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The Implementation and Challenges Impact of E-Learning Among Asnaf Students in Perlis: Analyzing using SPSS AMOS

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ABSTRACT

The rapid expansion of e-learning in Malaysia, accelerated by the COVID-19 pandemic and national education policies, has highlighted significant disparities in digital access among marginalized communities, particularly the *Asnaf* students in Perlis. Despite national initiatives like CERDIK improving device accessibility, systemic challenges such as poor internet connectivity, limited digital literacy, and socio-economic constraints continue to hinder effective e-learning adoption. This study investigates the implementation and challenges of digital learning among *Asnaf* students, employing a quantitative survey of 105 Form 3 and Form 4 students from three secondary schools in Perlis. Data were collected through a structured questionnaire assessing awareness, engagement, and obstacles related to e-learning. Statistical analyses, including Confirmatory Factor Analysis (CFA), Composite Reliability (CR), and Discriminant Validity, were conducted using Statistical Package for the Social Sciences (SPSS), Analysis of Moment Structures (AMOS) (IBM SPSS AMOS) to ensure data reliability and construct validity. Results indicate that while 91% of students have access to digital devices, 71% struggle with unstable internet, 72% face technical difficulties, and 59% lack conducive study environments. CR (CR ≥ 0.70) confirmed internal consistency, yet engagement's Average Variance Extracted (AVE) (0.38) fell below the threshold, signaling measurement limitations. This low AVE indicates weak convergent validity, suggesting that the engagement construct may not robustly capture students' actual participation in e-learning. This study contributes to the discourse on digital equity by advocating for inclusive strategies that ensure sustainable and meaningful e-learning adoption among underprivileged students in Malaysia.

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1. Introduction

The accelerated adoption of e-learning in Malaysia, propelled by the COVID-19 pandemic and guided by frameworks such as the Malaysia Education Blueprint 2013-2025, has amplified disparities in digital access and learning readiness. This is particularly true among marginalized communities such as the Asnaf (zakat-eligible recipients) [1]. Notably, Asnaf students in Perlis, a socio-economically disadvantaged group, have emerged as a focal point in efforts to bridge the digital divide in education. Although digital transformation in teaching and learning was already underway, the pandemic intensified the urgency for alternative educational delivery, prompting both national and institutional responses [2,3]. While e-learning presents transformative opportunities through flexible, accessible and individualized learning environments [4-6], it also exposes pre-existing socio-economic and infrastructural limitations [7-9]. In regions like Perlis, characterized by limited broadband infrastructure, economic hardship, and varying levels of digital literacy, the success of e-learning depends not only on access to devices but also on the learners' socio-cultural context and technological competency [10,11]. Consequently, it becomes essential to critically examine how the local realities of Perlis shape the implementation and impact of digital education among Asnaf students.

This study seeks to address the research question: How do the implementation and challenges of e-learning affect Asnaf students in Perlis? It aims to investigate the efficacy of current digital learning frameworks, uncover barriers that impede meaningful engagement and propose targeted strategies that ensure equitable access to quality education. Thus, by focusing on the localized and socio-economically sensitive experiences of Asnaf learners, this research contributes to the broader discourse on digital equity and inclusive educational policymaking [12-15].

2. Literature Review

The implementation of e-learning in Malaysia, particularly among marginalized communities such as the *Asnaf* in Perlis, has been shaped by systemic infrastructural and socio-economic barriers. Research highlights that inadequate digital infrastructure, including poor internet connectivity and limited device accessibility, remains a critical challenge. To better understand the implementation of e-learning for marginalized groups, especially *Asnaf* students in Perlis, three key themes emerge from the existing literature:

i. Infrastructural barriers,
ii. Socio-cultural and psychological factors
iii. Policy and institutional gaps.

2.1 Infrastructural Barriers

Many studies identify poor digital infrastructure as a significant impediment to successful e-learning adoption among underserved communities in Malaysia. Jafar *et al.,* [16] reported that students in Sabah faced difficulties related to internet penetration and learning environments, similar to conditions in Perlis. Similarly, Mervyn *et al.,* [17] noted that architecture students in Sarawak encountered problems with unstable connections and device-sharing, while Ngui *et al.,* [18] observed that technical limitations hindered the use of e-portfolios in higher education. Although initiatives such as FrogVLE and CERDIK aimed to bridge these gaps [19], infrastructural shortcomings continue to marginalize students from low-income and rural areas.

2.2 Socio-Cultural and Psychological Factors

Beyond technology, socio-economic and emotional challenges heavily influence students' ability to engage with digital learning. Abdullah and Letchamanan [20] highlighted that limited household income and low parental digital literacy reduce the capacity of disadvantaged families to support online learning. Meanwhile, Kamil *et al.,* [21] discovered that economic constraints led to dissatisfaction among Quantity Surveying students with their online learning experience. Psychologically, Yusrisham *et al.,* [22] noted that 73% of university students experienced stress due to digital learning, particularly those from low-income groups. Additionally, Cheok and Wong [23] revealed that many rural teachers resist e-learning due to entrenched cultural preferences for traditional teaching. Collectively, these findings highlight the need for holistic, community-based strategies that acknowledge both material and psychological dimensions of digital learning inequities.

2.3 Policy and Institutional Gaps

Although policy initiatives such as CERDIK have increased device availability, fragmented implementation limits their effectiveness in rural settings [16]. Mathew and Chung [24] highlighted that Open and Distance Learning (ODL) in Malaysia is hampered by weak student-teacher interaction, a challenge compounded by digital isolation in low-connectivity zones. At the same time, Azlan *et al.,* [25] echoed similar concerns, where technical issues reduced learning effectiveness in online postgraduate settings. However, most existing research focuses on urban or East Malaysian contexts, with Perlis largely underrepresented. Furthermore, Mohamed Azmi *et al.,* [26] emphasized institutional support as key to e-LMS adoption but acknowledged that such systems may require customization for *Asnaf* communities. In addition, Albelbisi *et al.,* [27] asserted that low self-regulated learning skills further limit the adoption of Massive Open Online Courses (MOOCs), underscoring the significance of community-based training and mentorship models to enhance participation.

3. Methodology

3.1 Research Design

This study adopts a quantitative research method to collect and analyze data on the impact of e-learning on *Asnaf* students in Perlis. In particular, a survey approach is employed to gather standardized responses from a large group of participants, ensuring statistical validity. The use of a structured questionnaire allows for measurable and comparable data, making it possible to identify trends and relationships between students' engagement with e-learning tools and the obstacles they encounter. Simultaneously, this approach provides a clear and objective understanding of the research problem while enabling systematic data collection and analysis.

3.2 Sampling

The target population for this study comprises Form 3 and 4 students from three secondary schools in Perlis, with a total of 105 participants. Correspondingly, a purposive sampling method was employed, focusing specifically on students actively engaged in e-learning and belonging to the *Asnaf* community, a socio-economically disadvantaged group. While purposive sampling enhances the relevance and contextual appropriateness of the data, it inherently limits the generalizability of the findings to a broader student population, an issue acknowledged in the study's limitations. However, the sampling was restricted to three schools that received official approval from the Ministry of Education, Malaysia. This sampling method ensures that the participants possess relevant experiences with e-learning, making them suitable for the study. Table 1 illustrates the distribution of participants by school and gender involved in the data collection.

Table 1
Distribution of participants by school and gender

School	Total Students	Male	Female
School A	28	13	15
School B	45	18	27
School C	32	8	24
Total	105	39	66

Demographic data such as age, gender, and access to digital devices at home are collected as part of the survey. This information provides context for interpreting the results and helps identify patterns in e-learning accessibility and challenges among different groups within the student population.

3.3 Instrument Development

Data for this study were collected through a structured questionnaire to assess students' experiences with e-learning. The questionnaire was developed based on existing literature and underwent expert validation to ensure its relevance and effectiveness. To further refine the instrument, a pilot test was conducted to evaluate its clarity and reliability before full-scale implementation. Specifically, the questionnaire consists of three main sections, each addressing key aspects of students' engagement with digital learning. The first section, 'Demographic Information', collects essential background details such as gender, age, grade level and access to digital devices at home. These demographic factors provide valuable context for analyzing differences in students' e-learning experiences, as variations in technology access and personal circumstances may influence their levels of engagement.

The second section, 'Awareness and Utilization of Skills for E-Learning', evaluates students' familiarity with and usage of e-learning tools. This section includes statements assessing their awareness of available e-learning platforms, ease of accessing digital learning resources, motivation to use e-learning, and ability to troubleshoot basic technical issues. Moreover, to ensure a detailed and structured measurement of students' attitudes, responses are recorded using a four-point Likert scale (1-Strongly Disagree to 4-Strongly Agree). This allows for a clear distinction between various levels of engagement and proficiency in digital learning.

The final section, 'Problems and Challenges in Using E-Learning Tools', focuses on identifying obstacles that students encounter in digital learning environments. This section covers issues such as internet connectivity problems, limited access to digital devices, difficulties maintaining focus during online lessons, technical challenges, and communication barriers with teachers. Similar to the second section, the use of a Likert scale format enables the identification of common and significant challenges, allowing researchers to determine the most pressing barriers that hinder effective e-learning among students.

The questionnaire is digitally administered *via* Google Forms, ensuring an efficient and organized data collection process. The survey is conducted in school computer labs over two days, covering three selected schools in Perlis, providing students with a stable environment to complete the questionnaire without technological constraints. Prior to the data collection, permission is obtained from the Educational Research Application System (eRAS 2.0) (KPM) and the Perlis State Education Department (JPN). Additionally, parental consent forms are distributed through Google Forms to ensure ethical compliance and voluntary participation. Figure 1 demonstrates the flow of the data collection process, as discussed earlier.

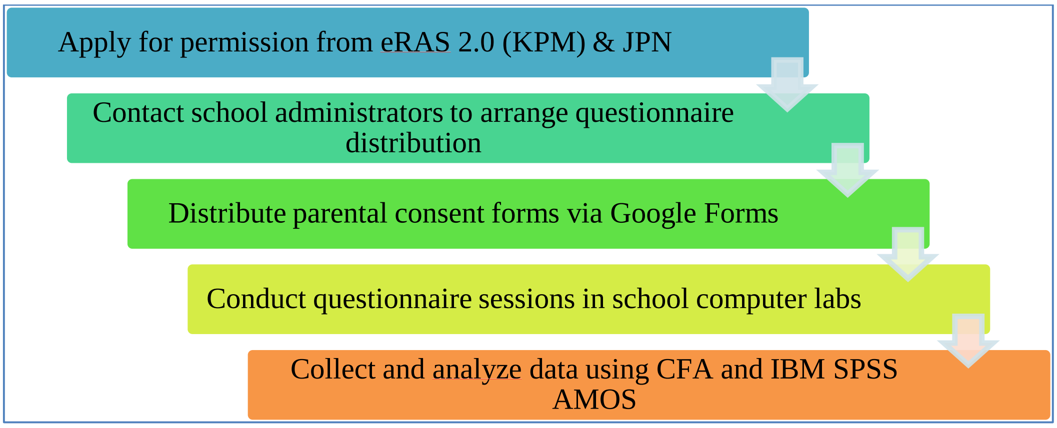

Fig. 1. Data collection process

3.4 Data Analysis

The collected data is analyzed using Confirmatory Factor Analysis (CFA) from IBM SPSS AMOS software. CFA is applied to assess the validity and reliability of the questionnaire's constructs, ensuring that each section accurately measures the intended variables, as displayed in Figure 2. Note that this step is crucial in confirming the structure and consistency of the survey instrument. Following CFA, IBM SPSS AMOS software analyzes relationships between key variables such as students' awareness of e-learning, engagement levels, and challenges. This statistical approach allows an in-depth examination of how various factors influence students' overall e-learning experiences. In addition, descriptive statistics such as mean scores, standard deviations and frequency distributions are also computed to provide an overview of students' responses. Figure 2 illustrates the data analysis process undertaken in this study, beginning with data collection from 105 *Asnaf* students *via* a structured questionnaire. The responses were initially screened for completeness and accuracy, followed by analysis using IBM SPSS AMOS to conduct CFA, assess construct validity, and evaluate reliability through Composite Reliability (CR) and Average Variance Extracted (AVE). Descriptive statistics, including frequencies, means and standard deviations, were then generated to summarize key trends and patterns in student responses. Finally, the findings were interpreted to identify critical issues such as low engagement validity and recurring challenges like poor internet access, which informed the study's discussion and recommendations.

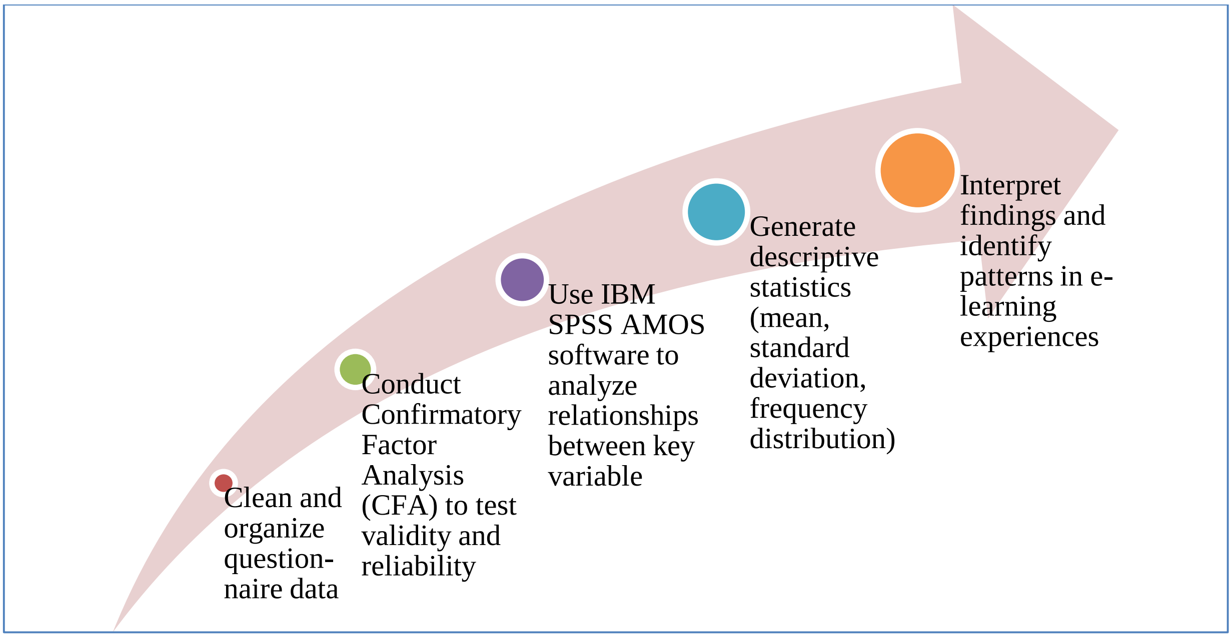

Fig. 2. Data analysis process

3.5 Ethical Considerations

Ethical approval for this study was obtained from the eRAS 2.0 system KPM and the Perlis JPN before data collection began. Additionally, informed consent is sought from parents before students participate in the survey. In line with this, participation in the study is voluntary, and students are informed that they can withdraw at any time without consequences.

Confidentiality and anonymity are strictly maintained throughout the study. In particular, no personal identifying information is collected, and responses are stored securely in a password-protected database. Note that the data is used solely for research purposes and is not shared beyond the research team. Furthermore, objectivity is ensured through standardized survey questions and statistical analysis methods that minimize researcher bias.

4. Results and Discussion

This section presents the findings of the study based on several statistical analyses, including CFA, Factor Loading, CR, and Discriminant Validity Index Summary. These analyses were conducted to assess the reliability, validity, and overall robustness of the measurement model used in this study. In particular, the CFA was performed to confirm the factor structure of the constructs, ensuring that the observed variables accurately represent the underlying theoretical constructs. Accordingly, Factor Loadings were analyzed to determine the strength of each indicator in measuring the respective latent variables, while CR was employed to assess the internal consistency of the constructs. Additionally, the Discriminant Validity Index Summary was examined to ensure that each construct is distinct and not highly correlated with other constructs, confirming the uniqueness of the measured variables. By analyzing these aspects, this section aims to provide a comprehensive discussion on the effectiveness and challenges of e-learning for *Asnaf* students in Perlis, Malaysia. Moreover, the findings will help educators, policymakers, and stakeholders understand the current scenario and implement necessary interventions to improve digital learning opportunities for disadvantaged communities.

Table 2 reveals the demographic data on gender, age, and access to devices at home. There are more female participants (66, 63%) compared to males (39, 37%). This suggests that the study sample has a higher representation of females. A majority of participants (f = 76, 72%) are between 13 and 15 years old. A smaller group (f = 29, 28%) falls in the 16 to 17-year-old category. This indicates that the study population is predominantly younger. At the same time, most participants (f = 96, 91%) have access to smartphones or laptops, while a small fraction (f = 9, 9%) do not have access. This suggests that digital accessibility is high among the participants, which could impact their engagement with technology-based learning.

Table 2
Descriptive analysis

Demographic	Categories	Frequency (f)	Percentage (%)
Gender	Male	39	37%
	Female	66	63%
Age	13 -15 years old	76	72%
	16 – 17 years old	29	28%
Access to devices at home (Example:	Yes	96	91%
Smartphone, Laptop)	No	9	9%

4.1 Awareness and Utilization of Skills for E-Learning

This section examines the level of awareness and competency among *Asnaf* (poor) students in Perlis, Malaysia, regarding e-learning platforms and digital learning tools. Hence, understanding the extent to which these students are equipped with the necessary skills for online learning is essential for assessing their ability to adapt to digital education.

4.1.1 Confirmatory factor analysis

Figure 3 illustrates the CFA output where loadings on the engagement factor were particularly weak, which aligns with the low AVE observed. In the structural model, engagement had a limited mediating role between implementation and impact, indicating a need for further exploration. The Fitness Indexes indicate a good model fit, with the following values: P-value: 0.041, Root Mean Square Error of Approximation (RMSEA): 0.052, Comparative Fit Index (CFI): 0.958, Incremental Fit Index (IFI): 0.960, Tucker-Lewis Index (TLI): 0.949, and ChiSq/df: 1.281. According to Awang [28], these values meet the criteria for a well-fitting model. Meanwhile, the Factor Loadings for each variable are as follows: Awareness of E-Learning Tools (0.93), Proficiency in Using E-Learning Tools (0.90), Engagement with E-Learning Tools (0.91), and Perceived Usefulness and Attitudes Toward E-Learning (0.92). Since all values are 0.9 and above, they meet the recommended threshold for high Factor Loading, as suggested by Awang [28]. In essence, these results confirm that the identified variables effectively represent Awareness and Utilization of Skills for E-Learning.

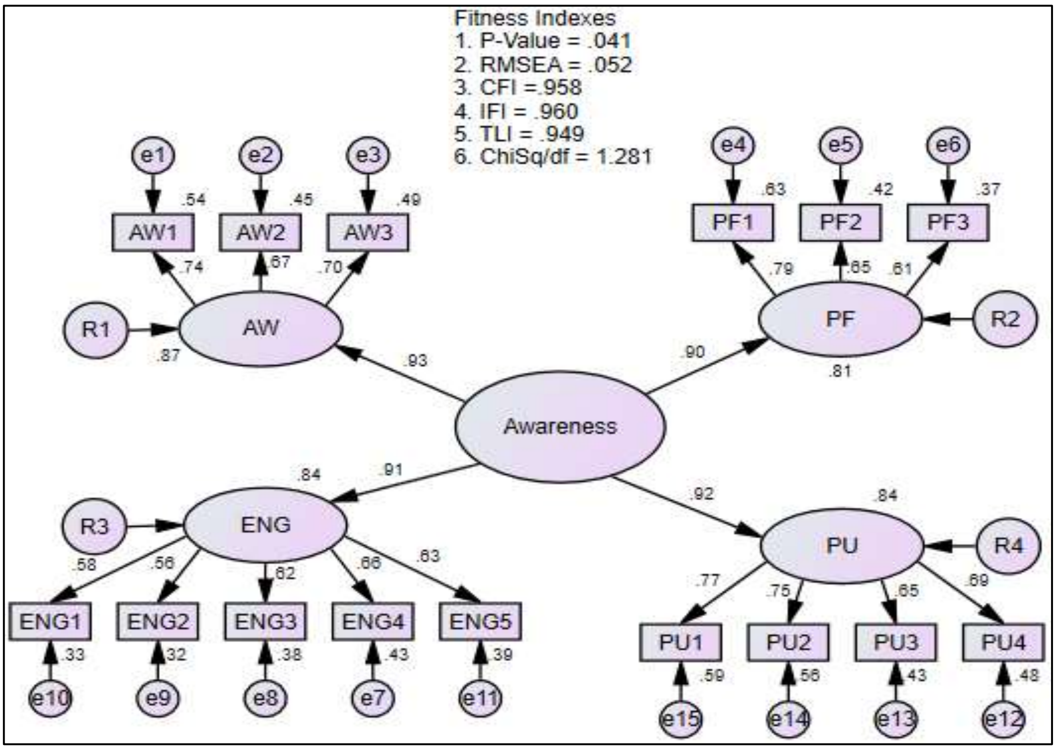

Fig. 3. Confirmatory factor analysis

4.1.2 Factor loading

Table 3 revealed the validity and reliability analysis of three constructs related to e-learning tools: Awareness of E-Learning Tools, Proficiency in Using E-Learning Tools, and Engagement with E-Learning Tools. The Factor Loadings for the Awareness of E-Learning Tools construct are AW1 (.74), AW2 (.67), and AW3 (.70), all of which are above .50, indicating good contribution. For the Proficiency in Using E-Learning Tools construct, the Factor Loadings are PF1 (.79), PF2 (.69), and PF3 (.61), indicating that all values are acceptable. Meanwhile, the Engagement with E-Learning Tools construct has Factor Loadings of ENG1 (.58), ENG2 (.56), ENG3 (.62), ENG4 (.66), and ENG5 (.63), which are also acceptable. Additionally, the Factor Loadings for the Perceived Usefulness and Attitudes Toward the E-Learning construct are PU1 (.77), PU2 (.75), PU3 (.65), and PU4 (.69), all of which exceed 0.50, indicating good contribution. According to Hair *et al.,* [29], Factor Loadings of 0.50 and above are considered acceptable and good.

4.1.3 Composite Reliability (CR)

CR was also assessed for the main constructs related to Awareness and Utilization of Skills for E-Learning. As summarized in Table 3, all CR values for each construct exceeded the minimum requirement of 0.60, confirming their reliability. Furthermore, all three constructs achieved acceptable CR values (above 0.70), indicating strong internal consistency.

Table 3
Factor loading, composite reliability, and average variance extracted

Construct	Code	Items	Factor Loading for items	Factor Loading for construct	Composite Reliability	Average Variance Extracted
Awareness of E-Learning Tools	AW1	I am aware of the e-learning tools used in my school.	.74	.93	0.75	0.50
	AW2	I am aware of the online safety measures while using e-learning tools.	.67			
	AW3	I am aware of the online learning resources provided by my school.	.70			
Proficiency in Using E-Learning Tools	PF1	I understand the functions of various e-learning applications.	.79	.90	0.74	0.50
	PF2	I know how to use basic e-learning tools.	.69			
	PF3	I can troubleshoot basic technical issues when using e-learning tools.	.61			
Engagement with E-Learning Tools	ENG1	I am comfortable with online learning platforms.	.58	.91	0.75	0.38
	ENG2	I find it easy to complete assignments through e-learning tools.	.56			
	ENG3	I use e-learning tools regularly to study.	.62			
	ENG4	I can access e-learning materials from home.	.66			
	ENG5	I am comfortable asking for help if I have trouble with e-learning tools.	.63			
Perceived usefulness and attitudes toward e-learning	PU1	I feel motivated to use e-learning tools.	.77	.92	0.81	0.51
	PU2	E-learning tools help me understand lessons better.	.75			
	PU3	I believe e-learning is essential for my education.	.65			
	PU4	I find e-learning tools helpful in completing my studies.	.69			

Note:
Item Factor Loading ≥ 0.5
AVE = indicator should be above 0.45; CR = indicator should be above 0.60

4.1.4 Average Variance Extracted (AVE)

Subsequently, the AVE was calculated for each construct related to Awareness and Utilization of Skills for E-Learning. All constructs met the recommended minimum threshold of 0.50, except for the Engagement with E-Learning Tools construct, which recorded an AVE of 0.38. However, this value falls below the accepted threshold, indicating that the indicators may not sufficiently represent the underlying engagement construct. As a result, the construct’s convergent validity is weakened, highlighting the need to refine or reconsider the measurement items used for assessing student engagement. Thus, all constructs are valid, except for Engagement with E-Learning Tools, which demonstrates weaker convergent validity. Additionally, the Discriminant Validity Index Summary was conducted for the main constructs.

4.1.5 Discriminant validity index summary

The Discriminant Validity Index Summary in Table 4 presents the square roots of the AVE values on the diagonal (bold values) and correlations between constructs in the off-diagonal positions as per Table 3. Diagonal values (bolded) represent the square root of the AVE for each construct (AW-Awareness: 0.70; PF-Performance: 0.70; ENG-Engagement: 0.61, and PU-Perceived Usefulness: 0.72). Overall, the table mostly supports Discriminant Validity, as most constructs satisfy the Awang [28] criterion. However, the Engagement (ENG) construct has a square root of AVE (0.61) that is very close to its correlation with PF (0.61). This suggests that all the constructs in Awareness and Utilization of Skills for E-Learning are valid, with no redundant items.

Table 4
The discriminant validity index summary

Construct	AW	PF	ENG	PU
AW	0.72			
PF	0.55	0.70		
ENG	0.48	0.61	0.61	
PU	0.52	0.58	0.57	0.72

4.2 Problems & Challenges

This section focuses on identifying the difficulties faced by *Asnaf* students in adopting e-learning, such as a lack of access to digital devices, poor internet connectivity, limited technical skills and financial constraints. Note that recognizing these challenges is crucial for developing effective strategies and policies to bridge the digital divide and enhance e-learning accessibility for underprivileged students.

4.2.1 Confirmatory factor analysis

Figure 4 reveals the results of the CFA of problems and challenges of e-learning. Fitness Indexes are fit, which are P-value: .000, RMSEA: .092, CFI: .890, IFI: .894, TLI: .855, and ChiSq/df: 1.877. According to Awang [28], the value of Fitness Indexes is fit. The Factor Loading for each variable, such as Access Issues (.93), Proficiency in Using E-Learning Tools (.90), Engagement with E-Learning Tools (.91), and Perceived usefulness and attitudes toward e-learning (.92) are higher which is .9 and above as recommended indicator of high Factor Loading by Awang [28]. These variables are the Awareness and Utilization of Skills for E-Learning.

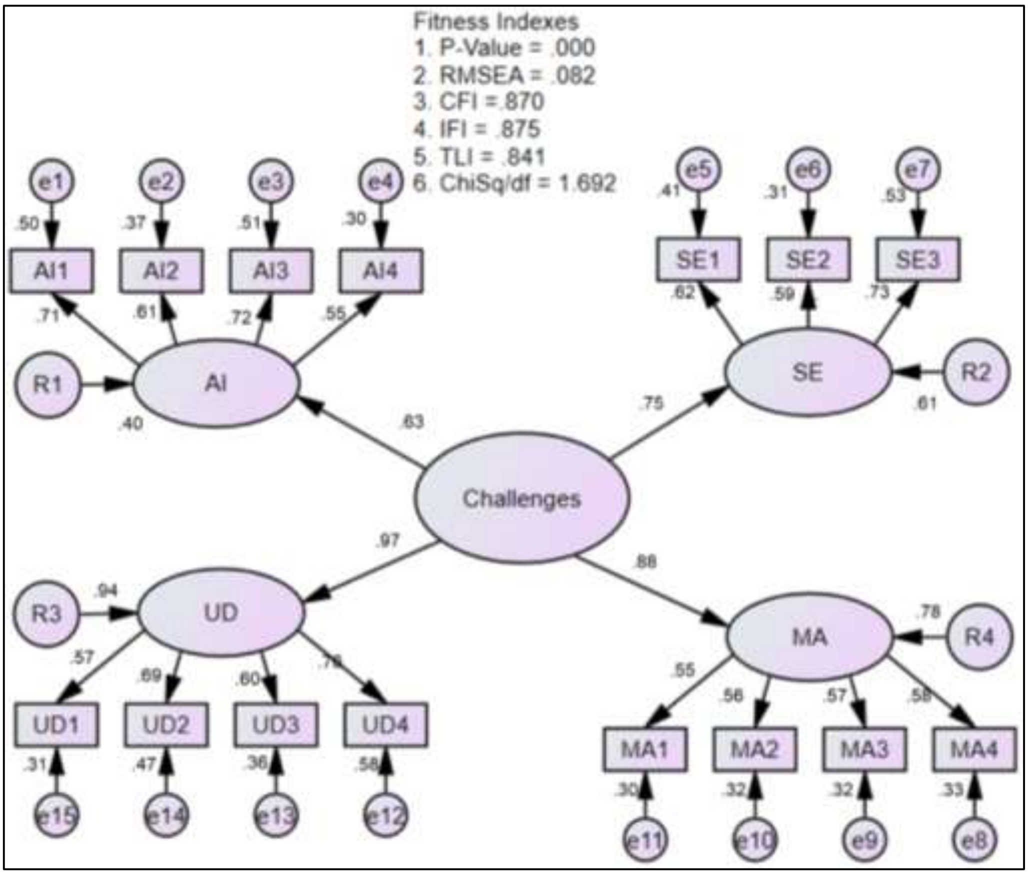

Fig. 4. Problems and challenges of e-learning

4.2.2 Factor loading

Table 5 presents the validity and reliability analysis of three constructs related to e-learning challenges: Access Issues, Usability Difficulties, Motivation and Anxiety, and Support and Environment. The Factor Loadings for each construct are as follows: Access Issues (0.63), Usability Difficulties (0.97), Motivation and Anxiety (0.88), and Support and Environment (0.75), all exceeding 0.5, indicating strong contributions. Meanwhile, for each construct, Access Issues: AI1 (0.71), AI2 (0.61), AI3 (0.72), and AI4 (0.55) fall within the acceptable range. Then, Usability Difficulties: UD1 (0.57), UD2 (0.69), UD3 (0.60), and UD4 (0.76) also meet the recommended threshold. In addition, Motivation and Anxiety: MA1 (0.55), MA2 (0.57), MA3 (0.56), and MA4 (0.58) reveal satisfactory values. In addition, Support and Environment: SE1 (0.62), SE2 (0.59), and SE3 (0.73) also demonstrate good Factor Loadings. According to Hair *et al.,* (2009), Factor Loadings of 0.5 and above are considered acceptable and reliable.

Table 5
Factor loading, composite reliability, and average variance extracted

Construct	Code	Items	Factor Loading for each item	Factor Loading for construct	Composite Reliability	Average Variance Extracted
Access Issues	AI1	I face difficulty accessing the internet.	.71	.63	0.74	0.42
	AI2	I have limited access to devices needed for e-learning.	.61			
	AI3	I often experience technical issues with e-learning tools.	.72			
	AI4	I often experience connectivity issues during online classes.	.55			
Usability Difficulties	UD1	I have limited knowledge of how to use e-learning tools effectively.	.57	.97	0.75	0.44
	UD2	I have difficulty understanding the instructions for e-learning tasks.	.69			
	UD3	I find it hard to keep track of assignments in e-learning.	.60			
	UD4	I feel e-learning tools are complex to navigate.	.76			
Motivation and Anxiety	MA1	I am comfortable with online learning platforms.	.55	.88	0.65	0.32
	MA2	I find it easy to complete assignments through e-learning tools.	.57			
	MA3	I use e-learning tools regularly to study.	.56			
	MA4	I can access e-learning materials from home.	.58			
Support and Environment	SE1	I struggle to find a quiet space for e-learning at home.	.62	.75	0.69	0.42
	SE2	My school does not provide sufficient support for e-learning.	.59			
	SE3	I find it challenging to communicate with teachers in e-learning settings.	.73			

Note:
Item Factor Loading ≥ 0.5
AVE = indicator should be above 0.45; CR = indicator should be above 0.60

4.2.3 Discriminant Validity

Table 6 presents the Discriminant Validity results based on the Fornell-Larcker criterion. The diagonal values (bolded) represent the square roots of the AVE for each construct: Access Issues (0.65), Usability Difficulties (0.69), Motivation and Anxiety (0.58), and Support and Environment (0.25). While Access Issues and Usability Difficulties meet the Discriminant Validity criteria, Motivation and Anxiety, as well as Support and Environment, fail to achieve the required threshold.

Table 6
Discriminant validity index summary

Construct	AI	UD	MA	SE
AI	0.65			
UD	0.58	0.69		
MA	0.52	0.63	0.58	
SE	0.49	0.64	0.57	0.25

5. Conclusions

This study investigated the implementation of e-learning and its challenges among *Asnaf* students in Perlis, Malaysia. The findings reveal a dual reality. On the one hand, national initiatives like CERDIK have markedly improved device access: 91% of surveyed *Asnaf* students have smartphones or laptops at home. In particular, CFA demonstrated strong construct reliability (Factor Loadings ranging from 0.90 to 0.93 for awareness, proficiency, and perceived usefulness), indicating that students value e-learning tools. On the other hand, systemic barriers persist. Nearly 71% of students struggle with unstable internet, 72% encounter technical difficulties, and 59% lack quiet study spaces. Notably, high awareness does not equate to active engagement; the Engagement construct had an AVE of 0.38, well below the recommended threshold. These analytical insights highlight a significant gap between digital access and meaningful utilization. In sum, while device provision has advanced, infrastructural deficits, limited digital skills and socio-economic constraints continue to hinder effective e-learning for this marginalized group.

The implications of these findings are substantial for policymakers, educators and community stakeholders. In particular, infrastructure must be strengthened. For instance, targeted investments in broadband networks, subsidized data plans, and public Wi-Fi hubs are urgently needed in rural areas like Perlis. In addition, expanding coverage and improving internet reliability would directly address the 71% of students reporting unstable connections. Furthermore, digital literacy programs should be tailored to the *Asnaf* context. Although 74% of students were familiar with basic online safety measures, only approximately 61% felt proficient at troubleshooting technical issues. This suggests a shift from theoretical awareness to hands-on training, teaching practical skills for navigating glitches. Similarly, partnerships between schools, zakat institutions, and technology companies could fund workshops and mentorship programs that build students' technical confidence. Moreover, community-centric support structures are essential. Accordingly, establishing e-learning hubs in local mosques or community centers could provide dedicated study spaces and peer support, helping alleviate the isolation and anxiety many students experience. In line with this, integrating local languages and culturally relevant content into online materials may further boost engagement. Finally, socio-economic support must be integrated. Many *Asnaf* families face extreme financial constraints, forcing them to prioritize basic needs over connectivity. Correspondingly, zakat-funded subsidies or micro-grants for internet bills, data packages, and device repairs could alleviate this burden and ensure financial hardship does not block access to digital education.

Despite these promising insights, the study has limitations that point to directions for future research. The sample was small (105 students) and focused on Form 3 and 4 *Asnaf* students in Perlis, which limits generalizability. Therefore, future studies should include a larger and more diverse sample, for example, primary school students or youth in other rural regions. Notably, the reliance on self-reported questionnaire data may introduce bias; therefore, mixed-methods approaches (such as interviews, focus groups, or classroom observations) would enrich understanding students' real-world experiences. The measurement model also suggests room for improvement: constructs related to Engagement and Support and Environment failed the Discriminant Validity threshold, indicating the survey instrument may need refinement or expansion. Thus, subsequent research could incorporate additional variables, such as parental involvement or teacher training levels, to capture the broader socio-ecological factors affecting e-learning. Longitudinal designs would also be valuable in assessing how interventions evolve and tracking changes as Malaysia moves toward hybrid education models. Alternatively, comparative studies with marginalized groups in other regions or countries could further identify transferable strategies for bridging digital divides. Figure 5 concludes the overall problem and challenges for *Asnaf* students.

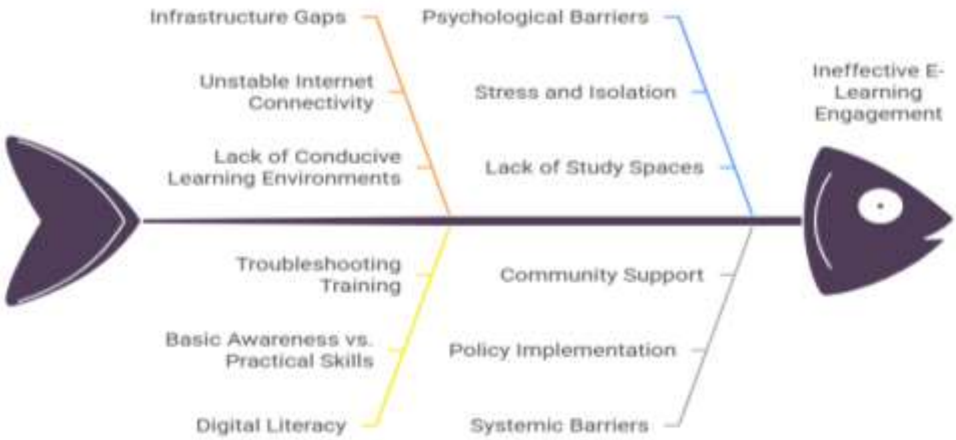

Fig. 5. A few factors help Asnaf students adapt to educational technology

In closing, this study underscores that technological access is only the first step toward educational equity. Nevertheless, bridging the digital divide for *Asnaf* students (and other underrepresented communities) requires integrated efforts across infrastructure, education, and community development. True digital equity indicates connecting devices and empowering learners with skills, support, and resources to ensure that technology enhances their education rather than heightening existing inequalities. Furthermore, policymakers and educators must recognize that technology alone cannot democratize learning; it must be coupled with empathy, equity-driven policies, and sustained commitment to uplift marginalized voices. Only then can no community be left behind in the digital age.

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