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Preface

This e-book describes the research papers presented at the International Conference on Emerging Computational Technologies (ICECoT 2021), organised by Faculty of Computer and Mathematical Sciences (FSKM), UiTM Cawangan Melaka. The main discussions of the conference is on the technological advances that help shape the skills that are required to cope with the Fourth Industrial Revolution (IR 4.0). Considering that this is our first attempt at organising a conference, we are therefore greatly honoured that the Universitas Negeri Semarang (UNNES), Indonesia, Mahasarakham University (MSU), Thailand and University of Hail (UoH), Saudi Arabia have all agreed to become our partners by contributing several reseach papers as well as providing reviewers to assess the quality of the papers.

Out of the numerous research works that had been submitted and reviewed, the Editorial Board have selected 22 papers to be published in the e-book. The discussions of these papers pertain to the use of technologies within the broad spectrum of Computer Science, Computer Networking, Multimedia, Information Systems Engineering, Mathematical Sciences and Educational Technology. It is hoped that the research findings that are shared in this e-book can benefit those who are interested in the various areas of computational technologies; such as graduate students, researchers, academicians and the industrial players, to name a few.

As the Project Manager, I would like to thank all of the committee members from the bottom of my heart for their tireless efforts in ensuring the success of ICECoT 2021. Without their continual support and excellent teamwork, this conference would not have come to fruition. In fact, holding this major event has been a good learning experience for us all, and I sincerely believe that our future conferences will become more outstanding if the same spirit is maintained.

Dr. Noor Aishikin Adam

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Adapting Computer-Based Micro Learning to Enhance Student Retention of SQL Key Terms

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Abstract—The focus in this study is to explore the methods of using computer-based micro learning to enhance student retention in Structured Query Language (SQL) key terms. One of the primary issues in teaching technical courses is a difficulty for students to recall and explain terminologies. It is one of the fundamental skills when learning technical courses. Educators introduce many techniques or methods to reduce students' difficulties such as implementing a micro learning concept. The concept of computer based micro learning encompasses a modern approach to learning, based on short, concise lessons delivered to the learners. Micro learning allows knowledge and information to be divided into small "chunks". **Method:** This study conducts a survey after each lesson to compare the number of terminology that students can recall or explain. First, students are given a lesson without adding a micro learning revision. Then, students receive additional micro learning revision to help them to recall. **Results:** Using the evidence from the questionnaire, the six cases are classified into two categories that have a little improvement and no improvement. Most cases demonstrate improvement when asked to recall SQL terminology. **Summary:** the study finds the retention and understanding level increases in comparison with traditional methods. In assessing student performance, this paper emphasizes the use of available technology to support classroom activities. The paper considers the implications for the teaching approach and student learning.

Keywords—computer-based micro learning, database, SQL

I. INTRODUCTION

Retaining information is one of the core in learning. Evaluating students' ability to retain information from the classroom is essential especially when they need to apply the concept to complete the courses. It is crucial for students to increase their knowledge and fully understand the meaning of each key term. This study focuses on a computer-based micro learning approach to help students retain more knowledge and skills and to supplement classroom learning.

During lectures, students normally acquire direct instructions from the teachers or instructors, and complete in class activities. However, students very soon forget about some of the important concepts and theories. This is a common problem because students hardly retain key terms and concepts in many different topics or subjects although it is essential to continue and complete each course. Even when they take notes in class, they tend to forget the key terms and concepts in the following class.

The objective of micro learning is to break up the material of the lecture into many micro or "small chunks" of key terms. The key terms are shared directly to the students at the end of each lecture sessions and made available in the online learning system. Using a questionnaire, the study investigates the students' ability to recall the number of key terms and their descriptions. The goal is to explore the impact of the proposed methodology on the outcomes using a well-defined questionnaire. The findings suggest that students' memory of database concepts improved significantly. This study proposes a framework for establishing a good micro learning system that can assist instructors in producing and preparing micro learning content.

This study shares the following contributions: First, to provide a computer-based micro learning methodology that can be used to enhance classroom teaching and learning, and assist students retain more information between lectures in a variety of courses. Second, to evaluate the impact of using micro learning content on student retention of database concepts specifically SQL key terms.

II. LITERATURE REVIEW

Students of Management Information System (MIS) program needs to have an adequate skill in SQL. It is essential in software engineering and computer science domain. SQL is a programming language that connect users to database. "It allows users to retrieve, store, modify and delete data or objects, grant and revoke user privileges, and group statements into transactions [1]". The researchers mention the difficulties in teaching SQL effectively because it requires techniques and knowledge about the language. Other researchers [2] discuss about teaching skill courses, and that having previous knowledge and experience may give advantages to the learners. Researchers examine a pedagogical approach to teach SQL and make a comparison using several models. Their suggestion is to adapt tools that should be used in teaching SQL and align with mental models.

Given the technology revolution, computer usage has become a normal part of our daily routine. Students in general use varying IT gadgets and devices; thereby making information more readily accessible. Therefore, educators need to explore different methods to use IT in education to support teaching and learning.

One of the most important requirements for successful learning experiences is learning activity on a regular basis and retaining the lessons learned. The problem with traditional learning methods is that the learner's mind gets used to being exposed with a lot of information. In a state of information overload, there is very little motivation to acquire new knowledge. Renard [3] reports that traditional learning process can reduce the student's attention from 12 to 8 seconds.

Micro learning is a modern approach to learning, based on short, concise lessons delivered to the learners when it suits them. It is fun for learners. Micro learning can be used to teach knowledge or skills that learners can approach at their own speed. Micro learning allows knowledge and information to be divided into smaller, easy-to-digest parts. Micro learning can make the learning subjects easy to understand and memorable for a longer period. Micro learning methods can provide the students with the required knowledge and skills they need [4]. A study [5] of micro learning-friendly materials in the format of videos to introduce the terms, offer explanations, examples, and provide micro learning experience. While others use infographics as a micro learning tool in teaching anatomy [6].

The effectiveness of micro learning is to improve students' learning ability [7]. However, that study and many others are in the contexts of primary and high school students. Moreover, most of the efforts in micro learning is about learning languages. For example, micro learning methods should extend to other fields of learning as well [8].

Previously, student retention of information focus on the techniques, such as mobile-based micro learning technique to assist students in retaining more information and skills while supporting classroom learning [9],[10]; or using Web-based micro questions method of measuring how well students can retain knowledge and overall student satisfaction with the online assessment [11]; or using focused group questions to increase retention level [12],[13].

To support the evidences by previous techniques, this study adapts a computer-based micro learning to support student retention of database concepts specifically SQL key terms. The student retention is measured by student's acquisition of knowledge and student's knowledge retention.

III. RESEARCH METHOD

The research framework will be based on QAIT, the model of effective instruction [14]. This model focuses on the alterable elements of Carroll's model, those which teachers and schools can directly change [15]. The components of this model are as follows:

1. Quality of instruction refers to the teaching activities namely lecturing, discussing, calling on students, and so on. It also includes the curriculum and books, software, or other materials. When instruction is high in quality, the information being presented makes sense to students, is interesting to them, is easy to remember and apply. The most important aspect of instructional quality is the degree to which the lesson makes sense to students.
2. Appropriate Levels of Instruction is the most difficult problem to accommodate instruction to the needs of students with different levels of prior knowledge and different learning rates.

3. Incentive is high if students want to know something, so they will be more likely to exert the necessary effort to learn it.
4. Time is important because instruction takes time. More time spent teaching a subject does not always translate into additional learning, but if instructional quality, appropriateness of instruction, and incentives for learning are all high, then more time on instruction is likely to pay off in greater learning.

For this study, the micro learning tools will:

1. Include QAIT features (Quality, Appropriateness, Incentive and Time).
 - i. Quality – Each student receives a course content in the beginning of semester via a Web-based learning system (Blackboard). Instructors give a brief description at the beginning of each topic, then continue with a lecture and a summary after each lesson.
 - ii. Appropriateness – labs are necessary to gauge the students' computing skills periodically. Those who are weak are given more tutorial, or peer teaching.
 - iii. Incentive – actively participating students get rewards such as bonus marks in their coursework assessments. Furthermore, those who can recall the highest number of terminologies receive a recognition in class.
 - iv. Time – the survey and flash cards are given during lecture. The students have ample time, about 2 hours and 50 minutes to participate.
 - v. Foremost, this research applies to the students in the selected courses and they will NOT be subjected to any kind of abnormal classroom activities that are not usually conducted in a normal class environment.
2. Teach students to use their audio and visual senses more effectively; therefore, the tools include music, video, infographics, animation, and flashcard.

One of the key goals of this research is to see how successful computer-based micro learning is at improving students' short-term retention. As a result, the study's design focuses on comparing students' retention of database concepts with and without micro learning activity. The sampling frame includes 14 cases in this study. The questionnaire guides students to recall the number of concepts that they learn in that lecture. For instance, students need to list the keywords or terminologies that they can remember from the topic covered. After listing, they need to explain or draw the meaning of the keywords based on their understanding. By explaining the meaning of the keywords, their comprehension level is tested. Minimal interference from the researchers during the data collection when using a form as shown in Fig. 1. The methodology is depicted in Fig. 2.

No.	Keywords or Terminologies	Explain

Fig. 1. Retrieval practice form

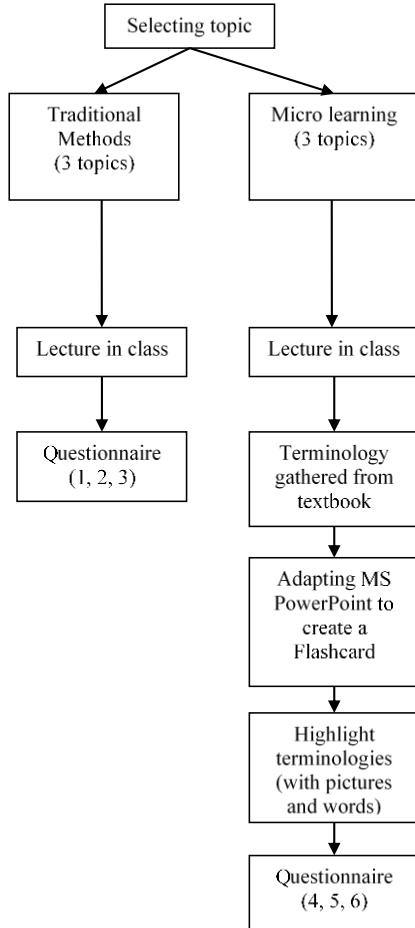


Fig. 2. An overview of research method

When creating a flash card using a Microsoft PowerPoint, several key terms are gathered from the chapter summary in a textbook. A flashcard uses a medium size image as a visual representation of a key term. For instance, six key terms were gathered from Chapter 6 namely JOIN OPERATION, CROSS JOIN, INNER JOIN, OUTER JOIN, UNION and INTERSECT. These words are transformed into a flashcard as depicted in Fig. 3.

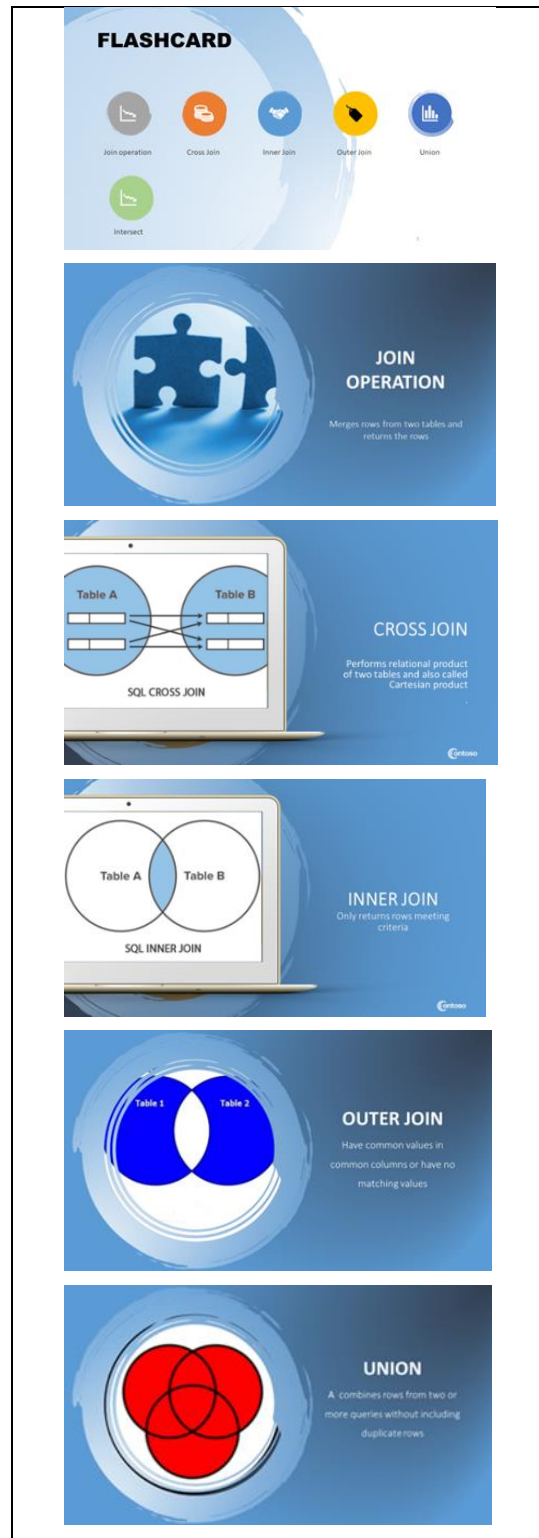


Fig. 3. Example of micro content messages

IV. RESULTS AND DISCUSSION

This study opts for a multi-case research approach [16] and a comparison of findings are tabulated. A total of 14 students register in the database course, with CGPA average between 2.0 to 3.0. The status of completion refers to their participation in this research. Their demographics is summarized in Table I.

TABLE I. STUDENT DEMOGRAPHICS

No.	Case	CGPA	Status of completion
1	Student A	<2.0	Complete
2	Student B	<2.0	Complete
3	Student C	Not mentioned	Incomplete
4	Student D	Not mentioned	Incomplete
5	Student E	2.0-3.0	Incomplete
6	Student F	2.0-3.0	Complete
7	Student G	Not mentioned	Incomplete
8	Student H	Not mentioned	Incomplete
9	Student I	2.0-3.0	Complete
10	Student J	Not mentioned	Incomplete
11	Student K	3.1-3.7	Incomplete
12	Student L	2.0-3.0	Incomplete
13	Student M	2.0-3.0	Complete
14	Student N	2.0-3.0	Complete

Table II shows the results of retention rate for these cycles. The results of the first cycle where the classroom learning is normal (without micro learning) shows that students manage to recall the terminologies in the previous chapters. Although on average, the number is low but it is their first attempt. They express their feelings for instance:

- Student A, B and E feel “not ready to do test”.
- In comparison, Student F, I, K, L and M feel “nervous before starting the test”.
- Only Student N feels “scared to do the test”.

After finishing the test, student A and K did not feel confident with their list of key words or terminologies. In contrast, student B, F and M feel confident that their answers are correct. Student E, I, L and N feel neither confident nor unconfident.

This research notices that students who has a problem to recall the terminologies/keyword gain some improvement in the micro learning cycle. Although it shows a minor repeated cycles for a few topics. For instance:

1. After finishing the test, student A and K still did not feel confident with a list of key words or terminologies. The rest of the students did not share their feelings about their answers.
2. Overall, the number of students participated in the second cycles increased compared to the traditional cycle.

This study excludes the incomplete cases and make an in-depth analysis on the completed case. Table III shows a comparison of correct key terms in both cycles. Although the attempts are still low but it shows some improvements in recalling a database key terms. The results of the first cycle where the classroom learning is normal (without micro learning) shows a low retention rate compared to those with micro learning. In the first cycle, students did not capture the essence of terminologies taught in the class. Students who has a problem to recall the terminologies/keyword gained some improvement in micro learning cycle. Although it shows a minor improvement but it does reflect the impact of using computer-based micro learning. For instance:

When assessing their understanding level in the traditional methods, all the students share that they understand “clearly the lessons/topics” except student M feels “neither clear nor unclear”.

In comparison, all the students highlight that they understand clearly the topic when adapting micro learning.

TABLE II. A COMPARISON OF THE NUMBER OF KEY TERMS IN BOTH CYCLES

No.	Case	Number of key term recall (traditional)	Number of key term recall (micro learning)
1	Student A	4	6
2	Student B	7	6
3	Student C	Not participate	6
4	Student D	Not participate	5
5	Student E	4	Not participate
6	Student F	5	5
7	Student G	Not participate	5
8	Student H	Not participate	4
9	Student I	3	3
10	Student J	Not participate	7
11	Student K	11	Not participate
12	Student L	3	Not participate
13	Student M	3	1
14	Student N	7	6

In this study, a questionnaire measures the effectiveness of using computer-based micro learning content on student retention. Using several questionnaires, student retention rate is compared in two different phases. In the first cycle, the study conducts traditional lectures. While the second cycle includes micro learning methods. Six students complete both phases and shows some improvement as in Table III.

TABLE III. A COMPARISON OF CORRECT KEY TERMS

No.	Case	Correct key term (Traditional)	Correct key term (Micro Learning)	Status
1	Student A	0	0	Remain
2	Student B	0	1	Increase
3	Student F	4	5	Increase
4	Student I	0	1	Increase
5	Student M	0	1	Increase
6	Student N	0	0	Remain

A. Cases That Have No Improvement

Students A and N, are not in the same category of students, if measured by CGPA. Both students explain that they know the concepts but are unable to express it due to language barriers. Both students show great efforts in class to learn the database concepts.

It is important for a teacher to use a clear and simple language so that it is understood by students. When a teacher provides more examples using a simple language, this will enable students to express their understanding.

B. Cases That Have A Little Improvement

Student F, I and M are average students except for student B that is have a low CGPA. They show a little improvement but they mentioned that their understanding of the database concept increase compared to before. These groups of students are able to recall the key term via images. Therefore, it is essential for teachers to include vivid images to attract student attention.

V. CONCLUSION

In conclusion, when compared to the traditional lecture cycle, the results reveal a significant improvement in student retention when adopting micro learning. Furthermore, the

findings demonstrate that students recall more concepts. This study offers significant student learning issues and research objectives for establishing a suitable solution that will benefit both teaching and learning. This study recommends that future studies should enhance the data collection methods by conducting further interviews to elicit students' knowledge. Furthermore, the sample should not be limited to MIS students only, but expanded to other courses. A comparison between flash card and other methods to determine student retention is valuable for future research.

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