Development and Trial Use of a Web-based Database Learning System

Jevri Tri ARDIANSAH[*1], Yasuhisa OKAZAKI[*2], Aji Prasetya WIBAWA[*3], Triyanna WIDIYANINGTYAS[*4]

[*1,2] Faculty of Science and Engineering, Saga University, Japan

[*1,3,4] Faculty of Engineering, State University of Malang, Indonesia

Email: [*1] jev.ardian@gmail.com, [*2] okaz@cc.saga-u.ac.jp, [*3] aji.prasetya.ft@um.ac.id, [*4] triyannaw@gmail.com

Summary : Database is an important part in a system, and it can be accessed by SQL (Structured Query Language). SQL is a language that used for manipulating data in database. To help beginners to learn about SQL, a system that can assist them to understand the SQL practical implementation is needed. The system that discussed in this paper is an online system. It provides tasks that should be solved by SQL syntax. To help user, the syntax compiler shows the message about syntax error, logic error and instruction that should users do. This system prototype is evaluated by using LORI (Learning Object Review Instrument).

Key words : SQL, database, logic error, string matching algorithm, Start End Mid Algorithm, prototype, LORI.

1. Introduction

Every system needs a storage media as a data base. Data base is contained of data which if the data is processed will give valuable information [1]. The data processing involves a language called SQL. There are two categories of errors that can occur in SQL statement, they are syntax error and logic error [2]. Different with a syntax error, logic error cannot be detected by SQL compiler. So, it is needed for further processing to user SQL statement to know about the logic error. One of the concepts that can be used to know the logic error is compare between the user answer with the related answer key [3].

To help beginners to learn SQL, this system was built as an online learning and it can be accessed at http://sqlzone.net. This system's name is SQLzone as the Figure 1. The lessons in this system is about Selection concept in SQL as shown as Figure 2.

Figure 1. SQLzone
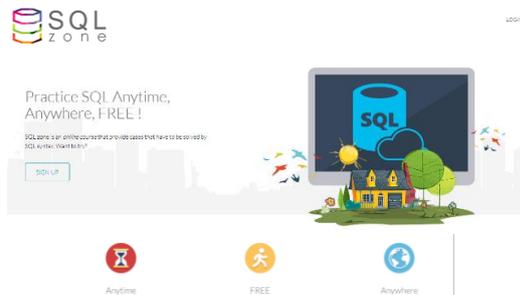

Figure 2. Lessons in SQLzone

The first prototype was evaluated by using LORI (Learning Object Review Instrument) and the result will be discussed in this article. LORI is a tool for eliciting ratings and comments from learning resource evaluators and its purpose is to support evaluation of multimedia learning objects [4].

2. System Overview

To help users for understanding SQL practically, SQLzone provides cases which has to be solved using SQL syntax. Information about the result that was submitted by users is also displayed to guide users about what should they do to solve the case. That information is about syntax error and logic error that occurred in user's SQL syntax. By informing those errors, users are expected to know the mistakes that they did and make corrections to solve the related case. The system overview is shown as the Figure 3.

Figure 3. The system overview

To give an information to user about corrections that should they do, system does these process:

1. Syntax error checking

After user tried to solve the case with the SQL, in the first phase, the user SQL statement will be checked by SQL compiler [5]. In this phase, the compiler will inform the syntax error until the SQL statement is true. Then the table result will be shown.

2. Logic error checking

In this phase, SQLzone uses Start End Mid algorithm to check the similarity between user's result table with key answer's table [6]. In this case, if those data are different, it means that the user's SQL has logical error to solve the case.

3. Suggestion making

The last one is about giving a feedback to users about the location of keyword that makes logic error in their SQL statement. This process compares the user's SQL with the key answer's SQL. By gives the different result table, both of those syntax must be different. Then the system searches the differences and gives a suggestion about the user mistakes.

To support the learning process, SQLzone has four sections as Figure 4. Those sections represent the standard minimum about effective e-learning media [7]. Those standards are activity, scenario, feedback, delivery, context, and influence components [8].

Practice

Concept   Scheme   Case   Compiler

Figure 4. The learning sections

Concept shows the general description about the chosen SQL keyword lesson. In this section, users can learn about selected keyword's basic knowledge. After users possess the basic knowledge, they have to know the database design. Database design will be shown in the *Scheme* section. And the *Case* section shows the story and case that should be solved in *Compiler* section.

3.   System Evaluation

To know the accuracy of the first prototype, evaluation was held in 4 days from 7th – 10th February 2017 and there were 10 male students who tried SQLzone. The percentage of their SQL ability is 1 advanced student, 7 intermediate students, and 2 beginner students. User's range age is from 21-24 years old. They accessed SQLzone by http://sqlzone.net and did the "select" and "select column's name" tasks. Answer, task's finishing time, clicked hints and system feedback were recorded. Table 1 shows the user's answer who made mistakes in their SQL syntax.

Table 1. Prototype trial data example

User's SQL	Answer Key	Feedback	Clicked hint button		
			DB table	Goal table	SQL key
Select * from company	Select * from department	Unknown column company in field list	v	-	-
Select * from departement	Select * from department	Table sqlr4324sql_departement does not exist	v	v	v
Select * from	Select * from department	You have an error in your SQL syntax. Check the manual that corresponds to your MySQL server version for the right syntax to use at line 1	-	-	-
Select * from department	Select city from department	Logic error occurs near the - * - word	v	-	-
Select country from customer	Select city from department	Logic error occurs near the – COUNTRY CUSTOMER – word	-	-	-
Select	Select city from department	No table used	-	-	-
Select * from employee where dept_id=5	Select * from department	logic error occurs near the – EMPLOYEE WHERE DEPT_ID=5 – word	v	v	v
…	…	…	…	…	…

Based on that data, there is no mistake about the system feedback. SQLzone displays feedback in the correct way as far. The average of task's finishing time is 139 seconds. And the percentage of clicked hint buttons is 58% for database table hint, 58% for goal table hint and 44% for SQL answer hint.

In this evaluation, there was also questionnaire that given to users. That questionnaire was based on LORI. It uses 9 scoring aspects to evaluate the object. For each point, there is a rating scale from 1 (low) to 5 (high) [4].

In the implementation, each scoring aspect was developed in to two related questions. Table 2 shows the result of this evaluation.

Table 2. Questionnaire result

No	Scoring Aspect	Average Score
1	Content quality	4.3
2	Learning goal alignment	4.4
3	Feedback and adaptation	4.1
4	Motivation	4.7
5	Presentation design	4.3
6	Interaction usability	4.1
7	Accessibility	3.7
8	Reusability	4.6
9	Standard compliance	4.0
	Average	**4.2**

4.   Conclusion

Based on the evaluation, SQLzone still has no bug in suggestion making. But based on questionnaire, the lowest score is on the accessibility (3.7) because the display of compiler page cannot fit in the tablet or phone access. Based on hint buttons that user used, all of hints are needed to help user to answer the case if they have no idea. This evaluation was conducted not for all lessons. Based on that matter, to know about the greater accuracy of system, it is needed to complete the all of the lessons and let users do all of them.

References

(1) Elmasri, Rames & Navathe, Shamkant. "Fundamentals of Database System (6th edition)". Pearson Education Inc. United States of America (2011)
(2) Goldberg, Christian. "Do You Know SQL? About Semantic Errors in Database Queries". British National Conference on Database (2009). http://dbs.informatik.uni-halle.de/sqllint /tlad09.pdf (12th February 2017)
(3) Dollinger, Robert. "SQL Lightweight Tutoring Module – Semantic Analysis of SQL Queries based on XML Representation and LINQ". Proceeding of World Conference on Education Multimedia, Hypermedia & Telecommunications Vol.2010 No.1 pp. 3323-3328 (2010)
(4) Leacock, T.L. and Nesbit, J.C. "A framework for evaluating the quality of multimedia learning resources". Educational Technology & Society Vol.10, No.2 pp. 44-59 (2007)
(5) Suriawan, Tofa. "Development of Web-based Database Lesson Learning Media for 2nd Grade Student in Vocational High School 5 Malang". Bachelor Thesis of Information and Technology in Education、State University of Malang (2015)
(6) Ardiansah, Jevri Tri. Aji Prasetya Wibawa, Triyanna Widiyaningtyas. "Start End Mid Algorithm Implementation for Detecting SQL Logical Error". National Seminar Information Technology and Multimedia, STMIK AMIKOM Yogyakarta Vol.4, No.1, pp. 3.7-1 – 3.7-6 (2016)
(7) Ardiansah, Jevri Tri, Yasuhisa Okazaki, Aji Prasetya Wibawa, Triyanna Widiyaningtyas. "Developing of a Web-based Database Learning Support System for Practical Implementation of SQL". IEICE (Institute of Electronics, Information and Communication Engineers) Technical Report Vol. 116, No. 266, pp. 57-62 (2016)
(8) Brown, Andrew R & Bradley D. Voltz. "Elements of Effective e-Learning Design". International Review of Research in Open and Distance Learning Vol.6, No.1 (2005) http://www. irrodl.org/index.php/irrodl/article/view/217/1618 (12th February 2017)