Indonesian Journal of Informatics Education

The Development of SQL Language Skills in Data Definition and Data Manipulation Languages Using Exercises with Quizizz for Students' Learning Engagement

Ratchadaporn Amornchewin

Department of Computer Science
Thepsatri Rajabhat University
Lop Buri, Thailand
ramornchewin@yahoo.com

Abstract:

The exercise is one of the educational activities that help students to understand and achieve their learning goals. Quizizz is a great online tool which helps students to check their knowledge and learning progress. In this paper, the researcher applied the SQL (Structured Query Language) skill in data definition language (DDL) and data manipulation language (DML) exercises and engaged the student's learning by using Quizizz on students' Introduction to Database course. The exercises and Quizizz were employed to an experimental group and a conventional teaching method was used for the control groups. The groups of students were of the heterogeneous level. Using the DDL and DML exercises, the students can review the knowledge repeatedly by doing exercises. In addition, the student can learn something from doing quizzes via Quizizz. The study on SQL exercises were conducted in order to improve students' achievement in DDL and DML. The purposes of this research were to 1) compare the students' pre-test and post-test achievement using Quizizz and 2) investigate the students' satisfaction while using SQL language skill exercises and Quizizz. The sample consisted of 34 students who enrolled in an Introduction to Database course in semester 1 of the academic year 2017. The students applied SQL language skill exercises when working on SQL assignment statement syntax. The students' pre-tests and post-tests were assessed. Percentage, mean and standard deviation, and average score (t-test) were used to analyze the data. The result showed that the students' scores from the post-test was higher than the pre-test. There was a statistical significance at the level of 0.05. According to the result, it indicated that the students' achievement was improved by the implementation. The students' satisfaction with the SQL language skill exercises and Quizizz was at a highest level ($X = 4.58$, S.D. = 0.54).

Introduction

SQL, or Structured Query Language, is an ANSI (American National Standards Institute) standard computer language used for managing and performing various operations on the relational database. SQL can be used to query a wide range of database systems, from traditional relational databases to modern Big Data systems (Silva, 2016). The students of computer science need to learn the basics of the SQL language skills for use in the next programming course. SQL language skills are divided into several types of commands. However, in this paper, we focus on DDL (data definition language) and DML (data manipulation language). DDL consists of the SQL commands for defining the relation schemas, deleting relations and modify relation schemas, while DML consists of the SQL commands for retrieving and manipulating data. SQL command is a structured and simple language, however, students have difficulties learning it. One problem comes from the misconceptions in the student's understanding of the elements of SQL and the relational data model in general (Kearns & Fekete, 1997,Mitrovic, 1998).

Based on the Thornlike's law (Thorndike, 1898), the law of exercise states that those things most frequently repeated is best remembered. The law implies that a student can learn and retain knowledge best through practice and repetition of the skill. The exercise is one of the educational activities that help students to learn by doing. A series of exercises can help students to understand and achieve their course expectations and requirements, such as the SQL language skill exercises, which were individual activities.

The students applied SQL language skill exercises when working on SQL assignment statement syntax. SQL language skill exercises are practical exercises that consist of a sample of problems and commands that are set up for the students to practice. The exercise was conducted in order to improve students' achievement in relation to data definition language and data manipulation language. Quizizz is a free gamified quiz which students can play in the class with any device and progress independently.

In this study, the researcher applies the SQL language skills in data definition and data manipulation languages exercises and engaged the student learning by using Quizizz on students' Introduction to Database exercises. Quizizz was employed to the experimental group and the conventional teaching method was used for control groups. The students also improved both cognitive and affective domains. Motivational theories related to exercises and Quizizz focused on DDL and DML exercises.

Method

The study of SQL language skill exercises and using the Quizizz technique was conducted in order to solve problems of learning the SQL language skills in data definition language (DDL) and data manipulation language (DML). The purposes of this research were to 1) compare the students' pre-test and post-test achievement after using exercises with application Quizizz and 2) investigate the students' satisfaction while using DDL and DML exercises, and Quizizz. The sample consisted of 34 students who enrolled in Introduction to Database course in semester 1 of the academic year 2017. The students applied SQL exercises when working with SQL assignment statement syntax. The students' pre-test and post-test were analyzed. Percentage, mean and standard deviation, and average score (t-test) were used to analyse the data

Related Work

The database system course is important in order to obtain a degree in Computer Science. One of the important topics in the Database Systems course is SQL. SQL is the basic language for the interaction between user and computer that are perceived as a difficult subject for the students to learn. In addition, a number of researchers state that SQL syntaxes are also perceived as a difficult subject for the students to comprehend (Sadiq, Orlowska & Lin, 2004; Cembalo, Santis & Ferraro,2011; Prior, 2003). Students are expected to know how to create queries when they graduate with the Computer Science degree (Kearn & Fekete, 1996).

To better deal with misunderstanding the logic of SQL problems, most of the tools have been developed to determine how to enhance students' understanding of the underlying logic of SQL. SQL-Tutor is constraint-based that supports the students to solve the problem by focusing on the system's configuration (Mitrovic, 1998). Game-based learning activities were considered to help disaffected students to engage with their basic SQL concepts learning (Barnes & Kuzma, 2009). To reduce the number of problems with misunderstanding, the researcher developed the SQL language skills in data

definition and data manipulation languages by using exercises with Quizizz for students' learning engagement.

Methodology

Based on the importance of the concept of reinforcement, a theory that was introduced and applied to the psychological principles to the area of learning, Thorndike (1998) introduced the law of effect, law of exercise and law of readiness. The law of effect is the behavioral responses that produce a satisfying result most likely to show established patterns and to occur again in response to the same situation. The law of exercise is behavior that is more responsive and follows frequent stimulus. The law of readiness is the teaching and learning process that introduces a new learning task when both student and teacher are adequately prepared.

According to Thorndike's theory, the researcher designed the repetitive and various exercises that help students for learning in SQL language skills in data definition and data manipulation languages. The students should learn by doing authentic activities more than by simply watching and listening. With the SQL language skill exercises, the students can review the knowledge repeatedly by doing exercises. The study on SQL exercise was conducted in order to improve students' achievement in data definition language and data manipulation language. In addition, the students were responsible for each other as well when working to reach the goal. Furthermore, the students can learn something from doing the quiz via Quizizz. Quizizz was employed to promote better learning, improve students' motivation, and increase enjoyment of the learning experiences.

The process of SQL language skill exercises is described as follows:

Model

Within the scope of the Introduction to Database course, in this study, the control group design of pre-test and post-test was predicated in order to examine the results of SQL language skill exercises by using Quizizz and the method on students' achievements.

Quizizz

Quizizz is a gamified learning tool that can motivate and engage students with its content. With a free account, it is easy to create multi-player quizzes that work on any devices, such as a computer, smartphone, or tablet, to complete the quiz. When the student joins the quiz, the questions and answers are shuffled for all students. The reward is given in a form of funny pictures and points based on accuracy and speed (Figure 1 and Figure 2), 600 points for getting it correct, and 0–400 based on speed when question timer is turned on or 1000 points when question timer is turned off. On the other hand, an incorrect answer is always 0, regardless of speed. Students can see their rank at the leaderboard after each question or quiz which is a picture with the rank and points for each student. The answer is shown after answering each question with a funny picture, called memes.
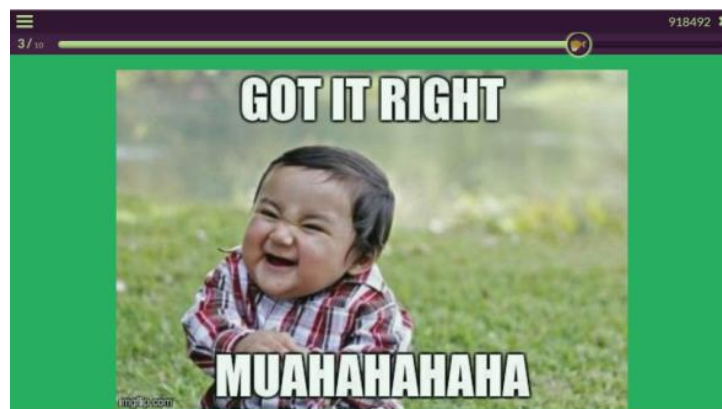

Figure 1. The picture displayed when you get the question correct

Figure 2. The picture displayed when you get the question wrong

Sample

The sample consisted of 34 students who enrolled in the Introduction to Database course in semester 1 of the academic year 2017. The students applied the SQL language skills with exercise when working with assignments about DDL and DML.

Process

The SQL language skill exercises were individual activities. The students applied SQL language skill exercises when working on SQL assignment statement syntax. The SQL language skill exercise consisted of 3 modules: (a) Basic concept of SQL, (b) Basic structure of data definition language (DDL) and (c) Basic structure of data manipulation language (DML). The exercises were conducted in order to improve students' achievement of data definition language and data manipulation language. Quizizz is a great online tool which helps students check their knowledge and learning progress. In this paper, the researcher applied the SQL language skills in data definition and data manipulation languages exercise and engaged the students' learning by using Quizizz.

By considering the main principles of the development of SQL language skills in data definition and data manipulation languages using exercises with Quizizz for students' learning engagement, the research was conducted as follows:
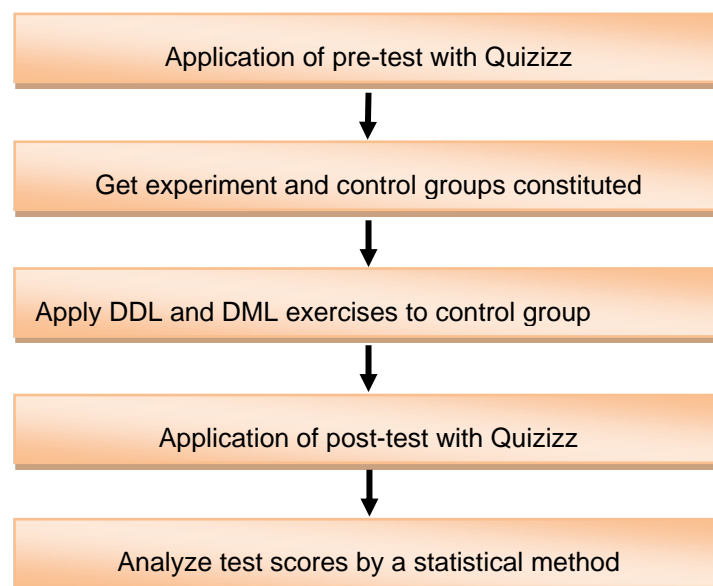

Figure 3. The instructional procedure of SQL language skills in data definition and data manipulation languages using exercises with Quizizz

    1. Application of pre-test with Quizizz. The researcher collected data based on the pre-test with the control group to define SQL language skills in DDL and DML.

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2. Getting experiment and control groups constituted. The researcher planned the experiment where the control group had been provided with instruction for development of SQL language skills in DDL and DML. The experiment lasted 3 weeks, 1 day per week, 4 hours per day in semester 1 of the academic year 2017.

3. Application of SQL language skills in DDL and DML exercises had been applied to the control group.

4. Application of post-test with Quizizz. When the experiment had been completed by the end of the 3rd week,

the researcher carried out the post-test using the standard test as the pre-test for measuring the DDL and DML skills.

5. Score collected from the tests had been analyzed by a statistical method.

The instructional procedure of the SQL language skills in DDL and DML exercises with Quizizz was illustrated in Figure 3.

Topics	Students' Satisfaction		
	$\overline{X}$	S.D.	Satisfaction Level
1. The activities are various and interesting	4.59	0.48	Highest
2. The activities allow the students to go over the lesson.	4.61	0.46	Highest
3. The activities are categorized by the SQL language skills in data definition and data manipulation languages	4.36	0.56	High
4. The activities increase the students' attention.	4.50	0.49	Highest
5. The activities allow the students to have more motivation towards learning.	4.61	0.57	Highest
6. The activities enhance the students' knowledge.	4.57	0.63	Highest
7. The activities are comprehensible and easy to understand.	4.68	0.75	Highest
8. It is fun to learn with Quizizz.	4.68	0.39	Highest
9. The students have more better and positive attitudes towards SQL language learning.	4.60	0.56	Highest
Total	4.58	0.54	Highest

As presented above, the overall students' satisfaction towards the learning with the SQL language skills in data definition and data manipulation languages using exercises with Quizizz was at the highest level ($\overline{X}$ = 4.58, S.D. = 0.54). Most of the students agreed that it was fun to learn with the technique and the activities were comprehensible and easy to understand ($\overline{X}$ = 4.68). In addition, the activities allowed the students to have more motivation towards learning and let the students to go over the lesson ($\overline{X}$ = 4.61). Besides, the students had more better and positive attitudes towards SQL language learning. ($\overline{X}$ = 4.60).

Recommendations

From the results of this study, it can be concluded that the development of SQL language skills in data definition and data manipulation languages using exercises with Quizizz for students' learning engagement can enhance the student's knowledge. Instructors may apply the following techniques when teaching:
1. During learning activities, the instructors should reinforce and encourage students to complete their task and explain what they are learning and how they are learning it.

2. The instructors should provide, participate and assign responsibility for students' learning.
3. The Instructors should use rewards to motivate students.

Conclusion

The development of SQL language skills in data definition and data manipulation languages using exercises with Quizizz can increase the students' DDL and DML skills. The overall abilities for SQL language skill exercises with Quizizz were higher than before applying activities for the development of the Introduction to Database course with a statistical significance of .05. The students applied the technique when working with assignments about DDL and DML. SQL language skills in data definition and data manipulation languages using exercises with the Quizizz can also enhance the students' motivation in their learning experience. They can integrate the DDL and DML skills with the other programming subjects. According to the Table 2, the results showed most of the students agreed that it was fun to learn with the technique and the activities were comprehensible and easy to understand. In addition, the activities allowed the students to have more motivation towards learning and let the students to go over the lesson.

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About the Author

Ratchadaporn Amornchewin received the PhD degree in Information Technology from King Mongkut's Institute of Technology Ladkrabang, in 2009. She is an Assistant Professor of Computer Science at Thepsatri Rajabhat University. Her research interests include Association rule mining, Human computer interaction and Education.