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Effectiveness of Using Interactive Learning Platforms in Teaching Programming to Non-Specialists Students in Computer Science

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فاعلية استخدام منصات التعلم التفاعلية في تدريس البرمجة للطلبة غير المتخصصين في علوم الحاسوب

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Abstract:

Programming is one of the most important aspects of a computing course. Despite the significance of the programming as among core courses in studying computer science, its curriculum hours have been reduced over time in many faculties. Moreover, some new programming languages need a lot of time to learn and practice, and students do not find time through time of classes, which compromised the students' ability to learn and understand. Many studies have shown evidence of progressive interest of computer science students in using Interactive Learning Platform (ILP) in learning programming subjects for non-specialist students, however there is still controversy about the positive impact of ILP on student performance and learning. The aim of this study was to investigate the impact and effectiveness of incorporating using ILP to the programming lectures on the performance of the mathematics department students in faculty of arts and science Alabyar, university of Benghazi. The results of this study revealed that students who were given lecture combined with ILP have shown enhancement in performance compared to others who were given ordinary lecture.

Keywords: Computing Course, Interactive Learning Platform (ILP), Programming courses, Programming languages teaching, Programming learning to non-specialist.

الملخص

البرمجة هي واحدة من أهم جوانب دورة الحوسبة. على الرغم من أهمية البرمجة باعتبارها من المقررات الأساسية في دراسة علوم الكمبيوتر، فقد تم تقليل ساعات مناهجها مع مرور الوقت في العديد من الكليات. علاوة على ذلك، تحتاج بعض لغات البرمجة الجديدة إلى الكثير من الوقت للتعلم والممارسة، ولا يجد الطلاب وقتاً خلال فترة الدراسة، مما يؤثر على قدرة الطلاب على التعلم والفهم. أظهرت العديد من الدراسات دليلاً على الاهتمام المتزايد للطلاب لمنصات التعلم التفاعلي (ILP) في تعلم موضوعات البرمجة خصوصاً لغير المتخصصين في مجال الحاسوب من التخصصات الأخرى، ومع ذلك لا يزال هناك جدل حول التأثير الإيجابي لمنصة التعلم التفاعلي (ILP) على أداء الطلاب وتعلمهم. هدفت هذه الدراسة إلى معرفة أثر وفعالية دمج استخدام ILP في محاضرات البرمجة على أداء طلاب قسم الرياضيات بكلية الآداب والعلوم الأبيار جامعة

بنغازي. كشفت نتائج هذه الدراسة أن الطلاب الذين تلقوا محاضرات مع ILP أظهروا تحسنا في الأداء مقارنة بالآخرين الذين تلقوا محاضرات عادية.

الكلمات المفتاحية: دورة الحوسبة، منصة التعلم التفاعلية (ILP)، مقررات البرمجة، تدريس لغات البرمجة، تعلم البرمجة لغير المتخصصين.

Introduction:

Programming courses are among the main requirements of study plans in higher education not only in the field of Computer Science and Information Technology, but also in Physics, Statistics, Mathematics, and Engineering field. In Mathematics department, programming considers a mandatory course that students have to take during their studying. However, the time frame assigned to that subject has been reduced in many schools [6]. Moreover, the lack of capabilities in terms of laboratories and the recent political and economic conditions in Libya and the consequent interruption of study times have a negative impact on students' learning and performance in all subjects of the mathematics department curricula, including programming. Programming teachers and researchers in many IT colleges and computer departments are actively searching for good ways to help students understand programming well in terms of understanding the logic of programs and the logical sequence of the program as well as how to transform algorithms into applicable programs. Understanding programming logic requires a lot of training. It also requires an interactive teaching methodology. Thus, students can obtain logical thinking, and can deal with programs and codes with the appropriate logic. Lack of logical, creative, and critical thinking among students leads to weaknesses in the implementation of problem-based learning [5].

Programming has been a difficult subject to learn and master even at the early stage of education. It has been a global problem and continues to worsen at the local level [2]. Not understanding programming may affect students in the rest of other courses, because most of computer science courses related to programming, as well as the rest of the other sciences such as mathematics which need to write some codes. This problem has become a cause of trouble for students directly and indirectly. There are general challenges in teaching and specific challenges when teaching programming [1][3]. It is mentioned in the literature that students who have weakness in understanding programming logic and do not have good training time scored low in programming languages tests.

The Interactive Learning Platforms (ILP) is one of teaching modalities that many studies have been conducted on in the last decade. Online education platforms has become one of the most important methods used in teaching programming courses, especially which use of interactive activities. However, there is still a controversy about the advantage of the Online Interactive Educational Platforms over other teaching modalities. Several studies have shown that the use of interactive learning has significant advantages over other learning methods. [4] studied the effectiveness of using interactive online learning by collecting data on 186 students. students in introductory Programming courses are solved in a reasonably large part (80.3% and 64%, respectively) Of the exercises available, each uses a relatively modest number of rendering attempts (2.74 and 2.25, respectively). The Advanced Algorithm course proves to be challenging An average of only 33.1% of the exercises solved, using more attempts 3.74. Next, let's examine the website interaction according to the survey answers. Students felt more engaged with the badges. own for each student.

The aim of this study was to investigate the effect of adding Interactive Learning Platforms (ILP) to the ordinary lecture on learning and performance of the Java programming course students of mathematics science department, faculty of arts and sciences Alabyar, University of Benghazi. I studied the short-term impact of Interactive Learning Platforms (ILP) on student learning, by comparing post lecture quizzes of the study and control groups.

Methodology And Study design

As illustrated in figure 1, 32 mathematics department students at Faculty of arts and sciences Alabyar, University of Benghazi were involved in this study. Students were divided into two groups based on a placement test. To ensure equal distribution of the students into the two groups, students whose score were excellent were divided equally into two groups. The same was done for the rest of the students who scored very good, good, average, and below average. In this way, each group contains equal distribution of the students from different levels. Group one – the control group – attended an ordinary lecture given by the java programming language lecturer at the Department of Computer science at the faculty. On the other hand, group two – the study group – was given a lecture augmented with online interactive learning platform. Both lectures were about the same subject – the Inheritance in Java – and were given by the same instructor. Also the two lectures were followed by the same exam to test the students' performance. The questions varied from easy

questions that test the basic knowledge about the subject to difficult questions that examine the students understanding of the complex structures of the Inheritance. A questionnaire was handed to both groups to fill out. One part of the questionnaire was to classify students based on their previous knowledge about the Inheritance subject. Another part of the questionnaire was to make sure all students have followed the lecture and their answers to the questions in the exam reflect the knowledge that they accumulated from the lecture.

The Interactive learning activities were taken from <https://www.codecademy.com/>. The Codecademy is a free online platform that provides interactive programming learning. Codecademy teaches programming skills to students of all levels. Through thousands of online courses, Codecademy offers a wealth of content covering 12 programming languages and two markup languages and they are HTML and CSS. Students used the Codecademy during the lecture and also as a homework. After the end of the lectures, some tests were conducted on the students about Inheritance and student's grades were recorded. The students' grades were recorded and analyzed using Microsoft excel.

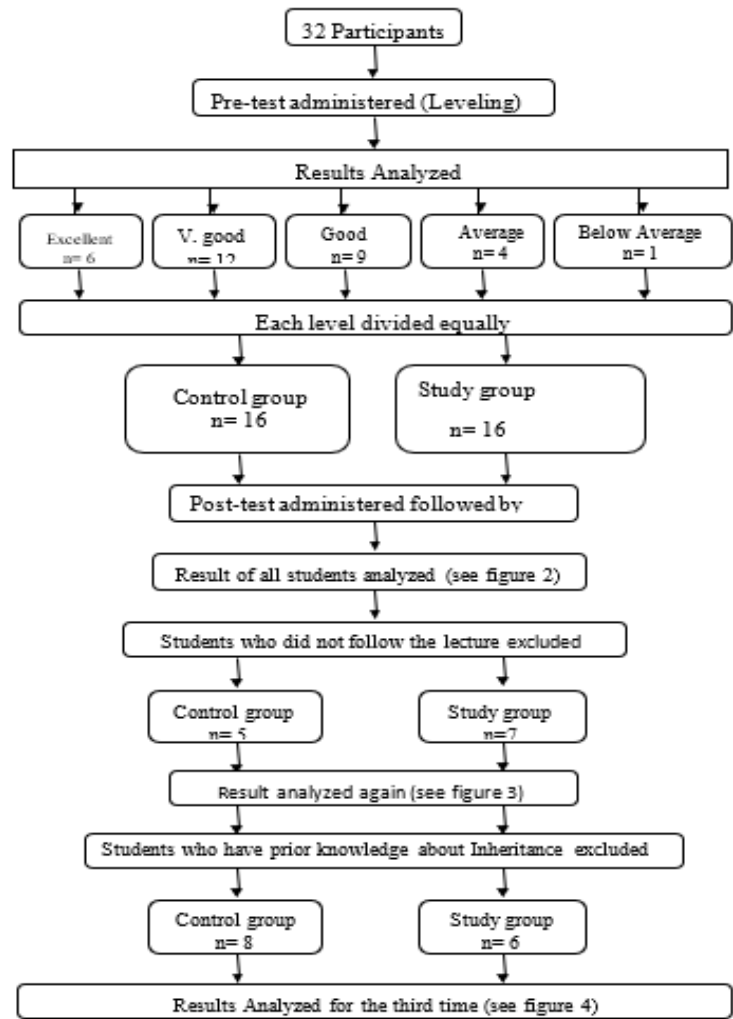


Figure 1: the flowchart of the study.

Results

The mean score of the correct answers of the control group was 4.9 out of 12 questions. On the hand, the mean for the study group was 6.23 out of 12 questions. These scores indicate better performance of the study group compared to the control group.

Figure 2, 3, 4 bellow show the results of each question for each group. Figure two, illustrates that the study group slightly outperform the control group in questions 1 to 4 and 6. The difference between the two groups is more notable in the rest of the questions where the study group scored better than the control group. The results in this figure are for all the students who participated in the study.

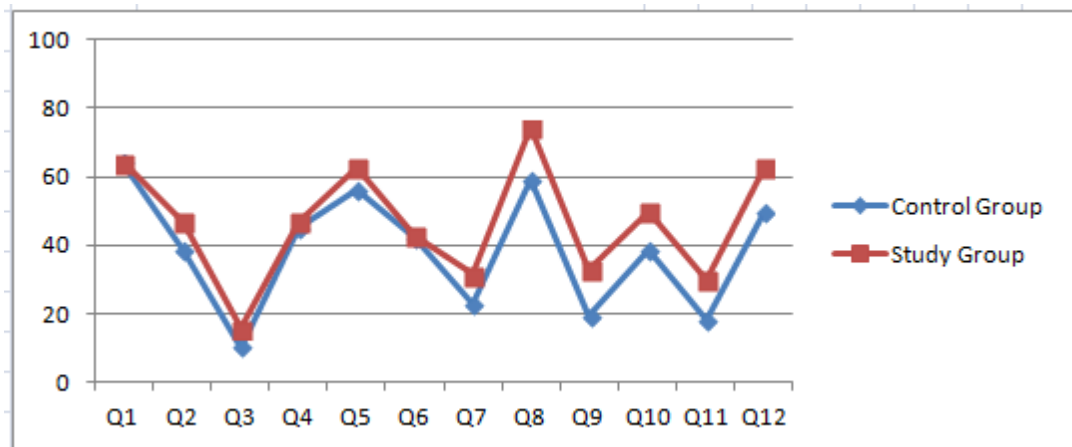


Figure 2: Results of the two groups including all students

In figure 3, we can see that group two demonstrated better performance than group one. This figure depicts only the scores of the students who have followed the lecture. (Students who answered, “Yes” for the survey question regarding the coverage of all parts of the inheritance by the lecturer); If a student answer was “No” for these questions, that means the student did not follow the lecturer and lost focus during some time in the lecture. In this figure we can also easily notice the better performance of the study group compared to the control group.

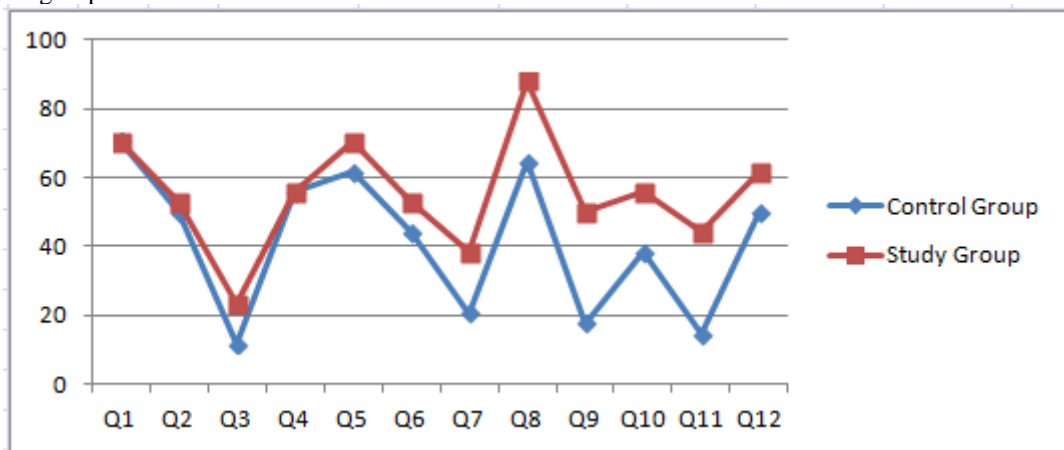


Figure 3: Results of the two groups excluding students who did not follow the lecture

In figure four we illustrate the results of the two groups excluding those students who have prior knowledge of the Inheritance. Again, the results show that student who attended the lecture augmented with Codecademy performed better than others how were given ordinary lecture.

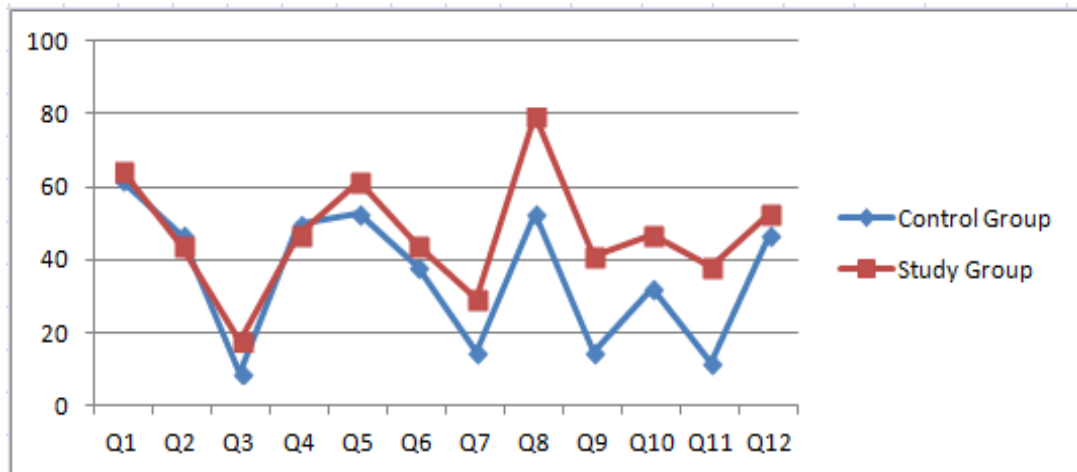


Figure 4: Results of the two groups

Discussion

The mean score for the study group was higher than the mean score for the control group. Namely the average scores were 4.9, 6.23 for the study group and control group respectively. This difference in the score may be an indicator to the positive influence of the addition of Codecademy to the lecture. Another factor was considered in this study is the score of each individual question. From the figures above, we noticed better performance of the study group in almost all the questions. Questions one through four was relatively easy questions and both groups performed almost the same as we saw in the figures. The complexity of the questions progressively increases as we go from question five to twelve.

The figures above reflect this complexity as an increase in the difference in the score between the two groups. We can relate this difference in the performance again to the positive impact of the using Codecademy. Adding Codecademy to the lecture made it easy to the students to comprehend the inheritance concept in Java. The ability to manipulate Codecademy and rotating them by the lecturer during the lecture enhanced the students' ability to accumulate more knowledge about the subject. The difference in the performance between the two groups is more notable as we exclude those students who did not follow the lecture and others who have previous knowledge about the subject. Students who did not follow the lecture may answer some questions randomly leading to an inconsistency in the data under analysis. The answers of others who have previous knowledge about the Inheritance do not reflect the impact of the Codecademy as the student may have learned about the subject from other different sources.

Conclusion

The purpose of this study was to investigate the short-term impact of adding online interactive learning platform to programming lectures for non-specialist students in University of Benghazi. All results have shown that the Online Interactive Platform enhanced the students learning and performance in programming tasks. More researches needed to be done to study the long- term impact of using Online Interactive Educational Platforms on higher education students' performance in other many majors.

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