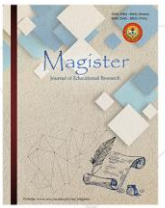

Magister
Journal of Educational Research
ISSN 2984 - 6641 (Online) ISSN 2545 - 9902 (Print)
Website: www.errc.ctu.edu.ph/ojs/magister

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Enhancing Computer Systems Servicing: A Modular Approach to Distance Learning

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Article citation details: Leones J. (2024). Enhancing Computer Systems Servicing: A Modular Approach to Distance Learning. *Magister – Journal of Educational Research*, *3*(1), 1-20.

Abstract

This study employs a descriptive correlational design to explore the effectiveness of modular distance learning (MDL) in enhancing Grade 9 Computer Systems Servicing (CSS) learners' skill proficiency in achieving the Most Essential Learning Competencies (MELCs). Conducted in a public school within Region VII, Philippines, the research takes a quantitative approach. It assesses learners' abilities in three crucial areas: applying quality standards, performing computer operations, and conducting mensuration and calculations. This study goes beyond simply measuring effectiveness. It delves into the practical challenges learners encounter in the MDL environment, providing valuable insights for improvement. Data collection involved administering questionnaires to 133 participants. The analysis employed a one-way ANOVA to identify significant differences in skill proficiency across the defined MELCs. The results revealed satisfactory performance in applying quality standards, performing computer operations, and conducting mensuration and calculations. However, the study also identified noteworthy challenges faced by learners. Insufficient data allowance and lack of access to necessary gadgets emerged as the most significant barriers. Interestingly, existing health conditions were considered the least impactful factor. These findings highlight the need for targeted interventions to address limited data and the lack of devices. By implementing such interventions, educational institutions can bolster the effectiveness of modular distance learning for CSS programs. This can facilitate learners' acquisition of practical skills and proficiency in computer systems servicing, preparing them for future careers in this growing field.

Keywords: *Modular Distance Learning, Most Essential Learning Competency, Computer System Servicing*

1. Introduction

Education, especially in the digital age, is a multifaceted process that harness technology to nurture the development of the learners. It is a

process of facilitating learning that equips learners with essential functional knowledge (Lamichhane, 2018). While practical approaches and learning models are crucial, the tools used to deliver learning materials have become equally important. Integrating technology into education can significantly enhance learning outcomes (Machmud et al., 2021).

Today's information-driven society thrives on modern and evolving technologies. Information and Communication Technologies (ICT) has revolutionized how individuals, businesses, governments, and the educational sector function. The recent global health crisis has underscored the need for adaptable educational systems. COVID-19 exposed vulnerabilities across various sectors, including education. Universities and research institutions must address these weaknesses by developing robust educational models based on lessons (Riofrio et al., 2015). ICT has emerged as a powerful tool in this endeavor. These technologies facilitated remote learning and ensured the continuity of essential societal functions during the crisis (Beldarrain, 2006). The pandemic has fundamentally reshaped our vision for education, highlighting the transformative potential of technology.

To effectively address these challenges, a particular focus has been placed on practical, skill-based subjects such as Computer Systems Servicing (CSS). This course equips learners with the technical competencies necessary for the digital era. CSS covers basic and standard competencies, including installing, maintaining, configuring, and diagnosing computer systems and networks (Paytaren, 2020). Despite the theoretical nature of traditional educational frameworks, the practical demands of CSS require hands-on experience, which poses a significant challenge in a modular distance learning environment. This research aims to assess the efficacy of a modular approach in delivering CSS education and evaluates student proficiency in essential technical skills.

This study utilizes the descriptive correlational research design to explore the effectiveness of modular distance learning in enhancing the skill proficiency of Grade 9 learners by examining and describing the relationships between their skill proficiency without manipulating them. At this essential stage in their journey, teachers aim to broaden their understanding of how learners grasp the skills needed in Computer Systems Servicing. This knowledge is essential for enhancing CCS in a modular approach. It will eventually benefit the progress of distance learning settings.

The paper is structured as follows: Section 2 reviews the relevant literature. Section 3 outlines the research methodology employed in this study. Section 4 presents a comprehensive analysis of the results and subsequent discussions. Finally, Section 5 offers a concise and insightful conclusion, summarizing the essential findings and providing potential avenues for future research.

2. Literature Review

2.1 Computer Systems Servicing (CSS)

Computer systems servicing refers to the smooth operation of the technology. Technicians in this field handle the installation, maintenance, repair, and troubleshooting of computers and their peripherals (Ibezim, 2010). This goes beyond just fixing problems; it also involves proactive measures to keep the system running optimally (Farayola, 2024). From upgrading hardware and software to regular maintenance and security checks, computer systems service technicians are the guardians of the digital world (Dawson, 2020). They play a vital role in both personal and professional settings. Whether it is a home computer or a company's entire network, their expertise ensures peak performance and efficiency, preventing costly downtime and data loss.

Educational programs must integrate theoretical knowledge with practical skills to ensure a steady stream of qualified technicians. Learners must gain valuable hands-on experience in areas like disassembling and reassembling computers, diagnosing hardware and software issues, performing data recovery, installing and configuring operating systems, and implementing security measures. Studies emphasize the need for such curricula; hands-on lab sessions complement theoretical learning, fostering a deeper understanding of computer systems servicing (Wu et al., 2014). They highlight that curricula should evolve to keep pace with technological advancements and industry requirements. Including computer systems servicing in curricula significantly enhances learners' practical skills and employability (Simões et al., 2022). Learners' training in computer systems servicing demonstrates improved problem-solving abilities and technical proficiency as an effective educational tool (Oduma et al., 2019). This training is particularly beneficial in preparing learners for roles that require immediate application of technical skills upon entry into the workforce.

The shift towards experiential learning methodologies has been beneficial. Project-based learning and real-world problem-solving effectively teach computer systems servicing (Anih & Ukeh, 2023). These methodologies engage learners more effectively and help them retain knowledge better by applying it in practical scenarios. Despite the benefits, several challenges hinder the effective integration of computer systems servicing into curricula (Johnson et al., 2016; Kennedy, 2023). One significant issue is school resource limitation, particularly in underfunded areas. The need for up-to-date equipment and trained instructors can impede the delivery of high-quality education in this field (Brownell & Tanner, 2012; Maffea, 2020).

Another challenge is the rapid pace of technological change. Educators must continually update curricula to keep pace with new developments in hardware and software. This constant need for revision can strain educational institutions' resources and capacities. Moreover, the fast-changing nature of technology means that what learners learn today might become obsolete quickly (Lavicza et al., 2022; Reaves, 2019). Integrating computer systems servicing into educational curricula has proven beneficial in enhancing learners' technical skills and employability. However, challenges such as resource limitations and the rapid pace of technological change must be addressed to maximize the effectiveness of these programs. Future research should focus on developing sustainable models for curriculum updates, resource allocation, and innovative teaching methodologies that adapt to technological advancements. By addressing these challenges and fostering innovative learning models, educational institutions can empower learners to become the tech guardians of tomorrow.

2.2 Modular Distance Learning Approach

Modular Distance Learning (MDL) refers to individualized instruGction that lets the learners use a self-learning module in print or digital format, depending on the applicability to the learner. It became a prominent educational approach in recent years, particularly in the Philippines, during disruptions brought about by the COVID-19 pandemic. It is a primarily driven shift by the global need for remote learning solutions (Bustillo & Aguilos, 2022). Learners can progress through course materials at their own pace, catering to diverse learning styles and schedules (Francisco, 2020). Studies even show its effectiveness in reaching students in remote areas who may not have access to traditional classroom settings (Talimodao & Madrigal, 2021).

The core principle of MDL lies in its modular structure, indicating that the course content is broken down into manageable units, allowing for independent or sequential completion (Jou et al., 2022). This modularity creates a personalized learning experience wherein the teachers prepare specific learning activities or modules, and the students are tasked to learn independently (Malik, 2012). Educators can tailor materials to address specific student needs and interests, fostering deeper engagement (Dargo & Dimas, 2021).

Recent research highlighted crucial factors for successful MDL implementation. Technological infrastructure and support systems are vital (Sato et al., 2023). Reliable intSatrernet connectivity and appropriate learning devices are essential for learners to effectively engage with MDL materials (Ahmed et al., 2017; Asio et al., 2021). However, unequal access to technology, limited data allowances, or outdated equipment can create significant barriers, potentially widening the digital divide (Lai & Widmar, 2021). While MDL offers flexibility (Liu et al., 2020), it also presents challenges related to self-directed learning. Studies suggest that navigating a modular environment requires strong self-regulation and time-management skills (Inzlicht et al., 2021).

Additionally, a sense of belonging impacts student experience and achievement (Peacock et al., 2020). The lack of face-to-face interaction inherent in MDL can hinder this sense of belonging, potentially leading to decreased motivation (Peacock et al., 2020). To address this and promote engagement, fostering community and collaboration within the MDL framework is crucial. Strategies like virtual forums and synchronous online sessions can create that sense of connection (Navarro & McGrath, 2022). To maximize its effectiveness, a comprehensive approach is necessary. This includes considering pedagogical strategies, technological infrastructure, and socio-emotional factors that can influence student success in this evolving educational setting.

3. Methodology

This study investigated the effectiveness of a modular distance learning approach in developing essential CSS skills among learners. A structured quantitative analysis was employed. Learners completed a questionnaire focusing on key performance metrics related to the three MELCS: applying quality standards, performing computer operations, and performing mensuration and calculations. Frequency counts and percentages were used to profile the learners, while weighted means

assessed their proficiency in each MELC. Additionally, an analysis of variance (ANOVA) compared skill levels across different learner groups, revealing significant variations. The study also identified and ranked challenges associated with modular distance learning, pinpointing areas for improvement within the instructional delivery system.

4.1 Objectives of the Study

This study investigates the impact of the modular learning approach on the skills of Grade 9 learners enrolled in Computer Systems Servicing (CSS) during the COVID-19 pandemic. Specifically, it assesses the learner proficiency in the three most essential learning competencies (MELCs) of TLE-ICT CSS: applying quality standards, performing computer operations, and conducting mensuration and calculations. It also considers learners' challenges in the MDL environment, providing valuable insights for improvement. Furthermore, this research determines the learning situation and educational resources available to CSS learners during the modular distance learning period, providing a more concise picture of the learning environment.

4.2 Research Design and Sample

The study used a descriptive correlational design to describe relationships among variables without establishing causal connections (Gay & Airasian 2002). This approach efficiently examines the relationships between learners' proficiency in the MELCs—such as applying quality standards, performing computer operations, and performing mensuration and calculations—and the challenges they face in a modular distance learning environment.

4.3 Instrument Design

The primary instrument for obtaining data was a questionnaire partly taken from the Learners Enrolment and Survey Form (LESF), modules of MELCs of TLE-ICT-CSS, and the Electronic Self-Assessment Tool for Teachers (E-SAT) of the Department of Education. The questionnaire is intended mainly for the learners. It has three parts: the first part consisted of questions on the profile of learners in terms of age, gender, and combined monthly family income; the second part contained a set of multiple-choice questions based on the chosen three Most Essential Learning Competencies (MELC's) of TLE-ICT-CSS,

and the last part covered queries on the challenges encountered by the respondent group using modular distance learning.

4.4 Data Gathering Procedure

A three-phase data-gathering process was implemented to assess the impact of the modular learning approach. Before the survey administration of the survey questionnaire, permission was secured from the school principal. The teachers who prepared self-learning modules for the week established communication with their classes through social media to facilitate engagement. The questionnaire was administered online during the survey phase, explicitly targeting Grade 9 learners enrolled in Computer Systems Servicing. This method allowed learners to complete the questionnaire at a designated time, ensuring uniformity in response collection. After completion, the responses were automatically saved to the researcher's Google Drive account for security and accessibility. The collected data were then analyzed and interpreted statistically to derive meaningful insights from the study.

4.5 Statistical Treatment

The data gathered was subjected to statistical treatment using weighted mean, ANOVA Single Factor, percentage, and ranking. Frequency counts and Percentages were used to present the profiles of learners and teachers in frequency and percent distribution tables. The weighted mean was used to determine the learners' proficiency in the skills specified in the MELCS. The ANOVA Single Factor was used to ascertain if there is a significant difference in the skills proficiency of the learners in the MELCs using modular distance learning. Percentage and ranking were used to identify the most apparent challenges encountered by the respondents on modular distance learning.

4.6 Participants

This study included 133 Grade 9 learners enrolled in Computer Systems Servicing, with the distribution comprising 51 males and 82 females, as detailed in Table 1. The Grade 9 learners were specifically selected for this study because they meet the age criteria for accessing social media and communication channels by the Child Safeguarding and Data Privacy Act as specified in RA 10173. Additionally, the learning competencies assessed were selected as they are essential and tailored explicitly for the Grade 9 curriculum, reflecting the level at which this major is offered. Before participation in the survey, parental

consent was obtained for all learners, ensuring compliance with ethical standards and legal requirements. Table 1 presents the profile of the Grade 9 learners for the school year 2020-2021 in terms of age and gender, the combined monthly family income, and the school ICT resources.

Table 1. Demographic Characteristics of the Participants n=133

Category		***n***	**%**
Grade 9 Sections	A	26	19.55
	B	16	12.03
	C	26	19.55
	D	22	16.54
	E	13	9.77
	F	30	22.56
Sex	Male	51	38.35
	Female	82	61.65
Age	19-21 years old	2	1.50
	16-18 years old	20	15.04
	13-15 years old	111	83.46
Combined Family Income	Php 21,000 and above	12	9.02
	Php 16,000-20,000	9	6.77
	Php 11,000-15,000	16	12.03
	Php 6,000-10,000	96	72.18
School ICT Resources	Computer Laboratories	4	
	Computer Units	196	
	Laptops/Netbooks	100	

Table 1 presents the demographic profile of the Grade 9 study participants, who are distributed across six sections, with Sections A and C having the highest representation at 19.55% each, followed by Section F at 22.56%, Section D at 16.54%, Section B at 12.03%, and Section E at 9.77%. Most participants are female, making up 61.65%, while males account for 38.35%. In terms of age, 83.46% are between 13 and 15 years old, with 15.04% aged 16 to 18 years, and a small percentage, 1.50%, aged 19 to 21 years. Regarding combined family income, the largest group, 72.18%, has an income between Php 6,000 and 10,000, followed by 12.03% with incomes ranging from Php 11,000 to 15,000, 9.02% earning Php 21,000 and above, and 6.77% earning between Php

16,000 and 20,000. The school's ICT resources include four computer laboratories, 196 computer units, and 100 laptops/netbooks.

4. Results and Discussion

This section presents the study's key findings, addressing each research objective through a series of comprehensive data tables, explaining the development of essential skills in computer systems servicing, highlighting the importance of quality standards, performing computer operations, and performing mensuration and calculations. While the assessment reveals satisfactory proficiency in these areas, specific challenges hinder optimal learning, particularly in a modular distance learning (MDL) environment.

4.1 Learners Performance Metrics Related to MELCS

This section examines the performance metrics of learners in relation to the Most Essential Learning Competencies (MELCS). By analyzing various proficiency levels and outcomes, we aim to understand how effectively students are meeting the learning objectives outlined by MELCS. The following data provides insights into learners' capabilities and highlights areas for improvement in their educational journey.

Table 2. Learner Proficiency Distribution in Terms Applying Quality Standards

Skills Proficiency in Applying Quality Standards		
Range of Scores	**Frequency (f)**	**Verbal Description**
13-15	26	Excellent
8-11	62	Satisfactory
4-7	40	Fair
3 and below	5	Poor
Total	133	
Mean	8.71	
Standard Deviation	3.09	
Interpretation	Satisfactory	

Table 2 presents the distribution of learner proficiency scores for applying quality standards among 133 learners. The scores are categorized into four ranges with corresponding verbal descriptions: 26 individuals (19.5%) scored between 13-15, indicating excellent proficiency; 62 individuals (46.6%) scored between 8-11, which is satisfactory; 40 individuals (30.1%) scored between 4-7, considered fair;

and five individuals (3.8%) scored three or below, indicating poor proficiency. The overall mean score of 8.71 indicates that the average proficiency level of the learners is satisfactory. This is further supported by the standard deviation of 3.09, suggesting moderate variability in proficiency levels among the learners. While the majority are competent, there are noticeable differences, with some excelling and others needing considerable improvement.

In today's ever-evolving world, the capacity to adjust and pick up new quality standards is essential. Learners can fulfill expectations and generate high-quality work by comprehending and implementing quality standards. To guarantee consistent performance and satisfy client expectations, the capacity to adhere to and apply quality standards is necessary for many occupations. While the average proficiency level is satisfactory, there is a clear need for targeted support and development to address the varying levels of learner proficiency in applying quality standards (Li et al., 2023). By focusing on tailored interventions and utilizing existing strengths within the group, educational programs can enhance overall learner performance and ensure a higher standard of quality.

Table 3. Learner Proficiency Distribution in Terms Performing Computer Operations

Skills Proficiency in Performing Computer Operations		
Range of Scores	**Frequency (f)**	**Verbal Description**
13-15	43	Excellent
8-11	52	Satisfactory
4-7	35	Fair
3 and below	3	Poor
Total	133	
Mean	9.35	
Standard Deviation	3.23	
Interpretation	Satisfactory	

Table 3 summarizes the participants' proficiency levels in computer operations, categorized into four score ranges with verbal descriptions. Out of the total, 43 individuals (32.3%) scored between 13-15, indicating excellent proficiency; 52 individuals (39.1%) scored between 8-11, reflecting satisfactory proficiency; 35 individuals (26.3%) scored between 4-7, considered fair; and three individuals (2.3%) scored three or below, indicating poor proficiency. The mean score is 9.35, with a

standard deviation of 3.23, suggesting that the average proficiency level is satisfactory. The data shows a moderate spread around the mean, with most learners achieving excellent or satisfactory proficiency levels in computer operations. Today, computer literacy is a requirement for the majority of jobs. Proficiency in software usage, online platform navigation, and electronic communication is crucial for career readiness. Numerous facets of schooling include technology integration. Learners proficient in computer operations can access online resources, participate in digital learning settings, and finish tasks quickly. The state of technology is ever-changing. Learners proficient in computer operations have the groundwork to master and adapt to new technologies.

In today's digital world, computer literacy is a fundamental requirement for most jobs. Proficiency in computer operations—including software usage, online platform navigation, and electronic communication—is crucial for career readiness (Morgan et al., 2022). The integration of technology in education underscores the importance of developing these skills. Learners who are proficient in computer operations can effectively access online resources, engage in digital learning environments, and complete tasks efficiently. As technology continues to evolve, these learners are better positioned to adapt to new tools and technologies, ensuring ongoing relevance and competence in a rapidly changing landscape. Thus, fostering and maintaining high levels of computer proficiency is essential for equipping learners with the skills necessary for success in both academic and professional contexts.

Table 4. Learner Proficiency Distribution in Terms Performing Mensuration and Calculations

Skills Proficiency in Performing Mensuration and Calculations		
Range of Scores	**Frequency (f)**	**Verbal Description**
13-15	46	Excellent
8-11	59	Satisfactory
4-7	28	Fair
3 and below	0	Poor
Total	133	
Mean	9.99	
Standard Deviation	2.68	
Interpretation	Satisfactory	

Table 4 presents the proficiency levels in performing mensuration and calculations among the learners, categorized by score ranges with corresponding verbal descriptions. A total of 46 learners (34.6%) scored between 13-15, indicating excellent proficiency; 59 learners (44.4%) scored between 8-11, reflecting satisfactory proficiency; 28 learners (21.1%) scored between 4-7, considered fair; and no learner scored three or below, indicating poor proficiency. The mean score of 9.99 and a standard deviation of 2.68 suggest that, on average, the learners demonstrate satisfactory proficiency in mensuration and calculations, with most scores concentrated around the mean and a relatively smaller spread of scores. The score distribution highlights a generally competent performance among the group.

Computer technicians typically measure parts, identify issues that call for computations (such as power needs or storage capacity), and ensure that parts are positioned correctly within systems (Zhou et al., 2022). Finding hardware problems frequently entails estimating voltage, temperature, or resource consumption. Measurement abilities are essential to measure components and debug physical space limits precisely. System performance optimization entails memory allocation, storage management, and network bandwidth estimates. Comprehending mensuration facilitates the correct installation of components for maximum efficiency.

Table 5. Challenges Encountered by Learners in Modular Distance Learning

Challenges	**Frequency *(f)***	**Percentage *(%)***	**Rank**
Insufficient load/data allowance	28	21.05	1
Lack of available gadgets	28	21.05	1
Difficulty in independent learning	27	20.30	2
Unstable internet connection	21	15.79	3
Conflict with other activities	11	8.27	4
Environmental distractions	8	6.02	5
Unavailable learning space	6	4.51	6
Existing health conditions	4	3.01	7
TOTAL	133	100	

Table 5 presents the challenges faced by learners in modular distance learning, ranked by frequency and percentage. The most common challenges encountered by 28 learners (21.05%) are insufficient load/data allowance and lack of available gadgets, tied for the top rank.

The difficulty in independent learning affects 27 learners (20.30%) and is ranked second. Unstable internet connection is the third most challenging, reported by 21 learners (15.79%). Other notable challenges include conflict with other activities (11 learners, 8.27%), environmental distractions (8 learners, 6.02%), and unavailable learning space (6 learners, 4.51%). The last reported challenge is existing health conditions, affecting four learners (3.01%). These challenges highlight significant barriers to effective modular distance learning, particularly regarding access to necessary technology and resources.

The data showed that insufficient load allowance limits learners from accessing online educational materials, lectures, videos, and resources essential for learning, impacting their skills proficiency. It hinders learners from conducting thorough research, affecting the quality of their assignments and projects. Learners need help participating in online discussions, collaborative projects, or virtual group activities due to limited data, potentially impacting their ability to engage and learn collaboratively. Efforts to bridge the gap include initiatives by schools or governments to provide subsidized or free data access to learners, promote offline resources where possible, and encourage the development of data-efficient educational platforms or materials (Sharma & Prince, 2023). Collaboration between stakeholders such as the Parents-Teachers Association, Local Government Units, and telecommunication companies ensures equitable access to digital resources for all learners. This covers the cost of creating, producing, and distributing high-quality modules and giving learners access to the required technologies (Müller & Wulf, 2021). Within the MDL framework, educators must incorporate ways to help learners become more adept at self-learning. This could entail offering opportunities for guided practice, tools for self-evaluation, and explicit learning objectives. Schools should implement programs that give parents the information and abilities to assist their children during MDL. Addressing parental concerns may entail workshops, internet tools, or communication channels.

4.2 Analysis of the Significant Differences in Learners' Skills Proficiency

This section explores the significant differences in skills proficiency among learners engaged in TLE-ICT-CSS using modular distance learning, specifically in MELCS competencies. The analysis aims to identify variations in proficiency levels and understand the impact of different learning methods on student outcomes in these key areas.

Table 6. Analysis of the Variance (ANOVA) Table on the Learners Proficiency in TLE-ICT CSS

Groups	*Count*	*Sum*	*Average*	*Variance*
Applying Quality Standards	133	1158	8.71	9.54
Performing Computer Operations	133	1244	9.35	10.44
Performing Mensuration and Calculations	133	1329	9.99	7.17

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	109.93	2	54.96	6.07	0.00	3.02
Within Groups	3584.95	396	9.05			
Total	3694.88	398				

Table 6 compares three groups: Applying Quality Standards, Performing Computer Operations, and Performing Mensuration and Calculations, each with a sample size (Count) of 133. The sum of scores (Sum) for these groups are 1158, 1244, and 1329, respectively, leading to average scores (Average) of 8.71, 9.35, and 9.99. The variances within these groups are 9.54, 10.44, and 7.17, indicating differing levels of score dispersion. The ANOVA analysis yields a between-group sum of squares (SS) of 109.93 with 2 degrees of freedom (df), resulting in a mean square (MS) of 54.96. The within-group sum of squares is significantly higher at 3584.95 with 396 degrees of freedom, producing a mean square of 9.05. The calculated F-value is 6.07, which exceeds the critical F-value (F crit) of 3.02, and the associated P-value is 0.00, indicating a statistically significant difference between the groups at the 95% confidence level. This analysis suggests that the mean performance scores of the three groups are not equal and that there are significant differences in their performance levels.

The emphasis on quality standards ensures that graduates possess the necessary knowledge, skills, positive attitude, and work ethic to excel in their roles. Adherence to safety regulations and best practices safeguards personnel, clients, and the environment. Learners benefit significantly from hands-on experience in computer operations, including utilizing keyboard shortcuts, navigating the internet, and working with various software applications. However, limited access to devices and data at home creates a barrier, potentially widening the digital divide between privileged and underprivileged learners (Robinson et al., 2021).

Understanding and applying measuring tools is crucial. These tools at home can help learners grasp their functionalities. Furthermore, grasping the concept of binary code, the language of computers, presents an additional hurdle. While the assessment indicates satisfactory skills proficiency, the MDL format presents distinct challenges, including limited resources, autonomous learning difficulties, unreliable internet connectivity, time management and adaptability, learning environment distractions, and health considerations.

More data allowance and a lack of personal devices restrict access to online resources and hinder the development of practical skills. This can perpetuate the digital divide. Independent learning can be demanding for learners who require additional support to develop self-directed learning skills. Inconsistent internet connection disrupts learning and hinders access to essential information. Upgrading infrastructure is necessary to ensure reliable internet access for all (Freeman, 2020). Balancing MDL with other activities necessitates strong time management skills and adaptable lesson plans to cater to diverse learners. Unstructured learning environments can be disruptive and hinder focus (Reich, 2020). Educators and curriculum developers can explore solutions like dedicated study areas or noise-canceling headphones could be explored. Existing health issues can impact learning and limit participation. Developing educational materials and providing support services that consider health concerns is crucial.

The findings highlighted the importance of core skills in computer systems servicing and the challenges faced in an MDL setting. By addressing these challenges and promoting access to resources, educational institutions can empower learners to develop their skillsets and bridge the digital divide. Furthermore, it encourages ongoing education, real-world experience, and pursuing relevant industries.

5. Conclusion

The transition to modular distance learning (MDL) in computer systems servicing (CSS) education presents a unique opportunity to explore flexible and self-paced learning models within the constraints of the new normal educational system. The educators will adequately address the needs of the students and could look into the possibility of providing flexible learning options to its students (Samortin et al., 2022).

Based on the study's findings, there is a significant difference in the skills proficiency of learners in Computer Systems Servicing for the

three most essential learning competencies using modular distance learning. This indicates that learners must adapt to the new normal phase of education, where they bear greater responsibility for learning. Teachers can enhance competency by identifying students' strengths and weaknesses and customizing learning experiences accordingly. A significant variation in proficiency suggests that the current MDL design or delivery strategies may need to be more effective in meeting all students' diverse learning needs. Therefore, it may be necessary to adjust instructional strategies, learning resources, and support systems. The discrepancy in skill proficiency highlights a potential failure for some learners to acquire the required knowledge and skills through MDL, which could exacerbate existing educational disparities and lead to uneven career readiness.

Enhancing computer systems servicing through MDL must tailor the learners' various learning experiences and styles. Assessing each learner's strengths and weaknesses must be the first step in customizing instructional materials and support systems. The customization includes offering tiered learning modules or incorporating multisensory resources based on individual learning styles. Facing challenges like the digital divide that provides for limited devices and internet connections is crucial. However, designing the MDL with more practical and interactive components can bridge the gap in skill proficiency. Enhanced teacher training, regular feedback sessions with the learners, and better social or personal support can also improve the desired learning outcomes. By focusing on these areas, educational institutions can better prepare students for careers in computer systems servicing, ensuring they acquire the necessary skills and knowledge despite the constraints of distance learning. While MDL offers a viable path for continuing education in computer systems servicing, it requires careful refinement and targeted support to overcome its inherent challenges and maximize its benefits.

References

Ahmed, S. S., Khan, E., Faisal, M., & Khan, S. (2017). The potential and challenges of MOOCs in Pakistan: a perspective of students and faculty. *Asian Association of Open Universities Journal, 12*(1), 94-105.

Anih, A. A., & Ukeh, B. O. (2023). Effect of Project-based Learning on Computer Science Education Students' Academic Achievement in Computer Networking in Tertiary Institutions in Bayelsa State. *Journal of Research in Science and Vocational Education, 3*(1), 56-64.

Asio, J. M. R., Gadia, E., Abarintos, E., Paguio, D., & Balce, M. (2021). Internet connection and learning device availability of college students: Basis for institutionalizing flexible learning in the new normal. *Studies in Humanities and Education, 2*(1), 56-69.

Beldarrain, Y. (2006). Distance education trends: Integrating new technologies to foster student interaction and collaboration. *Distance education, 27*(2), 139-153.

Brownell, S. E., & Tanner, K. D. (2012). Barriers to faculty pedagogical change: Lack of training, time, incentives, and… tensions with professional identity?. *CBE-Life Sciences Education, 11*(4), 339-346.

Bustillo, E., & Aguilos, M. (2022). The challenges of modular learning in the wake of covid-19: a digital divide in the Philippine countryside revealed. *Education Sciences, 12*(7), 449.

Dargo, J., & Dimas, M. (2021). Modular distance learning: Its effect in the academic performance of learners in the new normal. *Journal of Education, Teaching and Learning, 6*(2), 204-208.

Dawson, P. (2020). *Defending assessment security in a digital world: Preventing e-cheating and supporting academic integrity in higher education*. Routledge.

Farayola, O. A. (2024). Revolutionizing banking security: integrating artificial intelligence, blockchain, and business intelligence for enhanced cybersecurity. *Finance & Accounting Research Journal, 6*(4), 501-514.

Francisco, C. (2020). Effectiveness of an online classroom for flexible learning. *International Journal of Academic Multidisciplinary Research (IJAMR), 4*(8), 100-107.

Freeman, J., Park, S., & Middleton, C. (2020). Technological literacy and interrupted internet access. *Information, Communication & Society*, *23*(13), 1947-1964.

Gay, L. R., & Airasian, P. W. (2002). *Educational Research: Competencies for Analysis and Applications S/G*. Addison Wesley Longman.

Ibezim, N. E. (2010). Assessment of the Performance Level of Computer Education Learners on Work Skills required for Employment in Computer Maintenance Jobs. *Nigerian Vocational Association Journal*, *15*(1), 89-95.

Inzlicht, M., Werner, K. M., Briskin, J. L., & Roberts, B. W. (2021). Integrating models of self-regulation. *Annual review of psychology, 72,* 319-345.

Johnson, A. M., Jacovina, M. E., Russell, D. G., & Soto, C. M. (2016). Challenges and solutions when using technologies in the classroom. *In Adaptive educational technologies for literacy instruction* pp. 13-30. Routledge.

Jou, Y. T., Mariñas, K. A., & Saflor, C. S. (2022). Assessing cognitive factors of modular distance learning of K-12 students amidst the COVID-19

pandemic towards academic achievements and satisfaction. *Behavioral Sciences, 12*(7), 200.

Kennedy, G. M. (2023). Challenges of ICT Integration in Teachers' Education: A Case Study of the College of Education, University of Liberia. *International Journal of Social Science and Education Research Studies, 3*(5), 860-870.

Lai, J., & Widmar, N. O. (2021). Revisiting the digital divide in the COVID-19 era. *Applied economic perspectives and policy, 43*(1), 458-464.

Lamichhane, C. D. (2018). Understanding the education philosophy and its implications. *NCC Journal, 3*(1), 24-29.

Lavicza, Z., Weinhandl, R., Prodromou, T., Anđić, B., Lieban, D., Hohenwarter, M., ... & Diego-Mantecón, J. M. (2022). Developing and evaluating educational innovations for STEAM education in rapidly changing digital technology environments. *Sustainability, 14*(12), 7237.

Li, L., Shi, J., & Zhong, B. (2023). Good in arts, good at computer? Rural students' computer skills are bolstered by arts and science literacies. *Computers in Human Behavior*, *140*, 107573.

Liu, Z. Y., Lomovtseva, N., & Korobeynikova, E. (2020). Online learning platforms: Reconstructing modern higher education. *International Journal of Emerging Technologies in Learning (iJET), 15*(13), 4-21.

Machmud, M. T., Widiyan, A. P., & Ramadhani, N. R. (2021). The Development and Policies of ICT Supporting Educational Technology in Singapore, Thailand, Indonesia, and Myanmar. *International Journal of Evaluation and Research in Education, 10*(1), 78-85.

Maffea, J. (2020). Lack of resources in classrooms.

Malik, S. K. (2012). Effects of modular and traditional approaches on students' general comprehension. *Elixir social studies, 42,* 6228-6231.

Morgan, A., Sibson, R., & Jackson, D. (2022). Digital demand and digital deficit: conceptualising digital literacy and gauging proficiency among higher education students. *Journal of Higher Education Policy and Management*, *44*(3), 258-275.

Müller, F. A., & Wulf, T. (2021). Blended learning environments that work: An evidence-based instructional design for the delivery of qualitative management modules. *The International Journal of Management Education*, *19*(3), 100530.

Navarro, J. C. M., & McGrath, B. M. (2022). Strategies for effective online teaching and learning: Practices and techniques with a proven track of success in online education. *Handbook of research on future of work and education: Implications for curriculum delivery and work design*, 495-510.

Oduma, C. A., Onyema, L. N. & Aikit, N. (2019). E-learning platforms in Business Education for skills acquisition. *Nigerian Journal of Business Education. 6*(2), 104 – 112.

Paytaren, A. (2020). CSS droid: An android-based computer system servicing training app with virtual computer hardware assembly. *International Research Journal on Innovations in Engineering, Science and Technology*, *6*, 14-19.

Peacock, S., Cowan, J., Irvine, L., & Williams, J. (2020). An exploration into the importance of a sense of belonging for online learners. *International Review of Research in Open and Distributed Learning, 21*(2), 18-35.

Reaves, J. (2019). 21st-century skills and the fourth industrial revolution: a critical future role for online education. *International Journal on Innovations in Online Education, 3*(1).

Reich, J. (2020). *Failure to disrupt: Why technology alone can't transform education*. Harvard University Press.

Riofrio, G., Encalada, E., Guamán, D., & Aguilar, J. (2015, October). Business intelligence applied to learning analytics in student-centered learning processes. *In 2015 Latin American Computing Conference (CLEI)* pp. 1-10. IEEE.

Robinson, L., Schulz, J., Ragnedda, M., Pait, H., Kwon, K. H., & Khilnani, A. (2021). An unequal pandemic: vulnerability and COVID-19. *American Behavioral Scientist, 65*(12), 1603-1607.

Samortin, M. B., Corcuera, L. C., Alvarez, A. V. Jr., & Palm H. R. (2022). Education and the pandemic: Examining students' remote learning experiences in the Philippines. *International Journal of Scholars in Education, 5*(1), 1-13.

Sato, S. N., Condes Moreno, E., Rubio-Zarapuz, A., Dalamitros, A. A., Yañez-Sepulveda, R., Tornero-Aguilera, J. F., & Clemente-Suárez, V. J. (2023). Navigating the New Normal: Adapting Online and Distance Learning in the Post-Pandemic Era. *Education Sciences, 14*(1), 19.

Sharma, E., & Prince, J. B. (2023). Does E-Governance Bring New Normal Sustainable Way for Emerging Economies Post Pandemic? A Review. In *New Normal in Digital Enterprises: Strategies for Sustainable Development* (pp. 107-133). Singapore: Springer Nature Singapore.

Simões, S., Oliveira, T., & Nunes, C. (2022). Influence of computers in students' academic achievement. *Heliyon, 8*(3).

Talimodao, A. J. S., & Madrigal, D. V. (2021). Printed modular distance learning in Philippine public elementary schools in time of COVID-19 pandemic: Quality, implementation, and challenges. *Philippine Social Science Journal, 4*(3), 19-29.

Wu, H. T., Hsu, P. C., Lee, C. Y., Wang, H. J., & Sun, C. K. (2014). The impact of supplementary hands-on practice on learning in introductory computer science course for freshmen. *Computers & Education, 70,* 1-8.

Zhou, L., Zhang, L., & Konz, N. (2022). Computer vision techniques in manufacturing. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, *53*(1), 105-117.