DIPSEIL QUIZ MODULE EFFICACY ON STUDENTS’ LEARNING IN FUNDAMENTALS OF PROGRAMMING COURSE

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Abstract

DIPSEIL is a learning management system developed by a team from Plovdiv University (BULGARIA) and used in the learning process in various scientific courses – electronics, computer science, communications, physics, etc. DIPSEIL course content structure follows the performance support systems requirements – the content is structured to provide individualized online access to all needed information, instructions, advice, tools and software to enable the student to perform a task with a minimum support from teachers.

The new, fourth version of DIPSEIL is extended with a Quiz generation system, which consists of the following modules:

1 Quiz generation module that: supports different types of questions (dichotomous, multiple choice, short answer) and provides immediate feedback on the correctness of answers;
2 Quiz statistics module that provides calculation of: difficulty index, discrimination index, reliability and validity of tests, etc.

A study is conducted to explore the impact of the use of DIPSEIL Quiz generation system on the academic results of students in Fundamentals of programming course. The course is taught during the first semester of the academic year 2018-2019. 24 students are divided into two groups: experimental and control. Both groups were taught in DIPSEIL, but the learning of students in the experimental group was supported by DIPSEIL Quiz generation system. The results from the final test exam show that students from the experimental group performed better, which is an evidence that the use of Quiz generation system can improve statistically significantly learning achievement in DIPSEIL.

Keywords: Quiz generation system, e-learning environment, Internet based performance support system.

1 INTRODUCTION

The globalization and the fast technological changes require software engineers to possess not only technical knowledge but also critical thinking, problem solving skills. They must have lifelong learning skills to be up-to-date with the latest innovations in the software industry. That is why it is very important universities to teach students not only subject-specific knowledge, but also to help them to develop their soft skills [1]. Performance-based learning is an effective approach in providing software engineering knowledge and skills [2].

Plovdiv University (BULGARIA) has more than ten years of experience in the implementation of performance-centered approach in education by utilizing the Distributed Internet-based Performance Support Environment for Individualized Learning (DIPSEIL) [3], [4]. There are many studies proving the effectiveness of DIPSEIL in engineering education [5], [6], [7]. DIPSEIL course content structure follows the performance support systems requirements – the curriculum is represented in the form of learning tasks and in the process of their performance the student acquires the necessary knowledge and skills in the respective discipline. A DIPSEIL task combines the following elements:

- Task description;
- Task-specific training - training materials which help the user to learn while performing the task;
- Reference information - task relevant resources which students either have to study or use just in time to perform the task;
- Instructions how to perform the task;
- Expert advice about a task.
All these components enable students to perform the learning tasks with a minimum support from teachers.

The new, fourth version of DIPSEIL is extended with a Quiz generation system, which consists of the following modules:

1. Quiz generation module that supports different types of questions (dichotomous, multiple choice, short answer) and provides immediate feedback which guides to correct answers, helps students to identify gaps in their knowledge, increases students’ performance on subsequent tests of related learning material;

2. Quiz statistics module is a powerful tool that teachers can use to increase the quality of the developed tests and improve students’ assessment. Quiz statistics module provides calculation of difficulty index, discrimination index, reliability and validity of tests, etc.

2 METHODOLOGY

Fundamentals of programming is one of the most important professional courses in engineering education. The course serves as a basis for subsequent programming courses. It is therefore important for students to acquire not only software development skills but also theoretical knowledge about basic concepts and principles in programming. We believe that by extending DIPSEIL performance support system with a Quiz module, students’ achievement in Fundamentals of programming can be improved. On the one hand, the Quiz Module can help students to retain factual knowledge. On the other hand, the performance of the learning tasks will develop their algorithmic thinking and programming skills.

The course is taught during the first semester of the academic year 2018-2019. 24 first year students are randomly assigned to two groups: experimental group (12 students) and control group (12 students). All students have the same level of prior knowledge about the course content. Both groups were taught in DIPSEIL and the learning tasks and the training time were the same. The difference is that the training of students in the experimental group was supported by DIPSEIL Quiz System - there was a test for self-assessment corresponding to each learning task in the course. The tests provided immediate feedback on the correctness of answers. Each student from the experimental group had to fill in all tests in the course at least once.

Students in both groups performed the learning tasks and received credits for each solution. They received a final mark at the end of the training based on the collected credits and a final theoretical exam in the form of a test. The test:

- was the same for both groups;
- consisted of different types of questions (dichotomous, multiple choice, short answer questions, etc.);
- included questions from different levels of Bloom's Taxonomy: Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation.

Our hypothesis is that DIPSEIL Quiz generation system will improve students’ results on the final test. Obtained results from the final test are analysed using SPSS (version 17.0). Comparison between the two groups is performed using independent t-test. The significance level is 5%.

3 RESULTS

The results from the performed t-test analysis are shown in Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>mean</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>12</td>
<td>4.17</td>
<td>0.72</td>
<td>0.04</td>
</tr>
<tr>
<td>Experimental</td>
<td>12</td>
<td>4.75</td>
<td>0.58</td>
<td></td>
</tr>
</tbody>
</table>
The mean value of the experimental group (4.75) is greater than the mean value of the control group (4.17). The standard deviation of the experimental group is smaller which indicates a better homogeneity in students’ scores. The results reveal that there is a statistically significant difference between the final test achievements of the two groups (p < 0.05). This gives us reason to claim that the hypothesis of this study is confirmed.

The results from the final test for the control and experimental groups are shown in Fig. 1 and Fig. 2, respectively.

![Figure 1. Distribution of the final test results for the control group](image1)

![Figure 2. Distribution of the final test results for the experimental group](image2)

4 CONCLUSIONS

This study is conducted to explore the impact of DIPSEIL Quiz generation system on the academic achievement of students in Fundamentals of programming course. The system’s educational effectiveness is analyzed by comparing the final test results of control and experimental groups of students - both groups were taught in DIPSEIL, but the learning of students in the experimental group was supported by DIPSEIL Quiz generation system. According to the results from the performed t-test it can be concluded that DIPSEIL Quiz generation system has a positive impact on the academic results of students in Fundamentals of programming course and improves their results on the final test.

ACKNOWLEDGEMENTS

This work was funded by the following projects: МУ19-ФтФ-006 /2019/ of the Department for Scientific Research of Plovdiv University, Bulgaria; National Program "Young Scientists and Postdoctoral Students" at the Ministry of Education and Science, Bulgaria.

REFERENCES


