Fostering Novice Programmer in Learning Basic Concept in C++ Programming Using Micro Credential Variable in C++

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Abstract: *E-learning has rapidly grown into a global phenomenon. Most educational institutions are currently utilizing it. There are many courses developed to support e-learning education through Massive Open Online Course (MOOC) and Micro-Credential (MC) in Universiti Teknologi MARA. Students from multiple disciplines such as engineering, information technology, and business computing are required to study basic C++ programming. The C++ programming language is the foundation of all software and current programming languages. C++ has evolved into an important language for the development of high-speed processing-power applications such as autonomous devices, the internet of things, and video games. Students are asked to construct a C++ programming code step by step using the textbook without knowing the relationship between concepts, for example variables and data types. As novice learners, they will face problems in learning C++ program within a short period. As a result, many students who are unable to grasp the most fundamental concept of programming are unable to write basic programs and are also unable to acquire and understand more complex concepts in the future. MC Variable in C++ (MCVC++) is one of the courses that is designed to help novice programmers to learn basic concepts in C++ programming. The learning*

outcomes for this course are that students will be able to understand the fundamental concepts of variables in C++ and learn how to declare, use, and apply variables effectively in programming. This paper explains the development process of the MCVC++ course and evaluates its effectiveness among students from UiTM.

Keywords: *action research model, C++ programming, Micro Credential, novice programmer*

1.0 INTRODUCTION

With the rise of online learning, many approaches are being applied to the process to make it easier and more flexible. Massive Open Online Course (MOOC) and Micro-Credential (MC) approaches are a present technological innovation of teaching and learning in the modern higher education environment. As is well known, there are many key advantages of online learning including flexibility and convenience, cost saving, self-paced learning and accessibility. MC is designed to provide learners with a rapid and efficient method of acquiring specialized skills or knowledge relevant to their careers or personal interests. A noteworthy feature of this change is the emergence of micro-credentials as a competitive substitute for conventional degree programs, providing a more adaptable and focused method of learning and identifying skills (Ahmat et al., 2021). Educational institutions, online learning platforms, and professional organizations frequently provide these credentials.

Identifying problems is essential to effectively enhance learning and teaching. Learning programming at university takes years and requires a significant commitment from students even to obtain the most basic certification. Students prefer a more adaptable and intimate learning environment. Considering these factors, Micro-credential (MC) is used to introduce a smaller set of programming courses based on the MARA University of Technology (UiTM) syllabus that can be completed in a short period of time. UiTM is one of eight Malaysian Higher Education Institutions that are stepping up efforts to create flexible and appealing study materials for candidates taking short-term courses. Various short-term

courses are offered through these micro-credential programs and can be used as credit in learning as long as they meet the Malaysian Qualifications Agency (MQA) criteria. The development of the Micro-credentials program is critical to UiTM because it is self-directed and will be effective in future.

2.0 PROBLEM STATEMENT

Programming is relevant to many technological disciplines, and many university students are learning its fundamentals. Unfortunately, individuals, especially novice programmers, frequently encounter difficulties even in basic courses. This effort aims to alleviate the challenges associated with learning programming in order to aid in the development of learning materials for basic programming courses.

3.0 OBJECTIVE

1. **Development of the MC Variable in C++ (MCVC++) Materials:** Discuss the development process and the types of materials used in the MCVC++ course.
2. **Study the effectiveness of MCVC++:** Analyse the student performance on their assessment to determine the effectiveness of MCVC++.

4.0 LITERATURE REVIEW

4.1 C++ PROGRAMMING

C++ is a popular and enduring general-purpose programming language used to create programs across a wide range of application domains. Despite the fact that it was introduced a long time ago, C++ is now the fourth most popular programming language (Cass, 2021). Compared to more advanced and practical programming languages such as Java, Python, and Ruby, C++ can serve as a good starting point for learning programming from the ground up. Nonetheless, due to the nature of formal language, many students continue to struggle with C++ (Aung et al., 2022).

Learning computer programming is a difficult task for a novice (Prasad et al., 2021). Data from around the world show that an increasing number of students do not want to pursue a major in computer programming in higher education (Papadakis, 2020). One reason why novice fail to learn programming is that they struggle with relational reasoning (Corney et al. 2011) due to some variable misconceptions (Kohn,2017). As a result, they are often unable to accurately understand the fundamentals of programming (Prasad et al. 2021) or to combine the various statements and structures of the programming language into a valid program (Sana'a et al., 2020). It has long been studied how to identify the difficulties that novice programmers face. Lister et al. (2004) discovered in their findings from a multi-national study that after studying their first programming course, students frequently fail to trace the execution of even short pieces of code.

4.2 MICRO CREDENTIAL

A Micro-credential is a learning certification for a smaller set of courses or modules designed to provide learners with knowledge, skills, values, and competencies in a specific micro field of study (Selvaratnam & Sankey, 2020). At the most basic level, Micro-credentials validate specific skills or competencies gained through a course. They can be digital or physical. They differ from traditional degrees and certificates in that they are typically awarded for accomplishments achieved in shorter or more flexible time periods. Unlike conventional transcripts, which are controlled by institutions, students will have control over their micro-credentials and will be able to distribute them digitally (Matkin et al., 2020).

5.0 METHODOLOGY

In this study, we applied an action research model. Action research is a research method that tries to examine and address a problem at the same time. This model was created by Kurt Lewin, an MIT professor in 1944. Figure 1 shows the diagram of the action research model. In this model, there are four (4) main steps known as planning, action, analysis and conclusions.

Figure 1: *Action Research Model*

Based on the model, the planning stage design is applied, whereby we define the content requirements, the content presentation, the number of assessments, and style. In the action stage, we begin implementation based on the planning. Once the content is ready, we upload it to the online platform known as UFuture, provided by the Institute of Continuing Education and Professional Studies (iCEPS), UiTM. UFuture is an online learning platform built to serve students and instructors. Once the material and contents are ready, evaluations are conducted by individuals assigned by iCEPS to ensure the MC Variable in C++ (MCVC++) course meets iCEPS UiTM's requirements. Once the MCVC++ achieves the required marks, the course will be published and made accessible to students.

The video content material for MCVC++ are develop using variety of software like Canva, MS Power Point, Filmora and ClipChamp. Kapwing is one of the software that is used to edit the video content. The content materials also come in various forms like infographic, cartoon conversation, code writing, and simple example explanation. Figure 2 below shows the various types of content material used in MC Variable in C++.

Figure 2: *Variety of video notes content for MCVC++*

MCVC++ has designed various styles of assessment to make sure the student is able to interpret and explain what they have learned. The questions are designed in the form of objective questions, structured questions and writing a complete program. Figure 3 shows the layout of the various types of assessments applied in MCVC++.

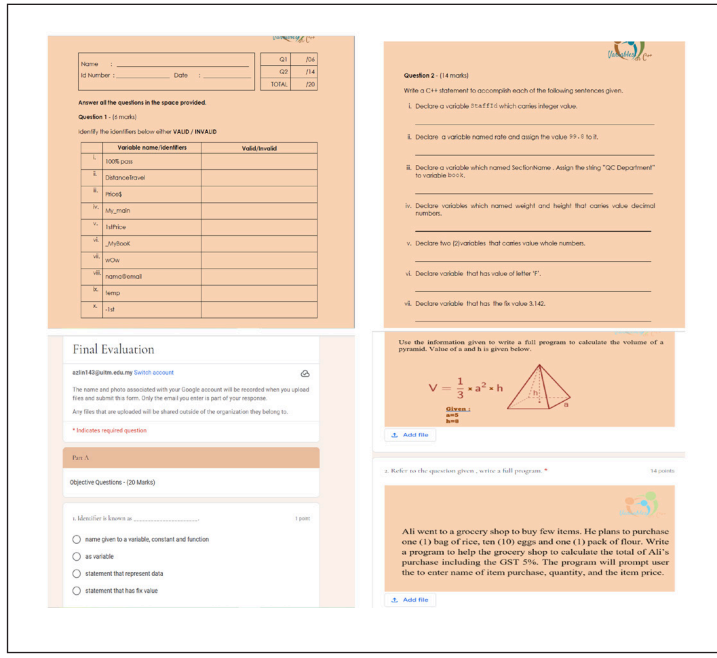
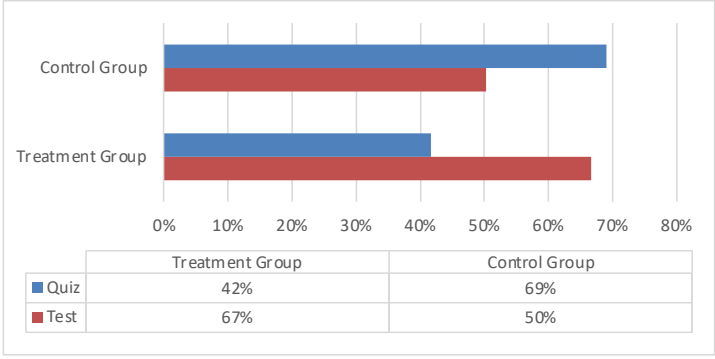


Figure 3: *Layout of various type assessment in MCVC++*

6.0 RESULT AND DISCUSSION

In this study, we perform the analysis on two distinct groups. The data is derived from these two groups: the treatment group consisting of 36 students enrolled in Fundamentals of Computer Problem Solving (CSC128) supplemented with MCVC and the control group comprising 97 students studying CSC128 without this additional component. The subsequent section involves a comparative evaluation of their respective academic performances, focusing on coursework outcomes, including quiz and test.

Figure 4 illustrates the comparative analysis of performance between the treatment and control groups, measured through two evaluation metrics: quiz and test. At the start of the semester, the quiz outcomes exhibited a distinct trend. The treatment group's average percentage was lower, specifically at 42%, while the control group demonstrated a comparatively higher performance with an average of 69%. However, a notable shift transpired during the mid-semester test evaluation. The treatment group displayed substantial improvement, achieving an impressive average of 67%, surpassing the control group's average performance of 50%. This transition underscores the treatment group's improved proficiency in test evaluations. These findings suggest a favourable impact resulting from the integration of MCVC++, contributing positively to students' academic accomplishments and overall educational experience.



	Treatment Group	Control Group
Quiz	42%	69%
Test	67%	50%

Figure 4: *Average Scores of Quiz and Test for the Treatment and Control Groups*

7.0 CONCLUSION

MCVC++ is an MC course that has been developed to help students understand the basic concept of C++ programming. This course is designed to help students understand and master C++ programming skills. The content of this course is presented in a way that allows students to easily understand and practice in everyday life. This study shows that students' performance has improved in their assessment since they joined the MCVC++.

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10.0 AUTHORS’ CONTRIBUTION

All authors offered valuable contributions to shaping the research, analysis, and manuscript.

11.0 CONFLICT OF INTEREST DECLARATION

I/We certify that the article is the Authors’ and Co-Authors’ original work. The article has not received prior publication and is not under consideration for publication elsewhere. This research/manuscript has not been submitted for publication nor has it been published in whole or in part elsewhere. We testify to the fact that all Authors have contributed significantly to the work, validity and legitimacy of the data and its interpretation for submission to IJELHE.

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