skills necessary for students to overcome future challenges. Research has shown that individuals with self-directed learning skills exhibit persistence, motivation, and engagement in online learning (Sandars et al., 2020). However, there is a lack of research in our local context that investigates self-directed learning alongside other study variables within a comprehensive framework.

E-learning readiness, as defined by Borotis and Poulymenakou (2004), refers to an organization's mental or physical preparedness for e-learning experiences or actions. Most studies conducted in the Pakistani context have focused on assessing the levels of e-learning and attitudes towards e-learning (e.g., Abbasi et al., 2020; Alhumaid et al., 2020; Rafiq et al., 2020). Additionally, a study by Rafique et al. (2021) explored the readiness of online learners but had a sample limited to adult students, making generalization difficult.

According to Lewis et al. (2011), student engagement is the active participation of learners' ideas, emotions, and actions in the educational process. Studies show that success in online learning environments requires persistent student participation (Fredrickson, 2015; Wolverson, 2018). Thus, in order to promote social change and improve learning competitiveness, it is critical to take student participation into account in the context of e-learning. According to Tzeng (2009) and other research, a number of studies indicate that a student's degree of involvement in technologically integrated learning environments is significantly influenced by their level of confidence in their technological skills. Therefore, it is crucial to investigate how each student's unique qualities affect their involvement in the online learning environment.

Adolescent pupils who are more used to in-person, teacher-centered instruction are the subject of this study.

## LITERATURE REVIEW

Previous studies have indicated that people who have high levels of self-efficacy tend to do well in online learning environments because they are socially willing, cooperative, and excited about taking on difficult activities rather than running away from them (Chen, 2014). Achukwu et al. (2015) investigated the association between computer self-efficacy, computer-related technology reliance, and readiness for online learning in a study including undergraduate students. The results showed that preparedness for online learning and computer self-efficacy were significantly and favourably correlated. Additionally, it was discovered that students' preparedness for online learning was predicted by their computer-related technology reliance and computer self-efficacy. Kanwal and Rehman (2017) looked at the factors impacting Pakistan's adoption of e-learning in another study. The results showed that perceived ease of use was significantly predicted by computer self-efficacy, internet experience, system features, and enjoyment. Chen (2017) carried out a study to look at the relationship as a mediator between learning performance, computer self-efficacy, and learning engagement. The findings showed that learner engagement and computer self-efficacy were positively correlated. Additionally, learning engagement acted as a complete mediator in the association between computer self-efficacy and learning performance.

A study by Pacheco-Velázquez and Viscarra-Campos (2019) looked into the main elements connected to self-directed learning, engagement, and reflection. The findings showed that student engagement and self-directed learning were positively correlated. Cavusoglu (2019) investigated the connection between online learning readiness and self-directed learning. The results demonstrated a strong and favourable relationship between the preparedness for online learning and self-directed learning. In a recent study, Jiang et al. (2021) looked at students' preparedness for

flipped learning and how motivation and engagement relate to it, with attitude acting as a moderator. According to the results, pupils showed a high degree of preparedness for flipped learning. The study also found that the association between students' motivation and involvement and their readiness was moderated by attitude and environmental support.

E-learning constructs have been found to be significantly predicted by ICT self-efficacy. As an example, Owusu-Agyeman et al. (2021) studied how technology self-efficacy acted as a moderator in the relationship between online learning and student engagement. The results showed that the relationship between online learning and student engagement was positively and considerably strengthened by technology self-efficacy. Tariq (2021) investigated the moderating role of web self-efficacy in another study. The association between psychological characteristics and user happiness was significantly mitigated, according to the results, by web self-efficacy. Rahim (2022) recently carried out a study to look at the moderating role that self-efficacy plays in the connection between online engagement and online teaching competencies. The results showed that the favourable correlation between teaching competencies and online engagement was strengthened by self-efficacy. It may be deduced from earlier studies that ICT self-efficacy positively modifies student engagement and e-learning preparedness.

In the realm of e-learning, self-directed learning is crucial. Kao (2016), for instance, studied the relationship between internet self-efficacy and methods for learning through web searches and the mediating role of self-directed learning. The findings showed that, among a sample of preschool teachers, self-directed learning had a major role as a mediator. Schweder (2019) looked into how learning behaviour, self-efficacy, and control mechanisms fit into self-directed learning. The results showed that the relationship between self-efficacy and effort investment as well as absorption was partially mediated by control techniques, which are a metacognitive component of self-directed learning. In addition, the association between

self-efficacy and elaboration was totally mediated by control techniques. The relationships between academic engagement, academic motivation, self-regulation, and academic performance were investigated in a study by Samavi and Najjarpourian (2019), with self-directed learning acting as a mediator. A sample of 390 high school students participated in the study. The results showed a strong correlation between academic achievement, academic motivation, academic engagement, and self-regulation. Moreover, the findings demonstrated that academic performance and academic engagement were considerably mediated by self-directed learning. Research on the mediating function of self-directed learning in the connection between online learning and self-leadership was carried out by Durnali (2020). The results showed that the association between online learning and self-leadership was totally mediated by self-directed learning. Kara (2021) looked on how learners' traits affected their participation during the pandemic. The findings showed that traits of learners, including motivation, self-directed learning, and digital competence, substantially influenced online learner engagement. Furthermore, it was discovered that motivation and self-directed learning considerably moderated the relationship between engagement and digital literacy. The analysis of prior research suggests that self-directed learning contributes significantly to the e-learning environment as a positive mediating factor.

## **RATIONAL OF STUDY**

Based on previous findings, it became clear from earlier research that successful engagement in online learning settings is highly impacted by the interconnection of crucial components. In order to fully understand the complex linkages between ICT self-efficacy, self-directed learning, e-learning preparedness, and student engagement, this project was started. Recognising that information and communication technology (ICT) is becoming more and more important in education, the study set out to investigate how students' perceived ICT proficiency affects their ability to learn on their own and their preparedness for online

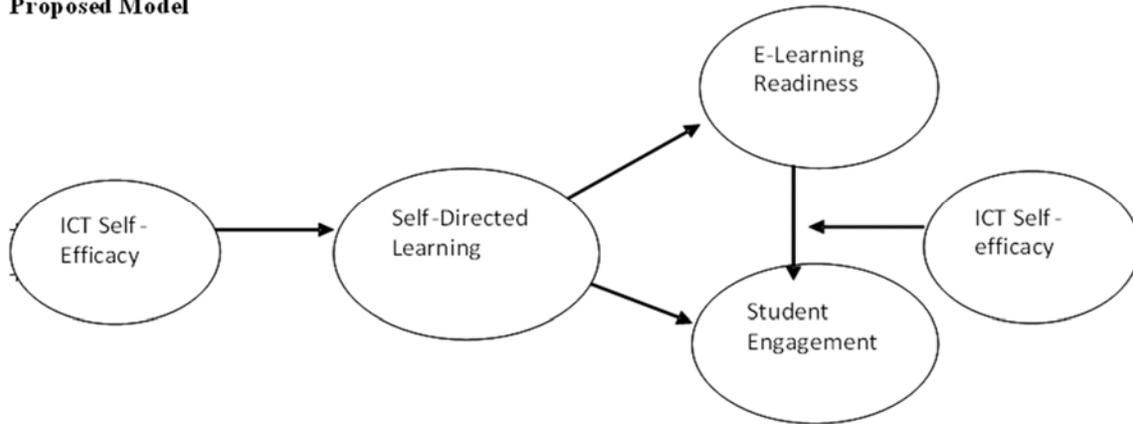
learning, which in turn affects how engaged they are in education as a whole.

Uncovering the complex role of self-directed learning within the intricate web of interactions was also one of the study's secondary goals. The study specifically examined the role that self-directed learning plays as a mediator between student engagement, e-learning preparedness, and ICT self-efficacy. The study aimed to offer a thorough grasp of the dynamics influencing students' interactions with digital technology in an educational setting by focusing on the intermediary role of self-directed learning.

Furthermore, another pivotal objective of the research was to scrutinize the role of ICT self-efficacy in the relationship between e-learning readiness and student engagement. This goal recognized the need to clarify how students'

perceived ICT proficiency might operate as a link, affecting the relationship between their preparedness for e-learning and their active participation in academic endeavours. The purpose of this project is to improve our understanding of the variables that affect productive engagement in online learning environments by investigating these relationships and providing educators and decision-makers with meaningful knowledge. Essentially, the main driving force behind this research was the desire to shed light on the intricate relationships between ICT self-efficacy, self-directed learning, e-learning readiness, and student engagement. This would enable a more comprehensive understanding of the many factors that influence the modern educational environment.

**Proposed Model**



+ve

**METHODOLOGY**

**Hypotheses**

1. Self-directed learning will serve as a mediator in the association between ICT self-efficacy and E-learning readiness.
2. Self-directed learning will act as a mediator in the connection between ICT self-efficacy and student engagement.
3. ICT self-efficacy will moderate the relationship between e-learning readiness and student engagement.

**Instruments**

**ICT self- efficacy scale**

The 23 items that make up the ICT self-efficacy

scale were created by Alahakoon and Somaratne (2020). A 5-point Likert scale is used, with the options being "Not at all confident" (1) through "Very confident" (5). The scale has a Cronbach's alpha coefficient of .94, indicating strong reliability.

**Self-directed learning with technology scale**

Teo et al. (2010) created the self-directed learning with technology scale, which consists of six questions divided into two categories: purposeful learning (items 3, 4, 5, and 6) and self-management (items 1 and 2). A 6-point Likert scale is used, with the options being "Not at all" (1) through "All the time" (6). With Cronbach's alpha coefficients of .85 for deliberate learning and .63 for self-management, the measure exhibits strong dependability.

### E-learning readiness scale

Alem et al. (2016) created the E-learning readiness scale, which has 17 items broken down into 5 dimensions: financial (items 12, 13, and 14), self-directed learning (items 4, 5, 6, 7, and 8), motivation (items 9, 10, and 11), and perceived usefulness (items 15, 16, and 17). A 7-point Likert scale is used, with the options being "Strongly disagree" (1) to "Strongly agree" (7). With Cronbach's alpha coefficients of .96 for self-competence, .91 for self-directed learning, .76 for motivation, .75 for finances, and .94 for perceived usefulness, the scale exhibits strong reliability.

### Student engagement scale in E-learning environment

The 24-item student engagement scale in the e-learning environment was created by Lee et al. (2019). It is broken down into six categories: learning management (items 22–24), teacher interactions (items 17–18), cognitive problem-solving (items 12–16), peer collaboration (items 7–11), psychological motivation (items 1–6), and community support (items 19–21). A 5-point Likert scale is used, with 1 representing "Strongly agree" and 5 representing "Strongly disagree".

disagree".

### Sample

A comparative cross-sectional research design was employed to gather data from a total of 300 adolescents using convenience sampling. The sample was divided based on gender, with 144 boys and 156 girls, and age groups categorized as middle adolescence and late adolescence, ranging from 15 to 21 years old. Data collection took place in various schools, colleges, and universities in Rawalpindi and Islamabad.

### Procedure

First, from various educational institutions in Rawalpindi and Islamabad, the researcher chose a sample of 300 individuals, including males and girls, ages 15 to 21. After obtaining permission from the relevant authorities, the participants were provided with informed consent forms, demographic sheets, and set of scales. Clear instructions were given to the participants before distributing the questionnaires. At the conclusion of the data collection process, the participants were appreciated for their involvement, and the researcher expressed gratitude to the heads and teachers of the educational institutions for their cooperation.

## RESULTS

**Table 1**

*The Main Study's Sample Characteristics (N=300)*

Variables	Groups	f%
Gender	Males	144 (48)
	Females	156 (52)
Age group	Middle adolescents	164 (54.7)
	Late adolescents	136 (45.3)
	Upper class	36 (12)
Socioeconomic status	Middle class	256 (85.3)
	Lower class	8 (2.7)

The sample characteristics are presented in Table 1, depicting the frequency distribution. The main study comprised a diverse sample of 300 participants, with gender distribution relatively balanced. The participants consisted of 52% females and 48% males. In terms of age, 45.3% fell into the category of late adolescents, while 54.7% were classified as middle

adolescents. The survey also considered the participants' socioeconomic status, revealing that 2.7% belonged to the lower class, 85.3% to the middle class, and 12% to the upper class. This demographic breakdown emphasizes the gender, age, and socioeconomic diversity within the study population, providing a comprehensive overview of the sample

characteristics.

**Table 2**

*Alpha Reliability Coefficients and Descriptive Statics of the Principal Study Variables (N=300)*

Variable	N	M	SD	A	Range		Skewness	Kurtosis
					Actual	Potential		
1.ICT-SE	23	86.68	16.78	.93	27-115	23-115	-.64	.34
2.SDL	6	25.64	5.93	.82	6-36	6-36	-.74	.08
SM	2	7.01	2.47	.63	2-12	2-12	-.24	-.62
IL	4	18.63	4.35	.85	4-24	4-24	-.93	.32
3.ELR	17	81.73	15.04	.89	34-119	17-119	-.47	.24
4.SE	24	77.22	18.58	.96	24-120	24-120	-.36	.14

The alpha reliability coefficients and descriptive statistics for the major study's variables are shown in Table 2. The mean (M), standard deviation (SD), range, skewness, kurtosis, and alpha coefficients ( $\alpha$ ) are among these statistics.

A sizable sample of 300 people provided the data. Regression analysis may be performed on the data because they showed a normal distribution, as seen by the skewness and kurtosis values falling between -1 and +1.

**Table 3**

*Inter-Correlation for Student Engagement, E-learning Readiness, Self-directed Learning, and ICT Self-efficacy (N=300)*

Variables	1	2	3	4
ICT -SE	--	.66**	.65**	.42**
SDL		--	.70**	.57**
ELR			--	.59**
SE				--

Note. \*\* $p < .01$ .

There are notable relationships between the study's variables, as indicated by the results

shown in the table above. Interestingly, self-directed learning and ICT self-efficacy have a strong and positive association ( $r = .66, p < .01$ ), suggesting that higher ICT self-efficacy levels are linked to more self-directed learning. Furthermore, there is a strong and favourable correlation ( $r = .65, p < .01$ ) between ICT self-efficacy and readiness for online learning. Additionally, the findings show a somewhat significant positive association ( $r = .42, p < .01$ ) between ICT self-efficacy and student

involvement. Additionally, a strong positive correlation ( $r = .70, p < .01$ ) is shown between self-directed learning and preparedness for e-learning. Student engagement and self-directed learning had a somewhat positive relationship ( $r = .57, p < .01$ ). Finally, there is a relatively substantial positive connection ( $r = .59, p < .01$ ) between student involvement and preparation for e-learning. These correlations offer insightful information about the links between the study's major variables.

**Table 4***Self-directed Learning as an Mediator between ICTSE and E-learning Readiness (N=300)*

Effect		Estimate	Std. Error	95%CI		t	P
				LL	UL		
Indirect effect	ICTSE→SDL→ELR	.28	.04	.21	.36		
Direct effect	ICTSE→ELR	.30	.05	.21	.39	6.42	.000
Total effect	ICTSE→ELR	.58	.04	.50	.66	14.62	.000

The findings of the mediation study examining the mediating function of self-directed learning (SDL) between e-learning readiness (ELR) and ICT self-efficacy (ICTSE) are presented in Table 4. The results show that ICTSE has a significant positive unstandardized indirect effect on ELR; this is supported by the non-zero

confidence interval (B = 0.28, 95% CI: 0.21 to 0.36). This suggests that SDL has a major mediating role in the relationship between ICTSE and ELR. Through the mechanism of ICT self-efficacy, the mediation pathway through SDL is essential in improving preparedness for e-learning.

**Table 5***Self-directed learning's role as a mediator between ICT self-efficacy and student engagement (N = 300).*

Effect		Estimate	St. Error	95%CI		t	p
				LL	UL		
Indirect effect	ICTSE→SDL→SE	.38	.06	.26	.50		
Direct effect	ICTSE→SE	.09	.07	-.05	.23	1.28	.202
Total effect	ICTSE→SE	.47	.06	.35	.58	7.99	.000

The findings, which are shown in Table 5, provide important new information on the mediation study examining the function of self-directed learning (SDL) as a mediator between ICT self-efficacy (ICTSE) and student engagement (SE). With a confidence interval (CI) that excludes zero, the results show a statistically significant positive unstandardized indirect effect of ICTSE on SE (B = 0.38, 95%

CI: 0.26 to 0.50). This shows that the relationship between ICT self-efficacy (ICTSE) and student engagement (SE) may be mediated by self-directed learning (SDL). The indirect pathway via SDL makes a substantial contribution to the overall effect, demonstrating the mediating role of SDL in raising student engagement via the mechanism of ICT self-efficacy.

**Table 6***Moderation Analyses of ICT Self-efficacy as a Moderator between E-learning Readiness and Student Engagement (N=300)*

Predictors	Estimate	St. Error	95% CI		t	p
			LL	UL		
ELR	.22	.26	11.75	89.84	0.83	.41
ICTSE	-.36	.24	-.83	.11	-1.49	.14
ELR x ICTSE	.01	.00	-.00	.01	1.85	.07

The findings regarding the moderation role of ICT self-efficacy between e-learning readiness and student engagement are presented in Table 6. The results indicate that the interaction effect of e-learning readiness and ICT self-efficacy is not statistically significant, as the confidence intervals encompass zero ( $B = .01$ ,  $t = 1.85$ ,  $p = .07$ ). Thus, the association between e-learning readiness and student engagement is not significantly moderated by ICT self-efficacy, according to the 95% confidence interval. The non-significant moderation effect is further supported by the p-value of .07, which is higher than the typical cutoff point of .05. These results imply that ICT self-efficacy did not significantly moderate the relationship between student involvement and e-learning preparedness in this 300-person sample.

## DISCUSSION

This study's main goal was to find out how self-directed learning and ICT self-efficacy relate to teenage students' participation in e-learning and preparation. Adolescents from different schools, colleges, and organisations in Rawalpindi and Islamabad, Pakistan, were among the participants. To meet the study objectives, the data were subjected to descriptive analysis (see Table 1), which confirmed the data's normal distribution and the majority of participants were middle-class. Significant and positive connections were found between student involvements, e-learning preparation, self-directed learning, and ICT self-efficacy, according to correlational research (see Table 3).

The relationship between ICT self-efficacy and e-learning readiness was hypothesised, and the study explicitly examined the mediation function of self-directed learning in this relationship. The findings, which are displayed in Table 4, verified that the relationship between ICT self-efficacy and readiness for e-learning was significantly and favourably mediated by self-directed learning. Consistent with other research, teenagers who felt more secure about their ICT skills showed improved self-directed learning, which improved their preparedness for online learning (Durnali, 2020; Kao, 2016).

According to the second hypothesis, the study looked at how self-directed learning mediated the link between ICT self-efficacy and student engagement. The results supported this hypothesis, as shown in Table 5, and demonstrated that self-directed learning was a substantial and beneficial mediating factor in the relationship between student engagement and ICT self-efficacy. Teens who felt more secure in their ICT skills demonstrated better self-directed learning, which increased student engagement. According to research, good self-directed learning and interaction with e-learning environments are associated with high ICT self-efficacy (e.g., Kara, 2021).

The study's findings also support Kahu's (2013) hypothesis, which postulates that learner characteristics like ICT self-efficacy and student engagement are mediated by psychosocial elements like self-directed learning. Further evidence for the mediating function of autonomous motivation was provided by Azila-Gbetor et al.'s (2021) study, which discovered a favourable link between self-efficacy, autonomous motivation, and student engagement.

Contrary to the third hypothesis, which explored the moderating effect of ICT self-efficacy on students' involvement and preparedness for e-learning, the findings (Table 6) revealed no discernible moderating influence. These results are consistent with earlier studies (Omar et al., 2022; Tripathi et al., 2022), indicating no significant moderating effect of ICT self-efficacy on the connection between student involvement and e-learning readiness. The non-significant moderation outcomes suggest that, despite their high ICT self-efficacy, adolescents today must possess intrinsic confidence and motivation for better engagement in e-learning, given the widespread use of e-learning in educational institutions worldwide.

## Conclusion

This study's main goal is to investigate the relationships between Pakistani teenagers' ICT self-efficacy (ICTSE), self-directed learning (SDL), e-learning readiness (ELR), and student

engagement (SE). The findings of the study showed strong and favourable relationships between each of the four criteria. This suggests that while ICTSE and SDL expand, ELR and SE rise at the same time. Furthermore, the results showed that self-directed learning influences the links between ICT self-efficacy and both e-learning readiness and student engagement in the e-learning environment. Furthermore, the results indicated that the relationship between student involvement and e-learning readiness was moderated, but not significantly, by ICT self-efficacy.

### **LIMITATIONS AND SUGGESTIONS**

Despite the fact that the current study has significantly added to the body of knowledge on e-learning in Pakistan, it is important to recognize that it has certain limitations.

1. The cross-sectional methodology of the current study is the first constraint. It only permits the examination of learner characteristics such as ICT self-efficacy and self-directed learning in connection to student engagement and e-learning preparedness. Future researchers are recommended to use experimental designs that integrate interventions targeting ICT skills in order to better understand the patterns of these variables.
2. Another limitation is related to the use of self-report measures, which may introduce biases and affect the accuracy of the findings. To enhance the reliability of results, it is recommended for future researchers to employ alternative methods such as in-depth interviews or focus groups to corroborate the study's findings.
3. The non-significant findings in the moderation analysis suggest that other factors, such as socioeconomic status, may play a significant role in adolescents' engagement with e-learning. Therefore, future research should consider incorporating socioeconomic status as an additional demographic variable to gain a more comprehensive understanding of its influence.

4. The two age groups under investigation in this study were middle adolescents and late adolescents, which fall between the ages of 15 and 21. It is recommended that future researchers incorporate a greater range of age groups in their studies in order to gain a deeper understanding of age-related changes in learners' features.
5. Finally, the main focus of this study was how learner characteristics affect student engagement. In order to gain important insights into efficient e-learning methods, it is advised that future researchers look into the impact that instructors' efforts and instructional strategies have in fostering student engagement.

### **IMPLICATIONS**

Policy makers, educators, and administrators in educational institutions, including schools, colleges, and universities, need to take note of the findings of this study. These findings emphasize the importance of incorporating ICT-related programs into the curriculum to ensure the equitable development of adolescents' ICT abilities. It is recommended that educational institutions, particularly those catering to primary school students, create a technologically advanced environment that fosters self-directed learning. Teachers can employ strategies such as scaffolding, wherein they assist students in building greater knowledge and cognitive abilities by providing support, guidance, and social support to promote self-directed learning (O'Donnell et al., 2011). Governments and universities should also consider providing financial assistance to students to enable them to afford computers or laptops, among other essentials. To address any technological challenges, training programs should be implemented for early learners and extended throughout universities. By implementing these strategies, educational stakeholders can establish an environment that supports the development of ICT skills, encourages self-directed learning, and equips students with the tools and assistance needed to overcome technological obstacles.

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