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THE EFFECTIVENESS OF USING ROLE PLAY IN CONDUCTING PROGRAMMING CLASSES

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ABSTRACT

It is always a challenge to a lecturer to obtain undivided attention from a programming lab class. Conventional lecture and lab sessions are not effective enough in the delivery of programming knowledge. Role play allows students actively involved in the class activities. Via the role assigned; the student is having a better understanding of the knowledge delivered to them. This paper performs a study on the application of role play in teaching parameter-passing of C programming language. Based on the observation during and after the class, it shows that role play do have a significant effect in conducting programming classes.

Keywords: Role play, Programming, Classes, Effectiveness.

1. INTRODUCTION

Teaching – is not solely a process of delivering knowledge but to ensure the students understood and able to apply the knowledge. In order to receive a sound result in conducting a class, the delivery methods used is an essential factor.

Conventionally, a programming subject class activities are conducted in lecture and practical lab sessions. Students study about the programming concepts and theories during the lecture sessions, while during the practical lab sessions, students are practicing the concepts and theories learned. This pattern of distributing the subject's activities into lecture and practical lab sessions are commonly practice in most of the Malaysian institutions. Theoretically, this pattern of distributing the class activities is suitable for the programing subject, but as aforementioned, the method of delivery is an essential factor. Normally, during the lecture sessions, the lecturer is the only active party who initiate most of the class activities, while the students are the passive party who are trying their very best to absorb the information delivered by the lecturer. While in the practical lab session, they are required to key in and execute the sample programs given. When a program is run successfully, the students will assumed that they had learned the programming skills and concepts. On account of this, whenever they are asked to solve programming exercises, majority of them

have totally no idea of how to solve it. A apart from this, for those students who failed to execute the sample programs, they are already tired with the identification and correction of programming errors, not to mention solving the given programming exercises. Due to conventional class room culture and delivery method used, students are constantly left in a situation of "Swim or Sink" in the programming classes (Nguyen & Sajous, 1998). Regardless of those who are able to "swim" or unfortunately "sink", the amount of problems and challenges that the students went through in learning how to program had marked the programming subject with "Programming is difficult".

Due to the conventional class room culture and practices, programming classes often ends up with monotonous presentation sessions. Role play is a suitable delivery approach that changes the class room learning atmosphere. As compare to the conventional class conduct, with the students' involvement in the role play activities, it enhance the students' understanding and retention of the information.

The second part of this paper shares the reasons of teaching and learning of C programming language then it is followed by the discussion of the motivation of conducting the experiment, the application of role play in conducting C programming language classes, the descriptions of the experiment and the observation from the experiment. The conclusion part concludes the discussions of the application of role play in conducting programming classes.

2. REASONS OF TEACHING AND LEARNING OF C PROGRAMMING LANGUAGE

C programming language is a popular programming language (Cheng, 2011), as reported by (TIOBE Programming Community Index, 2013), it is the top five programming language used for the past twenty five years (See Table-3). It's well structure programming characteristic allows it to become the elementary programming subject taught in most of the institutions to provide basic structured programming skill to the Information Technology (IT) program students.

C programming language is also the gatekeeper for IT programs. Besides of preparing IT students with the structured programming skill, it also helps to develop students' logical mindset for other computing subjects. Other than IT programs, C programming language is also an essential subject for programs from other disciplines, such as Mechanical Engineering and Electrical Engineering programs. With the experience in C, students are more prepared for the advance study in colleges and universities (Cheng, 2011). Table-1 below list the ten reasons of teaching and learning C programming.

Table- 1. Ten Reasons to Teach and Learn Computer Programming in C (Cheng, 2011)

- C is one of the foundations for modern information technology (IT) and computer science (CS).
- C is the most commonly used programming language in industry.
- C is the language of choice for programming embedded and mechatronic systems with hardware interfaces.
- C is one of the most commonly used programming languages in colleges and universities.
- C is the base for almost all popular programming languages.
- C excels as a model of programming languages.
- Once students have learned C, they can pick up any other languages by themselves.
- C is a standardized programming language with international standards.
- Computer programming is becoming a necessary skill for many professions.
- Computer programming can develop student's critical thinking capabilities.

The language's popularity is another reason for teaching and learning C programming language. As reported by TIOBE Programming Community Index, C programming language is the top ten programming language used in the IT industries. According to the Index, C programming language and its extensions languages such as C++ and C# are the top five programming languages used for the past twenty five years (see Table-2). Apart from this, C language is also the base language for other popular programming languages used in the industry, such as PHP and JAVA. With the programming skills and concepts learned from C language programming, it allows students to have a better adaption to other programming languages. Table-2 below list the top ten programming language abstracted from March 2013 TIOBE Programming Community Index and Table-3 list the TIOBE top ten programming languages for the past twenty five years.

Table-2. Top ten programming language list from TIOBE Programming Community Index March 2013(TIOBE Programming Community Index, 2013)

Position in March 2013	Position in March 2012	Programming Language
1	1	JAVA
2	2	C
3	5	Objective-C
4	4	C++
5	3	C#
6	6	PHP
7	7	(Visual)Basic
8	9	Python
9	13	Rube
10	10	Perl

Table-3. TIOBE top ten programming languages for the past 5, 15 and 25 years.(TIOBE Programming Community Index, 2013)

Programming Language	Position Mar 2013	Position Mar 2008	Position Mar 1998	Position Mar 1988
Java	1	1	3	-
C	2	2	1	1
Objective-C	3	45	-	-
C++	4	5	2	6
C#	5	8	-	-
PHP	6	4	-	-
(Visual) Basic	7	3	4	7
Python	8	7	16	-
Ruby	9	11	-	-
Perl	10	6	6	20
Lisp	13	20	11	2
Ada	22	19	10	3

2.1. Parameter Passing in C language

Modular programming is a methods of design a program that refining a complicated problem into smaller and single functioned module (subroutine). The advantages of modular programming are: ease of error debugging, improving traceability, reusability of code and code independent. In order to allow the interaction between these refined modules, parameter passing is a method of calling the module with the passing of data between these modules.

There are two types of parameter passing methods - Passing by reference and Passing by value. Normally, students are having difficulties to differentiate and apply these two methods of parameter passing. Majority of them solely memorize the characteristics of these two methods for the preparation of written examination and they will never apply it in their programs.

3. MOTIVATION

The unhealthy classroom culture and practices affecting the delivery of programming classes. The “spoon feeding” culture is an important factor. This culture had prevented students from trying to solve the problem by themselves (He & He, 2009). When the students are given a programming problem, they are rather waiting for the solution instead of trying to solve the problem. This is because they knew that their lecturer will definitely give them the answer.

(Yuanmei & Feng, 2009) commented that “As beginners, student usually have a misunderstanding that the program design is to remember the basic grammar norm, so they can understand the procedure but they do not know how to design a program by themselves”. This is commonly happen in the elementary programming classes. Students are memorizing the C programming language definitions and syntaxes without understanding and knowing how to apply it in solving the programming problem.

Conventional class delivery methods is another factor. This method may be suitable for students who are independent and have the initiative to spent time to practice the programming skill covered

in class. For those students who are weak or a bit slow, they are the group of students who are constantly left behind by their lecturer. Sometimes, due to embarrassment, these students rather keep quiet than to raise their problem.

The problem of compilation of sample programs is another factor. To the students, programming is "fighting the compiler" (Budny, Lund, Vipperman, & Patzer, 2002). When compiling a program, the compiler will list out the errors identified. In order to execute the program successfully, the student is required to clear all the listed errors. Without proper experience and knowledge in solving the errors, sometime it will take the student hours to solve a simple error and before the students are able to execute the program, their lecturer had started to explain another sample program. This situation is always happen in programming lab sessions. Again, due to self-esteem, the students might pretend that they understood the lesson.

Beside of the factors mentioned above, students are easily diverted by the surrounding environments in the computer lab. Video clip, websites, games and social networks can easily draw students' attention away from the class. It is a great challenge to the lecturer to capture the students' attention, especially during the programming lab classes

The above mentioned factors are the driving forces that motivates the authors to perform the study on the effectiveness of the application of Role Play in conducting the programming classes.

4. THE APPLICATION OF ROLE PLAY APPROACH IN C PROGRAMMING CLASS

Conventionally, in a programming subject lecture session, lecturer discuss about the programming concepts and theories, the common tools used are whiteboard and projector. While in the practical lab session, the students tries out the sample programs and exercises given. Very often, these will ends up with monotonous lecture and lab sessions, then the students are serving social networks while waiting for their lecturer to give them the lab exercise answer.

(Poorman, 2002) commented in his book that "Role-playing integrates experiential learning activities in the class increases interest in the subject matter and understanding of course content". The authors believes that role play can be used as the supporting tool to the conventional delivery method where it encourages class interactions and discussions (Clua, Feldgen 2001). Through role play, lecturer is able to deliver the programming concepts and enhance the student understanding of the concepts by working within and reflect upon a representation of a real environment (Sutcliffe, 2002). Table-4 below list some other reasons that promote the authors to apply role-play approach in their programming classes.

Table- 4. The educational advantages from using role play in teaching (Sutcliffe, 2002)

- It encourages individuals, while in role, to reflect upon their knowledge of a subject. As such, role-play is an excellent teaching method for reviewing material at the end of a course of study.
- Individuals are required to use appropriate concepts and arguments as defined by their role. As roles change, so might relevant concepts and arguments. Students may come, as a consequence, to appreciate more fully the relevance of diverse opinion, and where and how it is formed.
- Participation helps embed concepts. The importance of creating an active learning environment is well recognized if the objective is one of deep, rather than surface learning. Role-playing can make a valuable contribution in this process.
- It gives life and immediacy to academic material that can be largely descriptive and/or theoretical.
- It can encourage students to empathize with the position and feelings of others - something that, in the normal process of teaching, is likely to be missed.

4. THE EXPERIMENT

This experiment was carried out with two classes (class A and Class B) and during the week of this experiment, the topic need to be cover was parameter passing methods. In this experiment, the authors use role play as the supplementary approach to the conventional class delivery for Class A. For Class B, only the conventional delivery approach is used.

In class A, students were divided into four groups of around five students in each group, and then each of these groups was assigned a role of mathematical function - calculate the area of a circle, finding the area of a triangle, calculate the volume of a cylinder and finding the hypotenuse of a triangle respectively. While the author (lecturer) plays the role of the main function that activate or call the groups.

After each group was assigned with the role, they have to simulate themselves as the program subroutine that performs the calculation. Then each group was required to identify and present their inputs, processes and outputs to the other subroutines (groups). As the starting point of this role play activity, the main function (author) initiated the calling process, where one of the subroutine was called, the inputs declared earlier were provided to the subroutine. For example, the group that play the role of the subroutine that calculates the area of a triangle, the input data were base and height, while the output was the area of the triangle. In this case, when this function was called, the caller has to supply the required inputs to the subroutine and expecting the subroutine to provide the area of the triangle as the output. If the subroutine did not received the input as declared earlier, the subroutine can reject or not to answer the caller until the correct inputs are provided, then only the proper operations were carried out and the output was returned to the caller.

When the calling process completed, the author relates the outcomes of the role play activity to the C programming coding, for example, the identification of the inputs and outputs are related to the function prototype declaration, the data provided by the caller as the input to the subroutines and output returns from the subroutines are known as parameters. While the process of calling and providing the inputs to and receiving of outputs from the subroutines is known as parameter passing. The author also guide the students to observe the subroutine calling process, where the

caller is not required to know the actual calculation process carried out by subroutine, and it is related to one of the advantages of subroutine – independent coding.

The second role play session was carried out for the explanation of parameter passing methods. During this session, a student was selected to play the role of a subroutine that performs the calculation of the area of a triangle. All his classmates became the observer in this session. This student was briefed that the class will not interested with how he carry out the calculation, and he was also not allow to write any of the data using his own paper. The activity started with the declaration of the inputs and outputs data, in this case, the inputs were base and height, and the output was the area of the triangle. The author still plays the role of the main function that calls this student (subroutine) to perform the calculation.

In this session, three pieces of papers labeled with base, height and area were used to represent the inputs and output data (Number of papers used is depends on the number of input and output identified). Before calling the subroutine, the author wrote the input data on the base and height papers. For example, number 10 on the base paper and 20 on the height paper, meanwhile, on the area paper, the author wrote 0 on it, and this represent the initial value of the area. When calling the subroutine, these three pieces of papers are passed to the student and the student was required to perform the calculation and the answer was 100. The student cancelled the 0 written on the area paper and wrote the answer of the calculation next to it. Then these three pieces of papers were returned to the author and end the session.

After the completion of the second session, the author shows the three pieces of papers to the students, and gets them to observe the changes made on the three pieces of papers. There are no changes on the base and height papers, but the number on the area paper had changed from 0 to 100. The author then explains to the student that, passing by value method made no changes to the original data and it was reflected on the base and height papers and told the students that this method of parameter passing is only used when the caller is not expecting a return value from the subroutine. For the passing by reference method, it process was reflected on the paper that records the area of the triangle.

After the completion of the role play session, the author then only start the lecture session for parameter passing methods and discuss the sample programs using the conventional teaching approach. When the author explain the parameter passing methods and sample programs, the author always relate the explanations to the outcomes of the role play activities conducted.

5. OBSERVATION

During the experiment with these two classes, the author observed that it is easier to teach parameter passing after the role play activity. The students in class A are having a better understanding of the concept of parameter passing methods and they are also able to understand the sample programs better.

For Class B, the author have to spend extra time and efforts to explain the concept of parameter passing to the students and yet, there are many students still unable to see the changes of parameter values before and after the parameter passing.

In order to test the effectiveness of the role play approach, the author gave a class quiz to both classes, it is observed that students from class A are more confidence in solving the given problem. Even though some of them were stuck with the problem, but when the author relate the problem to the role play activity, then the students are able to carry on with the quiz on their own with minimum guidance. For class B, the students were having a tuff time in solving the quiz; the author needs to keep on reminding the students about the parameter passing concept. At the end, most students are able to solve the quiz questions, but the amount of time and efforts spent are more than class A.

It is also observed that the class room environment is different between these two classes. For class A, due to role play activity at the beginning of the class, the class atmosphere had become enthusiastic, the students are participative and it is observed that none of the student is serving net during the role play session. Even during the explanations of the programming concept, many students raised their questions on parameter passing and surprisingly, most of these questions are answered by their classmate with the author relating the questions back to the role play activity.

As for class B, the students are unable to concentrate in the class and the class atmosphere was monotonous. Finally, the author have to do another revision session on parameter passing using role play approach, then only the situation in the class improved.

6. CONCLUSION

As lecturers, the authors always wish to obtain students' undivided attention to their lecture; however the surrounding environment factors post challenges to them. Through the experiment's outcomes, it shows that role play is a useful tool that helps to enhance the teaching and learning experience.

Firstly, the effectiveness of role play approach was observed during the experiment. The authors observed that the role play approach is able to enhance the class room environment by allowing the students to not only participate in the class discussion but also provide the students a room to experience and learn the subject matter in another perspective. This is different from the conventional teaching approach, where the students are always as the third party position – they are being "informed" about the knowledge. However in the role play approach, the students had become the first party by simulate themselves as the role given. From the perspective of the role, the students learn the knowledge through the play, and they had become the "informer" in this case.

Secondly, role play encourages the student to study more about the topic. As the students playing the role, they are studying the topics from the perspective of the role. They might found something that is hidden from the other parties' perspectives. Due to the ownership – "I am the role played", it will challenge the student to find out more about the role and this encourages the students to do in-depth study on the topic.

Thirdly, different from the conventional teaching approach, role play also helps to enhance the classroom atmosphere by closing the gap between students and lecturer. During the role play experiment, it is observed that, the students are more open in answering questions and constantly, the questions are discussed among the students.

Besides of the positive outcomes discussed, there are drawbacks from this experiment. The

influence factors such as students' quality, previous experience and education background are not considered during the experiment. The two targeted classes of this experiment consist of students from different backgrounds. The uneven distribution of students in these classes might influence the accuracy of the outcomes. The time factor is also having influences on this experiment; this is because the experiment for class A was carried out in the morning session, where the students are still fresh. While the experiment on class B was done in the afternoon session, where the students had went through a long day of classes, they might be tired during the experiment session. Apart from this, the way the role play activity was carry out also have a significant impact on the outcomes. The briefing to the students and the coordination of the flow of role play activity will determine the successfulness of the experiment. All these coordination jobs need to be carrying out carefully, otherwise, instead of a supporting approach; the role play will become a burden to the class and the lecturer.

Lastly, this simple experiment on two classes may not reflect the overall population's perceptions of the effectiveness of using role play approach in programming classes. However, excluding those drawbacks discussed, this experiment does provide a glimpse that role play can be used as the supplement tools to the conventional teaching approach in conducting C programming class.

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