International Journal of Business Studies and Education (IJBSAE)
ISSN (Online):2735-0940
VOLUME:2
ISSUE: 1

Transition from Hands-On Learning To A Simulated Learning: An Investigation On Readiness, Challenges And Performance Among Polytechnic Students

Muhammad Fuaddil Bin Nor Ahad[1], Ahmad Fadli Bin Abd Hadi [2]
Mohd Ashadi Bin Mohd Yusop[3]
[1,3] Department of Electrical Engineering, Politeknik Kuching, Sarawak, Malaysia
E-mail: fuaddil@poliku.edu.my , ashadi@poliku.edu.my

[2] Department of Mathematics ,Science and Computer, Politeknik Melaka, Melaka, Malaysia
E-mail: fadli@polimelaka.edu.my

Abstract

The COVID-19 pandemic forced an abrupt shift in learning modalities, requiring students to transition from hands-on practical learning to simulation-based methods. This study investigates the readiness and challenges faced by diploma students at Politeknik Kuching Sarawak (PKS) in adapting to this change, focusing on electronic courses such as Measurement Devices and Electrical Technology. Using a quantitative research design, data were collected from 116 semester 2 and 3 students via a structured questionnaire. Statistical analyses, including t-tests, ANOVA and multiple regression were applied to assess differences based on gender and school learning streams and explore the relationships between readiness, challenges and academic performance. Key findings indicate that while gender does not significantly influence readiness or challenges, variations in school learning streams impact the challenges faced. Readiness was found to be a stronger predictor of academic performance than the challenges encountered. The study underscores the importance of preparatory measures to enhance readiness, such as tailored training programs, to ensure effective adaptation to simulation-based learning. Future research should explore additional factors, such as technology access and institutional support, to provide a comprehensive understanding of this transition.

Keywords **:** *Challenges; Computer Simulation; Hands On Experience; Readiness; Student Achievement*

I. INTRODUCTION

E-Learning is one way of learning methods, where students can learn individually at their preferred time, unlike the traditional classroom learning method. It is home-based and the courses designed can be altered to suit learners' needs and preferences [1].

For engineering course, to achieve an optimum student learning and to develop valuable skills for future employment, engineering courses often complement lectures and tutorials with laboratory classes [2]. A hands-on approach to learning means that the students must interact and involve with their environment to adapt and learn. This can be closely related to psychomotor domain which promotes deeper learning which is becoming increasingly popular as a means of assisting students in developing strong, transferrable knowledge and skills for the twenty-first century.

Politeknik Kuching Sarawak (PKS) students must be involve with cognitive domain (knowledge), psychomotor domain (skills) and affective domain (attitudes). This three domain is in Bloom's Taxonomy which act as guidance for PKS to maintain the accreditation from Engineering Technology Accreditation Council (ETAC).

The COVID-19 pandemic forced an abrupt shift in learning modalities which requires students to do hands-on activities such as practical and lab work in using a simulation software

II. LITERATURE REVIEW

Bloom's taxonomy is a set of three hierarchical models used to classify learning objectives according to levels of complexity and specificity. Cognitive, Affective and Psychomotor.

Psychomotor is used to measure practical and technical skills which includes physical movement, coordination and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. [3]

Practical in electronic are done using simulation software that can be shown in **Figure 1**

Received: 16 December 2024
Revised: 20 December 2024
Accepted: 31 December 2024
Publisher: ICBE Publication (NS0237611-W)

A, B and **C**. **Figure 1A** is the circuit that the students have to connect during the practical and **Figure 1B** and **1C** shows the comparison between simulated circuit and the real-world connection circuit. Software used is ThinkerCAD.

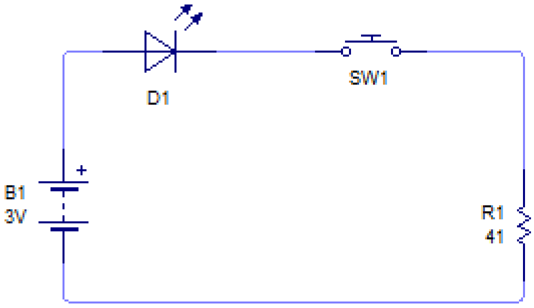

Figure 1A Circuit Schematic that is needed to be created

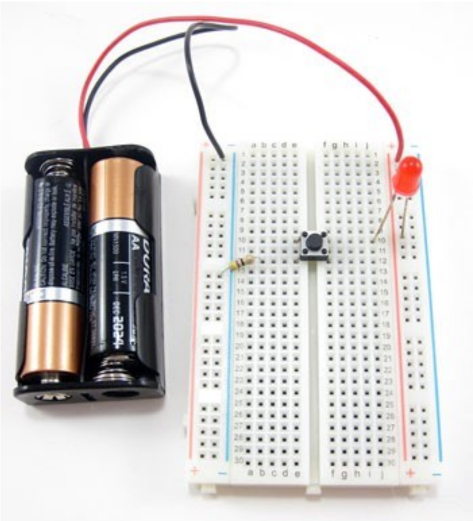

Figure 1B Real world connection

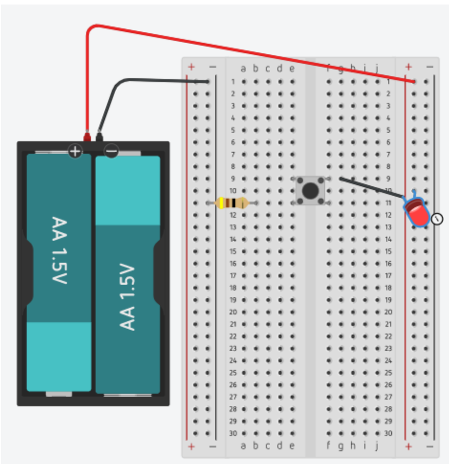

Figure 1C Simulated Circuit

This study will be focusing on the psychomotor domain in which psychomotor has five levels. The imitation level, which starts at the bottom and progresses to the top, is the lowest level, which began as an impulse and can develop through repeated acts. Choosing one action over another, following instructions, and acting correctly are all examples of manipulation. Precision relates to how quickly and precisely learners can control their activities in response to a particular goal. Learners who have mastered articulation may do a wide range of tasks, including multitasking. Naturalization is the last step of the process, in which learners demonstrate proficiency in their performance on any given job [3].

Simulation Learning and E-learning

Science and engineering educators believe that the hands-on experience of the science laboratory is a necessary supplement to the relatively passive experiences of reading textbooks and listening to lectures that comprise a large part of the student experience in universities. [4]

The use of simulation in formal education has been in existence for more than 200 years and the approach has been applied widely in medical, aviation and maritime courses.

Despite differences in understanding the construct and its applications, simulation has shown success in creating engaged and meaningful learning environments in various academic fields [5]. Hence the inquire of what simulation software is used and the effectiveness in collaborative learning is needed to facilitate and help both students and instructor.

III. RESEARCH METHODOLOGY

Research Design

This study aims to evaluate the readiness and challenges associated with the transition from practical to simulation-based learning, and to compare these factors with students' end-of-semester performance.

A quantitative research design is used to meet the stated objectives. The study participants consist of diploma students from Politeknik Kuching Sarawak (PKS), specifically those who experienced practical electronic courses during the COVID-19 pandemic, when face-to-face learning was replaced by online instruction. A non-random sampling

Received: 16 December 2024
Revised: 20 December 2024
Accepted: 31 December 2024
Publisher: ICBE Publication (NS0237611-W)

method was selected to ensure that all participants had experienced this unique learning environment.

The sample size for this research includes at least 100 students from semester two and three who have completed courses in Measurement Devices and Electrical Technology, both of which involve a significant transition from hands-on to simulation-based learning. The sample size was determined using G*Power software to confirm that it is sufficient for achieving adequate statistical power in the analysis.

Population and Sample

The population for this research comprises semester 2 and 3 students pursuing a diploma in Electrical Engineering at PKS. All participants have taken at least two courses that require transitioning from practical hands-on activities to simulation, ensuring the sample's relevance to the research objectives.

Instruments

The primary data collection tool is a questionnaire consisting of four sections:

1. Demographics: This section gathers background information about the participants, such as gender, course of study, and previous educational background.

2. Readiness for Simulation-Based Learning: This section measures students' readiness for the transition from hands-on to simulation learning.

3. Challenges in Simulation Learning: This section identifies constraints and challenges experienced by students during simulation-based learning.

4. Student Performance: This section collects data on students' end-of-semester results in electronic courses.

The questionnaire employs a Likert scale with detailed labels ranging from "Strongly Agree" to "Strongly Disagree" for greater accuracy in capturing participants' responses.

Data Collection Tool

The questionnaire was adapted from previous studies and refined through a pilot study to establish its reliability and validity [6][7]. Cronbach's alpha was calculated to confirm the internal consistency of the instrument. Once finalized, the questionnaire was converted into a Google Form for ease of distribution. The form was then distributed to a minimum of 116 participants in semesters 2 and 3 at PKS.

IV. RESULT AND DISCUSSION

Descriptive Statistics

Demographics and background information were summarized using descriptive statistics, providing insights into participants' characteristics and their distributions across different groups.

The hypothesis testing revealed the following:

1. Gender Differences (Ho1 and Ho2): The hypotheses concerning gender differences in readiness and challenges were accepted, suggesting that gender does not significantly influence students' preparedness, or the level of challenges faced during the transition to simulation-based learning.

2. School Learning Stream Impact (Ho3 and Ho4): Hypothesis 3 was accepted, indicating no significant differences in readiness based on school learning streams. However, Hypothesis 4 was rejected, demonstrating that students from different school learning streams experience varying levels of challenges when shifting to simulation-based learning. This result may be due to differences in prior knowledge or curriculum emphasis across school streams.

3. Relationship Between Readiness, Challenges, and Performance (Ho5 and Ho6): Readiness showed a stronger positive correlation with student performance in electronic courses than challenges, as indicated by the acceptance of Hypothesis 5 and the rejection of Hypothesis 6. This finding suggests that better preparation significantly contributes to improved academic outcomes.

4. Combined Effects on Student Performance (Ho7): Hypothesis 7 was rejected, indicating that readiness plays a more dominant role in influencing student performance compared to challenges. The multiple regression analysis revealed that while both factors contribute to student outcomes, readiness had a more substantial impact.

Implications for Educators: These findings suggest that increasing students' readiness for simulation-based learning could enhance their academic performance more effectively than simply

Received: 16 December 2024
Revised: 20 December 2024
Accepted: 31 December 2024
Publisher: ICBE Publication (NS0237611-W)

addressing the challenges faced. Educators could implement preparatory training sessions or orientation programs tailored to bridge knowledge gaps and better equip students for the transition.

Comparison with Previous Research: The results align with Watkins, Leigh, and Triner's (2008) study, which found that readiness significantly influences e-learning outcomes [6]. However, this study adds new insights by indicating that readiness is more crucial than challenges in simulation-based settings.

Sample Size and Generalizability: The study's limited sample size may affect the generalizability of the findings. Future research with larger and more diverse samples could yield more robust conclusions.

Self-Reported Data: The reliance on self-reported measures may introduce bias, affecting the accuracy of the findings. Using objective assessments or triangulating data sources could improve future studies.

Practical Recommendations

Training Programs: Introduce specific training for students and educators to improve readiness levels before transitioning to simulation-based learning.

Curriculum Adjustments: Customize programs to account for variations in school learning streams, potentially reducing the challenges experienced by students from different educational backgrounds.

V. CONCLUSION

This study investigated the readiness, challenges, and performance of polytechnic students transitioning from hands-on to simulated learning.

The findings indicate that prior knowledge and previous school streams significantly influence students' readiness and the level of challenges they face. The analysis revealed that readiness is a more dominant factor affecting students' academic performance compared to challenges. This suggests that students who are better prepared for the transition tend to perform better in their electronic courses.

The study also highlighted that the shift from practical to simulation-based learning presents varying levels of difficulty for students depending on their background. Consequently, to improve academic outcomes, it is essential to focus on enhancing students' readiness for simulated learning, possibly through targeted training and preparatory programs.

Future research could explore additional factors influencing readiness and challenges, such as access to technology and the effectiveness of support measures provided to students. Overall, the findings underscore the need for tailored approaches to support students in adapting to changes in learning modalities, ensuring a smoother transition from traditional hands-on methods to digital simulation tools. [9][10]

ACKNOWLEDGMENT

We would like to extend our heartfelt gratitude to all those who contributed to the success of this research. First and foremost, we thank the management of Politeknik Kuching Sarawak for their support and encouragement throughout this study. Their guidance and provision of resources enabled us to carry out this research effectively.

We express our sincere appreciation to the students who participated in the study, offering valuable insights through their responses. Without their cooperation, this research would not have been possible.

A special acknowledgment goes to Chung (2020) and Watkins (2008) for their foundational work, which provided a framework for our questionnaire.

Finally, we are deeply grateful to our colleagues, family, and friends for their unwavering support, encouragement, and patience during the research process. Thank you all for your contributions to this

REFERENCES

[1] W. M. Al-Rahmi et al., "Use of E-Learning by University Students in Malaysian Higher Educational Institutions: A Case in Universiti Teknologi Malaysia," IEEE Access, vol. 6, pp. 14268–14276, 2018, doi:

[2] F. Steger, A. Nitsche, A. Arbesmeier, K. D. Brade, H.-G. Schweiger, and I. Belski, "Teaching Battery Basics in Laboratories: Hands-On Versus Simulated Experiments," IEEE Transactions on Education, vol. 63, no. 3, pp. 198–208, Aug. 2020, doi: https://doi.org/10.1109/te.2020.2970554

[3] "Bloom Taxonomy," www.learningclassesonline.com. https://www.learningclassesonline.com/201

Received: 16 December 2024
Revised: 20 December 2024
Accepted: 31 December 2024
Publisher: ICBE Publication (NS0237611-W)

9/08/blooms-taxonomy.html

[4] J. E. Corter, J. V. Nickerson, S. K. Esche, C. Chassapis, S. Im, and J. Ma, "Constructing reality," ACM Transactions on Computer-Human Interaction, vol. 14, no. 2, p. 7, Aug. 2007, doi: https://doi.org/10.1145/1275511.1275513

[5] M. G. Jamil and S. O. Isiaq, "Teaching technology with technology: approaches to bridging learning and teaching gaps in simulation-based programming education," International Journal of Educational Technology in Higher Education, vol. 16, no. 1, Aug. 2019, doi: https://doi.org/10.1186/s41239-019-0159-9

[6] R. Watkins, D. Leigh, and D. Triner, "Assessing Readiness for E-Learning," Performance Improvement Quarterly, vol. 17, no. 4, pp. 66–79, Oct. 2008, doi: https://doi.org/10.1111/j.1937-8327.2004.tb00321.x

[7] E. Chung, G. Subramaniam, and L. Christ Dass, "Online Learning Readiness Among University Students in Malaysia Amidst Covid-19," Asian Journal of University Education, vol. 16, no. 2, p. 45, Aug. 2020, doi: https://doi.org/10.24191/ajue.v16i2.10294.

[8] "Volume 6 No. (S3) (March 2021) | International Journal of Humanities Technology and Civilization," Ump.edu.my, 2021. https://journal.ump.edu.my/ijhtc/issue/view/127

[9] J. K.-M. Sia and A. Abbas Adamu, "Facing the unknown: pandemic and higher education in Malaysia," Asian Education and Development Studies, vol. ahead-of-print, no. ahead-of-print, Dec. 2020, doi: https://doi.org/10.1108/aeds-05-2020-0114

[10] K. L. Chugh and B. Madhuravani, "On-Line Engineering Education with Emphasis on Application of Bloom's Taxonomy," Journal of Engineering Education Transformations, vol. 0, no. 0, Jan. 2016, doi: https://doi.org/10.16920/jeet/2016/v0i0/85709

Received: 16 December 2024
Revised: 20 December 2024
Accepted: 31 December 2024

Publisher: ICBE Publication (NS0237611-W)

AUTHOR'S INFORMATION

First Author: Name 	Muhammad Fuaddil Bin Nor Ahad Department of Electrical Engineering, Politeknik Kuching, Sarawak, Malaysia E-mail: fuaddil@poliku.edu.my
Second Author: Name 	Ahmad Fadli Bin Abd Hadi Department of Mathematics, Science and Computer, Politeknik Melaka, Melaka, Malaysia E-mail: fadli@polimelaka.edu.my
Third Author: Name 	Mohd Ashadi Bin Mohd Yusop Department of Electrical Engineering, Politeknik Kuching, Sarawak, Malaysia E-mail: ashadi@poliku.edu.my

Received: 16 December 2024
Revised: 20 December 2024
Accepted: 31 December 2024
Publisher: ICBE Publication (NS0237611-W)