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Qualitative Analysis of Challenge- Based Learning on Programming Course

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Abstract

In this study, Challenge-Based learning (CBL) is implemented in Visual programming course as a mean to improve students' programming skills. CBL provides authentic learning experience in collaborative group learning to enhance students' deeper conceptual learning. The researchers created Oh My Code Programing Competition (OMC) to employ the CBL in the Visual Programming Course. OMC is a CBL technology apps invention project which emphasises the innovation of the creation of an information system by instilling a business perspective in it. There are 3 main phases of CBL in OMC which consist of: 1) Challenge instructions by lecturer, 2) Preparations towards challenge 3) Delivery of complete challenge. A total of 50 students were involved in this study. The students' reflection was gathered through an open-ended online survey. The analysis was done using Co-occurrences Analysis. In summary, the OMC in Visual programming course demonstrates that the foundation in technology can make the students successfully take on the challenge to develop a system prototype with both technical and societal component. Through this CBL, students indirectly developed various professional skills such as teamwork communication and problem solving.

Introduction

Methods of learning are vital aspects to facilitate students in the learning process. Some people feel that studying in a group is more beneficial than individual learning while others probably have a different opinion. Challenge- Based Learning (CBL) is a mechanism for enhancing learning and organisational actions through meaningful learning experiences, enabling learners to use the technologies they use in their daily lives. CBL integrates independent learning and collaborative group learning in enhancing students' deeper conceptual learning. Educational research has shown that active learning focused on students can deliver a far deeper conceptual learning than conventional lectures [1]. With the assistance of a group-based learning environment, such as problem-based learning (PBL)[2], project-based learning (PBL)[3], or challenge-based learning (CBL), different technical functioning skills can be built by students such as problem-solving, written and oral communication, independent learning, teamwork and many more.

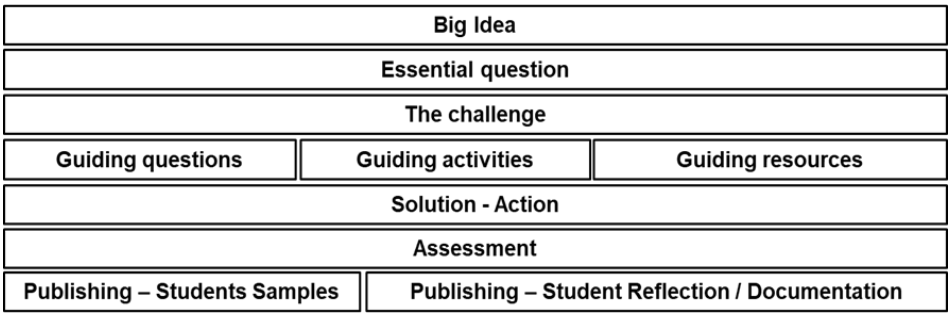
Problem Statement

The Visual Programming (VP) course introduces the fundamental concepts related to the principles of programming language, the programming structure and programming concept using object-oriented driven. As Programming Language course is considered as something new to young adult learners that have just left secondary school, the researchers adopted the Challenge-Based Learning. It is expected that students will not only be motivated to study and learn new knowledge outside the class, they will also be motivated to engage appropriately in group work as they are in a team. The focus of this study to investigate the experiences of students after they undergo challenge-based learning strategies in learning the programming course.

Literature Review

In CBL, there exists primary objectives shift from knowing concepts to using concepts. In regard to the educator, there is a need of a shift for them from an expert to a moderator [1]. The teacher will need to design and manage the overall instructional process instead of just dispensing information and concepts. As for students, they will need to shift from passive learners with limited responsibility for their learning to active learners with more significant responsibility for their learning. Fig 1 shows the activities in Challenge-Based Learning Framework [5].

Fig 1: Challenge-Based Learning Framework



Challenge Based Learning in Visual Programming course

The researches created Oh My Code Programing Competition (OMC) to employ the CBL in the Visual Programming Course. OMC is a CBL technology apps invention project which emphasises the innovation of the creation of an information system by instilling a business perspective in it. In this project, there are 3 main phases (Fig. 2): Finally, Students were required to answer an online survey to reflect their experience throughout the learning process

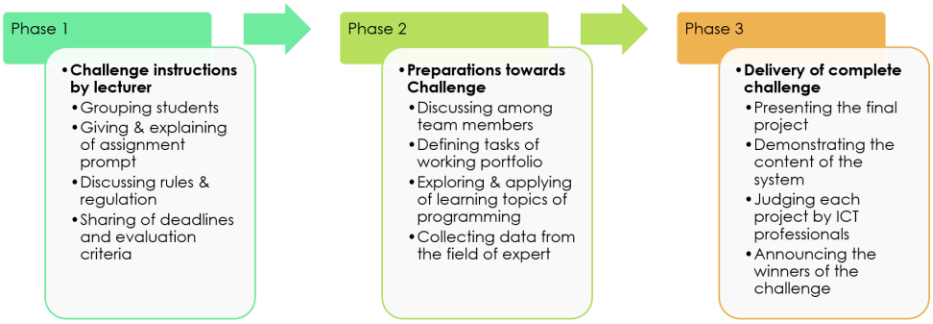


Fig.2: Details of Activities

Result and Discussion

A total of 50 students that were grouped into 12 teams were involved in this study. A qualitative data collection method using an open-ended online survey was used to collect the students' reflection. The analysis of the result is as follows:

a. *Students' experience during CBL*

The wordle in Fig 3 was generated based on students' answers when they were asked to describe their learning experience on programming after underwent Oh My code Programming competition.

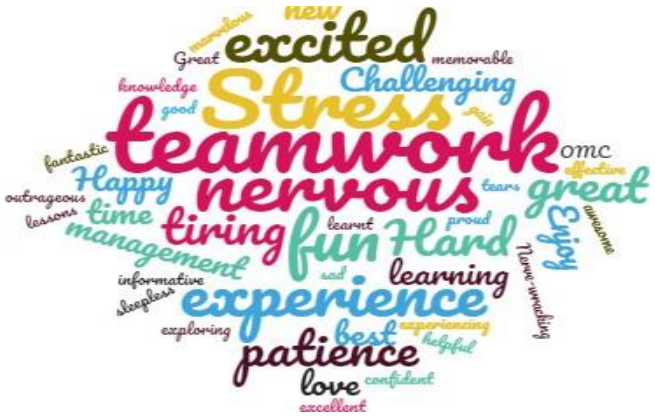


Fig 3: Most commonly used word in describing students' experience when learning programming using challenge-based learning

Based on the wordle, the most frequently mentioned words are teamwork, nervousness, experience, patience and stress.

b. Effectiveness of CBL in understanding programming

Students were also asked about the effectiveness of OMC in assisting them to understand programming. Most of the students agreed that their understanding of programming knowledge increased after underwent Oh My code programming competition which is a learning strategy using challenge-based learning. In order to develop a good business system, the prototype required them to explore more knowledge on the net. Co-occurrences Analysis was used to cluster the students' answers as in table 1.

Table 1
Emergent themes derived from students' reflection on the effectiveness of CBL on programming

Emergent Theme	Exemplar quotes
Improve understanding of programming	"*During class, we get to learn basic knowledge about VB or generally VS but by doing OMC, i got to discover more than what we have been taught. I love programming so OMC really gave me an experience in coding and designing* "
System development	"*OMC has influenced my understanding on programming by make use of database to built an good and efficient software*"
Knowledge exploration	"it makes me widen my knowledge on programming by doing research on youtube and other sources"

c. Challenges that you came across while doing OMC project. Co-occurrences Analysis was used to cluster the answers.

Students described their challenges towards the success of the group work particularly in developing functions for the main program. Here, students emphasised the importance of teamwork, brainstorming and even finding the best ways to develop the program. They wrote reflections of positive changes they encountered while completing the group tasks. These

adaptive characteristics were stimulated by the difficulty of solving the problem using programming and this process as linked directly to improve their communication as well as technical skills. For example, most students talked about increased motivation, knowledge, creativity and commitment in the findings. Co-occurrences Analysis used to cluster the students' answers as in table 2.

Table 2
Emergent themes derived from students' reflection on the effectiveness of CBL on programming

Emergent Theme	**Exemplar quotes**
Teamwork	*"Personally, i think one of the major challenges that i came across while doing OMC is teamwork. Since this year's OMC is held virtually, some people may neglect their work and not do as their tasked to do since we cant see each other physically."*
Communication	*"group members are far apart and hard to make discussion"*
Technical problem	*"sharing the vb project among teammates. When loading the project there always a problem even until deadlines."*

d. Skills generated throughout the process of developing and presenting the OMC project

Fig.2: Most commonly used words in describing generated skills after undergoing Challenge-based Learning

Based on the wordle, the most frequent words describing the skills they have gained and developed after learning programming through challenge-based learning are coding, presentation, problem-solving and management. From the students' reflections, it is shown that the students agreed that by adopting a challenge-based learning strategy in a programming course, it had successfully made them having a better understanding of the programming language, enrich students experience in the system development environment, develop better presentation skills, increase teamwork spirit as well as enhance their practical skills.

Conclusion

In a programming course, there are few skills required to prepare students for their future careers. Challenge-based learning strategy has allowed students to understand and tackle problem solving, knowledge exploration, teamwork and presentation skills. Through these processes, students will understand the programming knowledge that they have learned in the class. However, there are some

aspect that should be improved. A proper guideline in conducting this strategy is needed to ensure the smoothness of the process.

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