LAB University of Applied Sciences

IMPROVING AN ONLINE COURSE FOR SQL LEARNERS IN LAB UNIVERSITY OF APPLIED SCIENCES

Making use of MOOC for efficient courses

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Abstract

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Abstract

The main purpose of this Bachelor thesis is to improve the available SQL online course which is used in LAB University of Applied Sciences to an efficient one and to keep track of the making process, from researching to implementing. Thus, the thesis consists of two main parts which are theoretical (including knowledge and research from available sources) and empirical (noting the process of course improvement with real problems, solutions as well as explanation) part.

Implementing an efficient studying course requires concrete knowledge on the course content (SQL), awareness of users' learning method adoption (MOOC specifically) as well as how to implement the best possible course by using available utilities of the teaching/ learning method. As a result, theoretical is formed as a foundation for the mentioned knowledge.

As the main target of the thesis is to generate an efficient SQL online course, empirical part is a must. In this part, the creation will be described step by step through the suggestion, implementation, and improvement along with interview and survey during the process. Assignment creation using VPL will be explained and concentrated in the course implementation.

The study could be continued by improving the course by using the feedback from students after the deployment of the course.

CONTENTS

1 INTRODUCTION

The goal of this Bachelor's thesis is to create an efficient SQL online course used among LAB University of Applied Sciences (LAB UAS) by improving the available resources and to generate a report of the constructing process. In other words, the thesis will comprise a product which is the SQL online course as well as a report in which the making process will be described.

In order to create a productive course, the making process is designed to include conduction of research related to the topic from available sources, verification of the possibilities, implementation with available MOOC, evaluation, and improvement. Thus, the dissertation will also cover those steps and be separated into theoretical and empirical parts. The theoretical part introduces the research and knowledge relating to the topic, as well as the possibilities to use them in production, while, the empirical consists of the rest of the steps from implementation to improvement.

The theoretical part covers three segments namely, SQL, MOOC, and SQL lessons using MOOC. In SQL and MOOC section, readers will be introduced general knowledge of what SQL and MOOC are, ways to access as well as the importance of them in reality. In the SQL lessons using MOOC, suggestions for the implementation will be addressed by giving information of positive and negative impacts on MOOC, introducing the MOOC and tools used in LAB UAS, design pattern as well as crucial SQL lessons included in the course.

The empirical part describes the process of course implementation based on activities conducted in reality such as researching, course implementing, content evaluating based on interview and survey feedback, as well as product improving.

2   STRUCTURED QUERY LANGUAGE (SQL)

2.1   What is SQL?

SQL is frequently mentioned and crossed over on the Internet, as well as in real life. Popular as it seems to be, not everyone is aware of what SQL actually is, and how it looks. This section will equip details about SQL by explaining its definition and origin, as well as providing examples.

2.1.1   SQL definition and history

SQL indicates Structured Query Language. Back in the early 1970s, SQL was known as SEQUEL (A Structured English Query Language) (Babu 2018). The importance of SQL is undeniable as the world has witnessed enormous positive changes in the way data stored and managed between the past and present.

Not so long before the creation of SQL, many businesses figured out the challenges of not having a systematic data approach and manipulation. In those days, every business, as well as individual, had their own convention to store and access the data. Paperwork was tough when workers had to dig through many kinds of documents to find out the information that is matched or related to a specific subject. The objective, as well as the biggest question, for every business in those days, was how to create the best and most productive elaborate database system, while for Data Science, is how to deal with what called persistent data. Persistent data refers to data that exists in a computer system endlessly before it is explicitly removed. (Chamberlin 2012, 78.)

In order to deal with these persistent data, DBTG and IMS language were proposed in the 1960s and gained huge public interests. However, these two languages are undoubtedly complicating to conduct. The creation of Codd's relational model at the beginning of the 1970s has simplified the concept of the database in a logical schema and out of concrete storage information. Codd's model also plays an important role in inspiring the two SQL inventors, Ray Boyce and Donald Chamberlin, to transform DBTG, a complex database language to a much simpler one using Codd's language. (Chamberlin 2012, 78-79.)

SQL was worked on for the first time in 1973 with the name of SEQUEL. During the first attempt, SQL (or SEQUEL specifically) was used within IBM to manage the data system (Chamberlin 2012, 78-82). The language shortly penetrated over the company and was adopted by many businesses either to use it and develop it to their own system (e.g.: Relational Software, Inc). Later in 1986, SEQUEL was standardized by ANSI and ISO, however, with the name SQL, due to trademark issues on the SEQUEL name (Babu

2018). Until today, SQL has become one of the most powerful database languages in the market and is used worldwide.

2.1.2 Example of SQL

Although SQL may come across mainly in programming, the language is used in different fields involved by data management, thus it is conducted not only by programmers. The human-readable nature of the language makes things easier and possible.

```
SELECT CustomerName, City FROM Customers;
```

Figure 1 Example of SQL- Simple SELECT statement (W3Schools 2020a)

Figure 1 shows a SELECT statement in SQL. It is easy to interpret from the statement that all CustomerName and City in the Customers table will be selected and shown. The below picture (Figure 2) describes how the result looks like.

Number of Records: 91	
CustomerName	**City**
Alfreds Futterkiste	Berlin
Ana Trujillo Emparedados y helados	México D.F.
Antonio Moreno Taquería	México D.F.
Around the Horn	London

Image 2 Example of SQL- Result set (W3Schools 2020a)

The result has 91 records (rows) and about two fields (columns) which are CustomerName and City.

```
SELECT Customers.CustomerName, Orders.OrderID
FROM Customers
LEFT JOIN Orders ON Customers.CustomerID = Orders.CustomerID
ORDER BY Customers.CustomerName;
```

Image 3 Example of SQL- Customized SELECT statement (W3Schools 2020b)

The above picture is also a SQL statement but more complex than the previous one. It does not simply select some fields from a single table, but select fields (CustomerName, OrderID) from a result of which table Customers join to the left of Orders table (LEFT JOIN) based on CustomerID from both tables, and orders and orders the result set alphabetically by the CustomerName.

The statement can become more complicated depending on what kinds of information users want to retrieve. However, in general, the data work is obviously still simpler and more manageable than in the past.

2.2   Importance of SQL

SQL has a great impact on the world in general in different aspects. This chapter will only cover the significances in three major angles which are Data Sciences, different industries as well as personal aspect.

As mentioned in the "SQL definition and history", the creation of SQL is a revolution of Data Science when the language is able to turn huge and complicating tasks like data management into structured and easy-to-manipulate ones. This transformation has set new targets for the data industry. Instead of inventing an elaborate database system with manageable principles, the target has broadened to processing with big data and machine learning today, and expectedly, much more in the future.

It is obvious that the IT and Computing industry is greatly influenced and benefited by SQL as it is one of the most popular and powerful database languages nowadays. The fact that Android and iOS apply SQL has led to the association between the smartphone industry and this programming language. The domination of the language does not seem to stop dominating only in technology fields but expands to various industries. A lot of businesses regardless of size, banks, hospitals, and schools have collaborated with SQL. Online transaction and analytics are the two prime examples of SQL usage in business. (Babu 2018.)

The great impact of SQL in the world has promoted itself as an essential skill for individuals. In terms of usage, traditional spreadsheets such as Excel help users to handle the data easily, however, the ability is limited or impossible with the large scale data. Whereas, SQL is able to manipulate a countless amount of data. Adopting SQL in a first-place enables businesses or individuals to save time and cost in the long run. Furthermore, having SQL skill assets individuals with plentiful job opportunities and high salaries. According to Indeed.com data, SQL is ranked in top required programing languages for jobs. As beneficial as SQL is, learning SQL is not challenging as there are many available approaches that are revealed in the next section (Babu 2018).

2.3   Ways to approach SQL knowledge

Data management is always one of the biggest emphasizes of every business, thus, as the most popular language regarding this area, SQL is in high demand. Having skills in SQL helps students or employees to have better job opportunities and higher salaries. As promising as it seems to be, learning SQL is actually not difficult for two reasons which are SQL is open source and there are abundant methods to achieve the knowledge on the web as well as in the market.

SQL lessons can be easily accessed in both traditional and modern learning methods. Reading books and learning face-to-face in classrooms are among the most common traditional ways that learners consider to start a SQL course. Modern learning methods refers to learning activities using online resources. The difference between the two types of methods (traditional and modern) comes from where learners adopt knowledge and information. In particular, learners can access the lessons online remotely and actively with modern methods, while with traditional methods, learners get the information through physical materials or lecturers passively. Although the traditional methods' efficiency is believed to be ensured as there are various books and physical courses created and updated from time to time, modern methods, studying online particularly, have various self-study advantages enabling it to outshine the traditional ones. These advantages will be revealed in the next chapter.

3 MASSIVE OPEN ONLINE COURSE (MOOC)

3.1 What is MOOC?

MOOC stands for Massive Open Online Course, which is interpreted as a course that can be accessed openly and freely using the internet by massive numbers of users. The course is equipped with either lesson in different kinds of formats such as lecture text, videos, quizzes, and projects, or an interactive community environment where students can ask and exchange the knowledge with each other or with the lecturers. The interactive community environment plays an important role in MOOC due to the impact of connectivist theory which states that networking and connection have a positive influence on collecting knowledge. Some MOOCs provide credits for completion, however, it is not compulsory to give ones and those credits are not followed any specific convention. In practice, MOOCs can be separated into two smaller groups referring to two different types of platforms which are cMOOCs and xMOOCs. (Kesim 2015, 16.)

cMOOCs stands for connectivist MOOCs, which was founded based on connectivism theory principles. The theory believed that, as mentioned above, knowledge derives from connections among people (not only from lecturers to students), and the development of the internet enables the growth of the social network, therefore, also the knowledge. In cMOOCs, every user takes their own actions on the learning goals and processes, and importantly, the connections from which the knowledge is received. As a result, cMOOCs platform focuses on building personal learning environments (PLE) and personal learning networks (PLN). (Kesim 2015, 16-17.) The advantage of cMOOC is the knowledge can be vast and not limited by any structures, levels, or titles as everyone can learn and be learned (ExtensionEngine 2019).

The "x" in xMOOCs stands for extended (ExtensionEngine 2019). xMOOCs platform follows the traditional education system, in which, lecturers deliver lessons, and students adopt the lessons and implement the coursework remotely at their own pace. Although xMOOC is separated from cMOOCs for the lack of interaction among the community, some xMOOCs do have a channel where students can question and get answers from other colleagues or sometimes the course lecturers. However, the interaction channel is not as free and interactive as in cMOOCs. The biggest benefit of xMOOCs is the ability to expand to an enormous number of university-level students around the world (ExtensionEngine 2019). Recently, most of the term "MOOCs" mentioned refers to xMOOCs. xMOOCs are used commonly among the universities, Specifically at LAB University of Applied Sciences, the thesis's case study.

3.2   Why MOOC can enhance self-study

The importance of MOOC toward self-study is undeniable thanks to its "massive", "open" and "online" feature. The benefits of these features will be further explained below.

"Massive" character grants access for a large scale of users fitting the prerequisite to the courses. Consequently, users have high opportunities to attend the wished courses. "Open" can be interpreted as free of charge or open access. Free of charge contributes considerably not only to self-study but also to knowledge adoption for student groups who are passionated but have limited financial conditions to acquire face-to-face classes. With the meaning of "open access", learners are freely approached courses provided by the world's top universities in different subjects, which is impossible in history. Finally, "online" is the most essential factors defining MOOCs and accommodate them with great benefits.

"Online" makes it possible to widespread the knowledge and lessons on the global scale with the least effort and time. No matter how massive the number of participants can be up to, or no matter how open and free the course access is, MOOC cannot be considered as an education revolution if it cannot be adopted widely around the world with the Internet. Furthermore, the Internet enables updates and corrections of the content remarkably faster and easier in comparison to producing coursebooks. For users, learning has never been easier as what needs to be done before the lessons is ensuring the availability of the internet and device in their current location, instead of browsing in the library, paying for the class, or traveling.

Due to the abundant benefits and conveniences of MOOCs, more and more learners adopt this kind of learning method, which raises the demands for MOOCs. Eventually, MOOCs have become a business for many schools, universities, or individuals (Shah 2018). The more and more parties jump into this business, the more courses will be created and the better the qualities are (due to the high competitiveness). As a result, self-study is not only supported by MOOCs' conveniences, but also with the high-quality knowledge and teaching methods.

3.3   Examples of MOOC

MOOCs have started to be created and developed since the rise of the Internet, and especially, have gone viral in the last two decades. Among the huge amount of MOOC platforms available in the market, Coursera, EdX, and Udemy are in the list of the most familiar and trustworthy platforms. These three platforms will be described further in this section.

Coursera is the largest MOOC platform with up to 56 million users since the establishment. The platform comprises a massive number of courses ranging from different fields and is cooperated with more than 200 partner institutions. (Coursera 2019.) As a result, users can find almost every course from different subjects in Coursera. However, as the platform is supported by private financial funds, its courses regularly cost, and the number of free of charge courses is limited.

EdX is also established in 2012, but with a non-profit basis (Edx 2020a). Having more than 145 partner institutions, EdX is able to offer a huge selection of courses ranging from different majors (Edx 2020b, 3). The courses in Edx are free of charge for the audit version and paid for the certificate achievement. Some credits earned in Edx can be used for the Master's Degree with MicroMaster (Edx 2020b, 7).

Udemy was created in 2010, since then, the platform has risen up to 65 thousand courses and over 14 million users (MBA Crystal Ball, 2018). The partners in Udemy is not necessary universities or any institutions but can be individuals with specific expertise. Courses in Udemy are mostly not free of charge and entitled with certificates.

All of these three platforms offer users an enormous number of courses with a wide spectrum of fields and subjects. However, Coursera and EdX have more focus on the academic approach, while, with Udemy, users can adopt a new skill quickly or out of interest. In terms of cost on average, Coursera is the most expensive and can vary from $50 to $500, Udemy can be between $10-$200, and EdX can be free unless certificate tracking is adopted (Networks Training, 2020). Regarding course providers, Coursera and EdX courses are provided by universities and institutions, while Udemy can be from an individual instructor, thus, the course quality of the first two platforms are more ensured. Considering the range of topic, Udemy has more options from different subjects including subjects of interest, Coursera offers more courses relating to professional training, and EdX is quite similar to Coursera, however, it offers a huge number of courses in humanities and natural sciences (Networks Training, 2019; Edukatico, 2019).

4   SQL LESSONS USING MOOC

Up to this chapter, online courses are known with an abundance of benefits to users in learning and institutions/ personals in wide-spreading their lessons. However, the fact is only true with the well-conducted courses. A poorly organized course not only causes troubles to instructors which is wasting more time to troubleshoot and fix flaws but also creates bad learning experiences for students, which may result in the avoidance of attending similar courses by similar instructors. To be fair, these problems can also happen in traditional courses, however, it is much easier to fix in these cases, as instructors are able to make up directly in the classrooms. In order to prevent the negative consequences, an online course need to research, justify carefully which elements are positively influenced or suitable for the course, which one is inappropriate, familiarize the online course platform and design course pattern and content. This chapter aims to implement these steps for the SQL course.

4.1   Features of a good MOOC

An excellent online course not only benefits the study of learners but also the work of instructors. As a result, this section will focus on these two angles and collecting the valuable elements affecting them. In consideration of students' experience, the section will address five aspects (Organization and Structure, Communication, Student Orientation, E-learning Course's strategies, and Instructors' qualification) can be improved in an online course and align the impacts of them to the "Seven Principle of Good Practice" (Astin et al. 2003, as cited in Sorensen & Baylen 2009, 69-85). Regarding the instructors' benefits, the section will point out the help of the Email Archival and online course's utilities.

The **"Seven Principles of Good Practice"** indicates sufficient factors generating productivity in many learning environments including the online one. They are student-faculty communication promotion, students' collaboration boost, active learning support, feedback giving support, task-timing assistance, expected communication and varied talents, and learning methods encouragement. During this section, some suggestions are gathered in order to apply the principles in an online course.

Courses' organization and structure play an essential role in an online course. Understanding the organization and structure well enables students to learn actively and adopt different learning methods suitable for them. The course's organization needs to be simple, synchronized, and purposeful. The first two attributes help learners to find needed information or tools with the minimum effort, thus, enhance the active learning. The last attribute ensures the efficiency of the course.

The simplicity can be approached by preventing the excess of course management (Haley 2008, 22). Even though course management utilities are created with purposes, making use of unnecessary ones can cause confusion for the users. Hence, the instructor needs to make sure only the topmost necessary course management tools handled and not distract the main content.

The synchronization is important, as it helps the course's structure becomes transparent for the users. The course can approach the synchronization by following a specific design pattern throughout the course. The design pattern should provide options for varied learning methods, such as letting students either submitted group or individual assignment (with an equivalent amount of work), and the ability to learn at their own pace.

 Finally, the course's structure needs to be strategic. The course should be organized in the way that the content, assessments, and pedagogical are aligned to the course/module's objectives (Hirumi 2009, 49-50). It would be unprofessional and irritating when the assessment tasks are not relevant to what learners have been taught, or the content and events are not what they expect to learn based on the course/module's description.

Communication is always a critical aspect basically in everything. The importance of it in a learning environment can be easily spotted in the mention of the "Seven Principles of Good Practice", as it makes up at least four out of seven areas (student-faculty communication, students' collaboration, feedback, and expectation communication). The gravity of communication, thus, has created difficulties in transforming from traditional classroom to e-learning course, as there is no longer or limited direct communication. Luckily, the advance in technology and tools have now significantly enhanced communication in online courses. This part reveals three communication channels can be utilized in online courses to approach dynamic information exchange, which are email, discussion forum, and chatbox.

Email is a typical communication channel between students and instructors, as well as among students. A good online course contains an active and easy-to-find email channel between students and instructors. The activeness of the email can be varied depending on the size of the class and should be clearly announced before starting the class. In case there is any trouble preventing the answer from returning in the agreed time, the instructor needs to inform the students about the delay. This small action helps to maintain, or even gain the countability of this kind of communication channel from students' perspective. The Email Archival part will discuss this case handling in order to optimize instructors' work. Email can also be used to send feedback to learners. There are two types of feedback which are confirmatory and corrective feedback. The confirmatory one is sent to

confirm that the action made is correct, while, the corrective one is to point out the incorrect field needs to be fixed.

A discussion forum is another useful and easy-to-approach tool for communication. If email applies for personal and private matters, the discussion forum is open for everyone in the course to exchange information and find collaborators. The advantage of the discussion forum is that the instructors can post some related questions or interesting facts about the current topic and students can participate in the discussion or answer other students' problems. This approach will also foster active learning ability in students. However, the instructor needs to control the discussion forum to ensure it does not become a teaching space, and the conversation will not go too far from the topic.

Chat rooms can be considered in online courses to support online interaction. Equipping with the real-time feature, chat room is regarded as an alternative for a face-to-face session where instructors and students gather online to convey ideas and get responses quickly. When putting the chat room in practice, class size per session should be highly considered, as many questions and subjects can be missed or unanswered, thus, the session quality is not ensured. An informal setting is recommended in the chatting session to promote the pace of idea exchange, as participants are not worried about their grammar or using shortcuts during the conversation. However, if it is not an uncomfortable approach for some instructors or cultures, it can be changed upon. Rewarding for session participants can be applied in order to generate students' enthusiasm and competitiveness to attend the chat room.

Student Orientation is an essential step before starting an online course (Haley 2008, 45). It is not uncommon that some students in the class have to drop out because of the unfamiliarity of the course's tools, or the lack of workload acknowledgment. These problems are quite challenging and time-wasting with the ongoing course, however, they are much easier to solve or negotiate at the beginning of the lecture if the students are equipped with the course's overview and supported with their troubles. That is the reason why the orientation comes to place. It gives students a general view of the course's organization, protocol, content, and tools, as well as curtails the possible struggles, for example, in terms of technology, materials, or workload in the early stage. The orientation can be organized in different forms, either by physical meetings, emails, instructional videos, or the combination of them. It is not critical which arranging form is chosen, however, the instructors need to make sure that the orientation's duties can be delivered to all students. For instance, a face-to-face class is a nice approach for the orientation, still, it is not simple to gather all students to a place at one time, especially with the nature

of online courses. In this case, an instructional email or video should be ready to deliver to those students unavailable for the session. The content of the email will be detailed in the "Student Orientation" email in the Email Archival part. Aligning to the seven principles, the orientation is considered as a tool to give the course's expectation or initial feedback, to navigate students where to get contact information with the instructor and which utilities for the collaboration, as well as to foster their active learning.

There are various ways to approach students depending on the nature of the course. Thus, there are multiple **instructional design strategies** to conduct. Hirumi (2009, 51-53) has suggested nine different instructional models with detailed steps, which will be shown in pictures below.

Nine Events of Instruction
1. Gain Attention
2. Inform Learner of Objective(s)
3. Stimulate Recall of Prior Knowledge
4. Present Stimulus Materials
5. Provide Learning Guidance
6. Elicit Performance
7. Provide Feedback
8. Assess Performance
9. Enhance Retention and Transfer

Student-Center Learning
1. Set Learning Challenge
2. Negotiate Learning Goals and Objectives
3. Negotiate Learning Strategy
4. Construct Knowledge
5. Negotiate Performance Criteria
6. Assess Learning
7. Provide Feedback (Steps 1-6)
8. Communicate Results

Jurisprudential Inquiry
1. Orientation to the Case
2. Identifying the Issues
3. Taking Positions
4. Exploring the Stance(s), Patters of Argumentation
5. Refining and Qualifying the Positions
6. Testing Factual Assumptions Behind Qualified Positions

Simulation Model
1. Orientation
   - Present topic of simulation
   - Explain simulation
   - Give overview
2. Participant Training
   - Set-up scenario
   - Assign roles
   - Hold abbreviated practice
3. Simulation Operations
   - Conduct activity
   - Feedback and evaluation
   - Clarify misconceptions
   - Continue simulation
4. Participant Debriefing
   - Summarize events
   - Summarize difficulties
   - Analyze process
   - Compare to the real world
5. Appraise and redesign the simulation

Direct Instruction
1. Orientation
   - Establish lesson content
   - Review previous learning
   - Establish lesson objectives
   - Establish lesson procedures
2. Presentation
   - Explain new concept or skill
   - Provide visual representation
   - Check for understanding
3. Structured Practice
   - Lead group through practice
   - Students respond
   - Provide corrective feedback
4. Guided Practice
   - Practice semi-independently
   - Circulate, monitor practice
   - Provide feedback
5. Independent Practice
   - Practice independently
   - Provide delayed feedback

Experiential Learning
1. Experience—Immerse learner in "authentic" experience.
2. Publish—Talking or writing about experience. Sharing thoughts and feelings.
3. Process—Debrief: Interpret published information, defining patterns, discrepancies and overall dynamics.
4. Internalize—Private process, learner reflects on lessons learned and requirements for future learning.
5. Generalize—Develop hypotheses, form generalizations and reach conclusions.
6. Apply—Use information and knowledge gained from lesson to make decisions and solve problems.

Inquiry Learning
1. Confrontation with the Problem
   - Explain inquiry procedures
   - Present discrepant event
2. Data Gathering—Verification
   - Verify nature of objects and conditions
   - Verify the occurrence of the problem situation
3. Data Gathering—Experimentation
   - Isolate relevant variables
   - Hypothesize and test casual relationships
4. Organizing, Formulating and Explanation—Formulate rules or explanations
5. Analysis of inquiry process—Analyze inquiry strategy and develop more effective ones.

Inductive Thinking
1. Concept Formation
   - Enumeration and listing
   - Grouping
   - Labeling, Categorizing
2. Interpretation of Data
   - Identify critical relationships
   - Explore relationships
   - Make inferences
3. Application of Principles
   - Predicting consequences
   - Explaining predictions
   - Verifying predictions

Problem-Based Learning
1. Starting a New Problem
   - Set problem
   - Describe requirements
   - Assign tasks
   - Reason through the problem
   - Commitment to outcome
   - Shape issues and assignment
   - Identify resource
   - Schedule follow-up
2. Problem Follow-Up
   - Resources used
   - Reassess the problem
3. Performance Presentation(s)
4. After Conclusion of Problem
   - Knowledge abstraction and summary
   - Self-evaluation

Image 4 Instructional Design Models (Hirumi 2009, 51-53)

It is not necessary for instructors to follow these steps for a specific lecture model, as long as the information flow is logical and easy for students to manage.

The role of the **instructors** will not vanish even when they may not appear in the online lesson. The obvious reason is that they are the backbone of those lessons. Contributing good intellection may be enough for a satisfying course, but for a successful one, they also need to adapt requirements as an online teacher. According to Karen Heise (2008, 11-14), a prosperous online course requires six characteristics from an instructor, which are Eagerness to learn, Passion for teaching, learners, and the teaching area, Devotion, Detail Orientation, Resilience, and Patience.

The shift from physical class to the online course requires an instructor to intake different instructional and technological knowledge. As the nature of the two teaching methods is distinctive, the traditional pedagogical methods may not be applicable, and the methods can be diverse in different study fields. Additionally, the constant development of technology, the learning will never end to keep up the trend. Thus, having the enthusiasm to learn is imperative for an online instructor in order to generate an excellent course and gain competitiveness in the e-learning market.

Not many people actually choose careers based on passion. However, it is undoubtfully a huge advantage for work prosperity, including an educational career. In online teaching, one of the key success is the ability to create an engaging and delightful learning environment for as many students as possible. In order to implement this work, the instructor should accommodate extensive energy and enthusiasm. Passion for teaching, for students and for the teaching area is able to support this accommodation work.

 Devotion is fundamental for people working in the educational field. Similar to the traditional class, teachers have to spend extra hours outside the lecture to answer students' question or solve their problems. Switching to online courses can lead to the greater dedication, as an online course can be approached to a bigger number of students, and online communication is easy to access.

Spotting students' problems is manageable in a physical classroom through direct interaction. The same work is not accessible in the online course, thus it requires instructor the sensitivity in detail. For instance, a student normally is well-done in the course, however, he/ she takes longer time or performs poorly in a particular part. Pointing out this small difference could help the teacher solve the student's problem immediately,

or improve the quality of the part. Addressing potential questions and solutions before the students actually ask is also a sign of detailed orientation.

A common reason why students choose online courses is because of the flexibility. They are able to take the lessons in their free and most favorable time. Hence, it is not unexpecting that instructors may receive emails asking for help during an exotic time, such as midnight or holiday. It is understandable that instructors are not necessarily available in those times, however, in general, they are demanded with higher availability in "off" hours. In addition, instructors sometimes need to be flexible on deadlines with some students' special situations, such as course overload, or health issues.

Patience is considered as the most essential characteristic in the list due to the modern feature of the learning method (Heise 2008, 13-14). Although e-learning is no longer a phenomenon in the world, it has not yet arrived for everyone. As a result, it is expectable that a class may consist of one or several students that may not know the proper and efficient ways to handle the course. Spending time with these students for the problems is necessary for their later course experiences. This task requires enormous time and effort, indeed, great patience, and dedication from an online instructor.

Online courses demand enormous effort and time from an instructor, especially in terms of communication. A **collection of pinned emails for general purposes** assists the instructor's work with lesser effort while maintains the efficiency in learning experiences. Extracting from Karen Heise's work (2008, 43), nine email types should be constructed for long-term usability, including "Welcome to the Course", Student Orientation, Help emails, Guidance for communication channels, Lesson Announcements, Offline Notifications, Timing Reminders, Details for the final test, Elimination notices.

"Welcome to the Course" email is used to inform the students at the beginning of the course with brief information about the syllabus, conducting rules and timetables, as well as to build an enjoyable learning atmosphere (Chen et al. 2015). According to the research, the email insists of course targets, common misunderstanding explanation, course handling description (whether it is completely online or requires other interaction, how interaction effects on the grade), meeting place details (if a direct meeting is included), course timetable, supporting contacts, related learning materials, and communicating methods (how students get notifications from the course, or how to give questions or feedback to the instructor).

Student Orientation email is also sent at the beginning of the course to minimize students' confusion during the course. If the "Welcome to the Course" is used for the course's general ideas and protocols, this one plays a role as the guidance for the success course

management. The email includes steps or instructions to get started with the course (e.g: finding the course material with course id and enrolment keys), how communication channels work, how to use the available course utilities (e.g: calendar to mark events), how the assessment operates, to what limit the students can be dropped out, as well as other useful advice for the course implementation. As having been mentioned from the "Student Orientation" part, the orientation can be conducted by face-to-face meeting, email or video. However, having an email archival for this event is useful, as the students can look back to the instruction during the ongoing course, instead of asking the instructor in the first place.

The rest email archival items are not always needed in every online course. However, in the long term, almost every instructor faces situations where they show power. Help emails are delivered when there's an event or task requiring new tools or information that have not been covered in the "Student Orientation" to provide supports for students' performance. For example, the task expects students to deliver in a report format, then, an help email can come in place with a report template or formatting instruction. Communication channels Guidance is necessary in those occasions when an interaction is required as a compulsory task. In optional cases, the students can gain the information from the "Student Orientation" letter. Lesson Announcements are used to inform events or information relating to the lessons. However, it is not a tool to deliver lecture notes, as it cannot be reused in other courses. Offline Notifications are used to inform the instructor's unavailability at a certain time. Timing Reminders alert important events or deadlines. Details for the final test describes the time, location, conducting methods, covered knowledge, and assessing criteria for the final or other exams. Elimination notices are used for students who have been dropped out systematically or manually.

The evolvement of technology has greatly supported teaching creation and performance, especially in a distant learning environment. An online course can be equipped with many **plugins and utilities** to assist the learning and teaching process. For example, in a programming language course, a workspace can be provided for students to test the codes in real-time and submitted directly. With programmed solutions, the students can get the results immediately, and the instructors do not need to waste time to go over a big amount of students to check the solutions. Another outstanding tool is calendar, which enables students to mark the schedule and notify the incoming events. However, the course should prevent too many extra tools included to reduce learners' confusion.

4.2   Moodle and VPL

Following the emerge of e-learning trends, a variety of e-learning platform is established in the market. However, this part only covers Moodle which is one of the most well-known platforms and is used by the Finnish Universities of Applied Sciences. Additionally, the part also introduces briefly some outstanding utilities or plugins applicable in Moodle and concentrates on the VPL plugin.

Moodle stands for Modular Object-Oriented Dynamic Learning Environment. It provides a powerful, secure, and immaculate environment where educators can generate courses and lessons, and learners can approach their wanted ones. Moodle is considered to be a platform for global usage thanks to its trustworthy characteristic in numerous organizations and institutions, easy-to-handle, flexible, integrated and secure features, various available resources, no licensing fees, and having strong community backing up. The flexibility to customize, detailed instructions, and a wide range of available utilities enable instructors to easily manage their courses and contents based on targeted audiences. (Moodle 2020.)

There are a variety of utilities and tools provided in Moodle to ease the teaching process as well as enhance the user experience for learners. Teachers are allowed to create different types of activities such as creating lessons and assignments, chatting sections, forums, feedback, etc. Moodle's main website also provides a quick guide for teachers who have to launch their first course with the platform. Grading systems or tracking progress are common tools for teachers and students to evaluate the learning situation. For group activities, the user grouping tool can be helpful and time-saving for teachers. Regarding content management, some useful tools such as file/ folder/ media handler, document converters, and plagiarism checker are provided. File/ folder/ media handler can be adopted to process with submission either in file, folder, or media (image, sound, video) format. Document converters are needed to convert students' submissions to PDF format. Plagiarism checker is highly recommended in academic work. It helps to prevent students from copying from other authors' work. (Moodle 2020.)

VPL stands for Virtual Programming Lab which is used in programming exercises management. VPL allows students to edit, run, and get checked the coding tasks in the browser, and teachers to evaluate with less time and effort. Besides the common attributes such as grading, grouping, and access management, VPL comprises various features suitable for programming exercises such as submission and file management, running and evaluating processes, and authorship control. Teachers are enabled to customize submission settings such as accessing time period for submissions and task descriptions, limits for number and size of file upload, etc. Code editor utility can be

applied for editing in the browser. The file can be set with initial values or displayed with highlights. VPL has run and debugged script for different programming languages such as C, C++, C#, Java, and SQL. In order to enable evaluation, scripts definition and evaluation files need to be provided by the instructors and may be followed other VPL instances. Students' submissions can be evaluated in each submitting time. Regarding managing authorship, VPL enables users to seek for related files, and teachers to avoid students' external pasting. Moreover, code can be set to include the watermarks when downloaded. (VPL 2020a; VPL 2020b; VPL 2020c.)

4.3   Keys for online course design

Following design keys for an online course is beneficial not only for students' learning experience but also for instructors' teaching process. According to Simonson et al. 2000, Moore & Kearley 1996, Sherry & Morse 1995 (as cited in Zheng and Smaldino 2009, 112-124), seven elements should be considered in an online course design, which are student concern, content, teaching strategies, media, learning environment, course evaluation, and materials.

According to the research (Zheng & Smaldino 2009, 113-118), there are four aspects of **students** should be taken into account, namely, characteristics, engaging ability, student support for needs, and student support for satisfaction. Determining students' characteristics relating to their study's styles, knowledge, or interests enables an online course produce more study options which approach diverse types of student.

Engaging activities help distant learners to beat the feeling of being isolated, accommodate themselves to the flexible environment as well as to gain diverse interacting experiences (Belanger & Jordan 2000, as cited in Zheng & Smaldino 2009, 114). Engaging activities can be divided into three types which are student-content, student-instructor, and student-student engagement (Moore & Kearsley 1996, as cited in Zheng & Smaldino 2009, 114). Student-content engagement refers to the interaction between the students and lessons and events available in the course. Student-instructor and student-student indicate communication or collaboration between students and instructors or among students. The engaging activities can be weighed up for the most appropriate one, however, it is recommended to include all types to create a variety of experiences.

Support for students' needs can be conducted in several ways by instructors and faculty. Instructors can provide help by actively paying attention to potential challenges in students' angles and sending support feedback. Faculty play an important role in connecting students with suitable online courses. In order to do that, the faculty should

involve in courses' design and delivery, and access to students' expectations and skills. Personal student support is as important as the general one. A direct communication channel between student-instructor, and student-faculty should be facilitated for the purpose.

Ensuring satisfaction and comfort in learning is key for positive learning experiences. One of the best approaches to create a comfortable learning environment is by familiarizing the students with the online course platform and tools. This task can be conducted at the beginning of the course, which is described in the Student Orientation part, or during the ongoing course by communicating with the instructor or faculty.

The element **content** not only refers to the information included in the course but also the organization of information. The course information is undoubtfully important. The information or subjects need to adapt to students' skills and expectations. Meanwhile, the course organization provides the most accessible way to collect information, as well as providing tools to support their study.

In the previous section "Feature of a good MOOC", some strategies for interaction suggested by Hirumi have been demonstrated. Instructors can apply one or several models to create the most accessible lectures. Besides **strategies** relating to interacting models, Willis (2000/ 2001, 197) has also recommended teaching principles for a productive course. The principles consist of five criteria which are applying a variety of course events, creating related and familiar examples frequently, keeping the lesson concise, adopting knowledge enhancement through feedback and communication between student-student or instructor-student, and finally being patient to see the result.

 Until this decade, almost everyone is familiar with the existence of the Internet. Conducting an e-learning course through the Internet is accessible and efficient. However, it is necessary to take into account the fact that not every student has studied online before. For example, students in mountainous areas where have limited access to the Internet may feel more comfortable with lectures from TV. Choosing proper **media** for lecture delivery is necessary for better user experiences.

Evaluation is a crucial phase in instructional design. It helps to determine whether the outcomes meet expectation, materials and instructonal events are productive, students accomplish their objectives, as well as to improve the course quality by using feedback (Morgan & O'Reilly 1999, Belanger & Jordan 2000, as cited in Zheng & Smaldino 2009, 122-123). Three criteria are suggested to take into consideration in terms of productivity when evaluating an online course are the number of learned content, skill practice, and students' feedback on the learning experience. In terms of content, the instructor needs to

make sure the content learned can classify students' levels relating to a specific topic, and align them to the course's standards as well as the students' goals. Putting skills in practice is encouraged in education, as it helps students to get familiar with the methods in reality. A real-life working environment or project can be set for such an approach. Finally, feedback from students relating to course satisfaction greatly influences the improvement of an online course. Thus, the feedback section should be included in instructional design.

One of the most important sections in learning **material** is assessment exercises. A good assessment is not only able to create practical cases for the lesson, but also to evaluate the students' abilities and coordinate them with the course's and students' objectives. Creating diverse options for exercise as well as providing materials for further personal research are highly recommended for the variety of student's learning methods. Lastly, identifying appropriate methods for the assessment should be considered in order to create the most efficient and less effort-requiring assessing tasks for instructors. For example, plagiarism and grammar checking can be installed for each submission in courses relating to literature. This method allows the instructor to save time and focus on other important criteria.

4.4   SQL lessons

This section will discover SQL knowledge in vertical and horizontal aspects. In the vertical aspect, the whole structure of SQL knowledge is generally reviewed and divided into basic and advanced levels in the first sub-section. The basic level of SQL will be horizontally analyzed and explained in depth in the second sub-section.

4.4.1   The overview of SQL

According to Michael Donahoo and Gregory Speegle (2005, 7-11), SQL can be divided into thirteen criteria. They are basics of data, elementary selection, result reformat, result aggregation, join function, set queries (Union, Intersect and Except), subqueries, data modification, table modification, views, transactions, database privileges, and cursors and triggers. As can be seen from the list, SQL knowledge is quite various in different aspects. However, in order to use it in real life, learners are not necessary to understand all these aspects in the beginning, but only the basic and most essential ones. This part will introduce briefly all criteria mentioned above from the essential (the first nine criteria) to the (more) advanced ones.

Basics of data include basic information to get familiarize with database components such as table, data types, null, primary key, and table relationship. Elementary selection comprises commands supporting data selection such as SELECT function, row selection, comparison operators, string comparisons, LIKE function for string patterns, and other sets of functions such as NOT, AND and OR, BETWEEN, IN, IS NULL, and WHERE. Result reformat consists of functions to modify the structure of query results, which are AS for column naming, DISTINCT and ALL to encounter duplications, acquired features, WHERE, ORDER BY, CAST, and conditional terms (CASE, COALESCE, and NULLIF). Result aggregation consists of functions to combine results having the same categories. Functions relating to this area include AVG, SUM, MIN, MAX, COUNT, GROUP BY, ORDER BY, HAVING, DISTINCT, and WHERE. Join commands are used to merge two or more tables having at least one same area into one table. Join functions separates into INNER JOIN, OUTER JOIN, NATURAL JOIN, and CROSS JOIN. Subqueries refers to those queries that have query inside another. Some commands can be used to manipulate data such as INSERT for row insertion, DELETE for row removal, and UPDATE for row value update. Table modification includes table creation (CREATE), deletion (DROP), and alteration (ALTER), which is also known as Data Definition Language (DDL).

Views in SQL are virtual tables extracted from the SQL statement result. Users can create, update, and delete views for their own purpose. Transaction in SQL refers to work conducted against a database. The control of transactions consists of commands such as COMMIT, ROLLBACK, and SAVEPOINT, and can be used only with Data Manipulation Language (DML) commands (INSERT, UPDATE, DELETE). (Tutorialspoint 2020.) Database privileges can be set with GRANT, REVOKE, and PUBLIC commands. Cursors and Triggers are database objects. Cursor retrieves data row by row from a result set (Pandere 2020). The trigger is a procedure that will automatically be called when special events such as DML or DDL happen (GeeksforGeeks 2020). The cursor is used for network flow reinforcement, while, the trigger is for the maintenance of database unity.

4.4.2 The essentials of SQL

The first requirement for data workers is to obtain the ground basics of data in the adopted data language/ system. SQL users, in particular, need to understand the concepts relating to database tables, data types, null, primary key, and relationship types (Donahoo & Speegle 2005, 3-21). In SQL, data is stored in the form of tables with unique names. Each table consists of rows and columns. Columns in the table indicate categories for data objects and are distinguished from each other by column names. Meanwhile, each table

row demonstrates a data object which can also be known as a database record. The picture below describes how a typical SQL table looks like.

CustomerID	CustomerName	ContactName	Address	City	PostalCode	Country
1	Alfreds Futterkiste	Maria Anders	Obere Str. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Around the Horn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

Image 5 SELECT result set (W3School 2020a)

The table above contains five rows, excluding the column names row, which corresponds to five records (objects). Each record is separated into seven columns representing different categories, namely, CustomerID, CustomerName, ContactName, Address, City, PostalCode, and Country. The name of each column in one table must be unique. The same rule name is applied to the table. A database can consist of many sets of tables, keeping names unique prevents replacement or loss of data.

SQL language consists of five basic data types which are string, numeric, temporal, binary, and Boolean type. A string data contains one or multiple characters, of which the amount is declared in advance. There are two ways of declaring the string type which are CHAR and VARCHAR (or CHAR VARYING). Data declaring with the former one has to have exactly the amount of characters and length identified in the setting, while, data with the latter can be varied within the limit. (W3Schools 2020c.)

Numeric type is used for numbers. Categories served with whole number use INTEGER (INT), SMALLINT, and BIGINT for declaration. The difference between the three types is their range, specifically, SMALLINT has the smallest range for whole numbers (-2^{15} to $2^{15}-1$), BIGINT has the biggest range (-2^{63} to $2^{63}-1$), and INT has the middle range (-2^{31} to $2^{31}-1$). Selecting appropriate an range for the whole numeric data not only helps to enhance database performance but also prevents errors in inserting data. (Zelen 2020.)

For fractions, there are several ways to declare the type which are NUMERIC, DECIMAL (DEC), REAL, DOUBLE PRECISION, and FLOAT. NUMERIC and DECIMAL are used for the fixed-point numbers. They accept two arguments which are the maximum of the total

number of digits (p) and the maximum number of digits in the right of digit point (s). For example, when a number is declared as NUMERIC (6, 2) or DECIMAL (6, 2), it means the number can have a maximum of six digits in total (including fractional part), and maximum two digits in the fractional part. Numbers such as 123.45 or 1234.56 are accepted in this case, while 12345.67 or 123.567 will not be passed as the numbers of digits are exceeded. In general, NUMERIC and DECIMAL are similar to each other and are recommended in circumstances where accurate calculations are required. A difference between these two types is the real precision of the number declared with DECIMAL may go beyond p in the declaration for more convenience, however, the number of digits of the fractional part is still ensured. (Donahoo & Speegle 2005, 5.)

REAL, DOUBLE PRECISION, and FLOAT are similar to each other, as they accept rational numbers which are appropriate for the chosen type range, instead of the number of digits. The range of these types is limited with bits for mantissa and storage bytes. Number types can be defined with FLOAT type with a number of bits for mantissa storage (e.g: FLOAT(22)). The minimum and maximum for the mantissa bits are 1 and 53. REAL type uses 24 bits for mantissa storage (FLOAT (24)), thus, it makes up a maximum of four bytes in storage. DOUBLE PRECISION has 53 bits for mantissa (FLOAT(53)) and holds 8 bytes in storage. Defining number type as FLOAT (without any number following) will be considered as FLOAT 53, which also known as DOUBLE PRECISION. (Microsoft 2020; W3Schools 2020c.)

Temporal data can be stored in SQL with several data type options. With DateTime data, users can choose either DATE (YYYY-MM-DD), TIME (HH:MM:SS), or the TIMESTAMP which is the combination of DATE and TIME (YYYY-MM-DD HH:MM:SS). Temporal data can also be interpreted as interval data (INTERVAL). The interval data can be created by identifying type for the interval (e.g: YEAR, MONTH) and place the amount of interval in string form between the keyword "INTERVAL" and the type (e.g: INTERVAL '2' YEAR). (W3Schools 2020c.)

SQL allows binary data to be stored. Examples for binary data includes photo, and multi-media such as sounds and video. There are three available binary types which are BIT, BIT VARYING and BINARY LARGE OBJECT (BLOB). Following the type declaration is the storage size limit. The given size is fixed for data entry using BIT, and is the maximum point for BIT VARYING and BLOB. BLOB is used for larger data than the other two. (Donahoo & Speegle 2005, 7-8.)

Similar to other programming languages, BOOLEAN is supported in SQL. There are three available values that can be stored with BOOLEAN in SQL, namely TRUE, FALSE, and UNKNOWN. (Donahoo & Speegle 2005, 8.)

NULL is used for an optional field that does not have any value. NULL can be used for value comparison or filter selection with "IS NULL" and "IS NOT NULL" clauses. The NULL value is not accepted in columns declaring as PRIMARY KEY. (Donahoo & Speegle 2005, 8.)

PRIMARY KEY is used to mark a column as an identifying factor for the records. Playing a role as the identifier, PRIMARY KEY columns are required to be unique and not NULL, which means a data record will not be accepted if the primary key field is blank or duplicated with another available record in the table. PRIMARY KEY is not compulsory in every database table, however, it is essential in those tables which demand a separation between records, such as banking data. (Donahoo & Speegle 2005, 9.)

Data can be stored separately in different tables for brief and coherent interpretation. For example, library data can be split into many tables such as 'books', 'customers', and 'loans'. These tables have relationships with each other through PRIMARY KEY columns. The 'loans' table may have customer, and book identity numbers to connect to 'books' and 'customers' tables. The relationship between 'loans' tables and the other two is called One to Many relationship. Besides One to Many, there is also Many to Many relationship between tables and PRIMARY KEY columns also take responsibility as connectors.

The SELECT statement allows SQL users to selects records from database tables. The syntax 'SELECT * FROM table_name;' is used to select the whole row records from a table named table_name in this case. The 'table_name' should be replaced with the real table name in reality. Users can limit the categories of records to show by selecting the desired columns with syntax 'SELECT column1, column2,.. FROM table_name;". (W3Schools 2020a). Regularly, data selection is not merely choosing all the records with needed categories, but also with conditions. Before starting condition requests, the WHERE clause needs introducing. Operators can be utilized for condition generation. Operators in SQL include '=' (equal), '<>' or '!=' (for not equal) depending on SQL version, '>' (more than), '<' (less than), '>=' (more than or equal), '<=' (less than or equal), BETWEEN (middle of a specific range), LIKE (for pattern comparison), IN (for value comparison between certain column fields and the suggested values). (W3Schools 2020d). Besides operators, there are other syntaxes supporting condition construction, such as AND, OR, NOT, and IS NULL. AND clause enables multiple conditions or uses as

pair with BETWEEN clause (e.g: BETWEEN 5 AND 10). OR is given in situations where adapting only one among several conditions is sufficient for the output. (W3Schools 2020e.) IS NULL is applied to extract data of which chosen column fields do not contain values, whereas, IS NOT NULL is to filter only specific column fields holding data.

There are several ways to reformat result sets such as duplication avoidance, ascending/ descending/ alphabetical order, giving new names for columns created from logical statements, displaying, or grouping records with similar features. To work with duplication, DISTINCT can be used to ensure all the output values in the selected column are unique. For instance, 'SELECT DISTINCT customer_name FROM loans;' query will return only unique values in customer_name column in loans table and ignore all the duplication. (W3Schools 2020f.) The syntax 'SELECT column1, column2,… FROM table_name ORDER BY coumn1, column2,… ASC | DESC;' will return result sets which have columns declaring after 'ORDER BY' ordered either ascendingly or descendingly. The nearer the declaring column is to the 'ORDER BY' keyword, the more ordering priority it has. ASC and DSC can be used for both numeric and string type. (W3Schools 2020g.) 'GROUP BY' supports grouping same values of a specific column, regularly, for aggregate operations. Aggregate functions include COUNT (number of records), MAX (maximum value), MIN (minimum value), SUM (sum of all column values), and AVG (average of all column values). For example, 'SELECT COUNT(book_name), customer_name FROM loans GROUP BY customer_name;' will return the number of books each customer has loaned (grouped by customer_name) and the customer names. The column name in the result set for the number of the loaned books will be 'COUNT(book_name)' as the column has not yet given a name. To modify the name in the result view, the 'AS' command is applied and followed by a customized name. For example, the name for the book counting column will become 'number_of_books' with this new query: 'SELECT COUNT(book_name) AS number_of_books, customer_name FROM loans GROUP BY customer_name;'. (W3Schools 2020h.)

Having been mentioned before, data can be separated into several tables for a brief and logical organization. These tables are connected to each other through one or some 'primary key' columns. In reality, demand for table connection is certain. SQL offers JOIN command for table association with several options such as INNER JOIN, LEFT JOIN, RIGHT JOIN, and FULL OUTER JOIN. The common syntax for JOIN function is 'SELECT table_name(1 | 2).column_name FROM table_name1 JOIN table_name2 ON table_name1.keycolumn = table_name2.key_column;'. Depending on usage, the selected type of connection will replaced the keyword 'JOIN' from the syntax. Tables joining to each other will be declared on the left and right side of the 'JOIN' function. The connectors

(primary/ foreign key columns) will be defined after the 'ON' keyword. By default, 'JOIN' is interpreted as 'INNER JOIN', which is the connection that only show the records of which the chosen primary key columns both have identical values. 'LEFT JOIN' also connect tables with same values from connectors, however, the records from the table on the left side of the keyword 'JOIN' will all show, even when their values from the chosen primary/ foreign column do not match any value from those of the right side table. For example, two tables have a relationship with each other through a primary/ foreign key column owned by each. If the left table has ten rows of records which corresponding to ten unique values in primary/ foreign key column, and the right side table only has five rows (five values in the primary/ foreign key column). The result set will be ten rows of records, as LEFT JOIN prioritizes the left table over the right one. On the contrary, RIGHT JOIN will prioritize the right table more, by which the result set from the example will only have five rows of the records based on the right table. FULL OUTER JOIN (also known as FULL JOIN) will join tables including also those records from both tables that the connectors' values do not match any from the other. (W3Schools 2020i.)

Subqueries refer to queries nested within another to create more complex functional queries. Subquery syntax can be in various forms such as 'SELECT column1, column2,.. FROM table_name1 WHERE value IN (SELECT column_name FROM table 2 WHERE condition;'. Regardless of form, a subquery is required to be enclosed within parenthesis. Similar to basic queries, subqueries will also return results either as individual values or data sets.

Data Manipulation Language (DML) contains commands used for manipulating data. The most basic and popular commands belonging to this kind are SELECT, INSERT, UPDATE, and DELETE. As being mentioned above, SELECT is used for data selection from the database. INSERT is used for data insertion. There are two syntax forms possibly applied for inserting, which are 'INSERT INTO table_name (column1, column2,..) VALUES (value1, value2,…);' and 'INSERT INTO table_name VALUES (value1, value2,..);'. The former allows admins to customize the adding order by specifying column names correspondingly. Meanwhile, in the latter, the added values will be inserted based on the default order of columns in the table. The UPDATE command is applied when the existed records demands for correction or modification. An UPDATE statement has a structure as 'UPDATE table_name SET column1= value1, column2= value2,.. WHERE condition;'. WHERE clause in the UPDATE statement is essential as it identifies to which the modification should take place. DELETE command is used to conduct record deletion. Similar to the UPDATE statement, it is mandatory to contain WHERE clause to specify the

record needs deleting. Thus, the syntax for the DELETE statement will be 'DELETE FROM table_name WHERE condition;'.

Data Definition Language (DDL) refers to commands responsible for database or table construction and schemas. The most common DDL commands include CREATE, ALTER, and DROP for database/ table creation, alteration, and deletion. For database generation, the syntax is quite simple by adding the database name after the CREATE DATABASE command ('CREATE DATABASE database_name;). It is more complicating for table creation, as column names and types are required declaration. The CREATE syntax for table will be shaped like 'CREATE TABLE table_name (column1 datatype, column2 datatype,…);'. Opposite to the CREATE command, DROP is used for database or table deletion. The syntax for this statement is simple, however, its consequence may be immense as the statement relates directly to data loss. For database elimination, the syntax will be 'DROP DATABASE database_name;', and 'DROP TABLE table_name;' for table destruction. For database manipulation such as CREATE DATABASE and DROP DATABASE, admin authentication may be demanded. ALTER TABLE operates the modification of table structure by adding, deleting, type altering columns. Column injection is conducted with 'ALTER TABLE table_name ADD coumn_name datatype;' syntax, deletion is with 'ALTER TABLE table_name ADD coumn_name;'. Data type alteration syntax is varied depending on the type of adopting SQL server, some servers accept 'ALTER TABLE table_name ALTER COLUMN column_name datatype;', some take 'ALTER TABLE table_name MODIFY COLUMN column_name datatype;', while others use 'ALTER TABLE table_name MODIFY column_name datatype;'. (W3Schools.in 2020.)

4.5 Designing and implementing a SQL course

This section will cover the process of designing a SQL course following the suggestions from the theoretical research on designing an online course. The process starts with target audiences analysis, content structuring, teaching strategies adoption, and ends with a brief information of evaluation and material recommendations.

4.5.1 Analyzing Targeted Students

The course is aimed at second-year BIT students in LAB University of Applied Sciences. As a result, students are most familiar with the Moodle platform, as well as faculty/ instructor contact information. Contact information is not necessary within the course syllabus, but is recommended in "Welcome to the course" letter. In terms of technology, the course contains assignments in the form of VPL which may be quite new and should be instructed before students implement the tasks. These instructing guidance will be

included in "Student Orientation" letter. Regarding to engaging activities, depending on the nature of the course whether it will be conducted 100% online or in class. If no classroom provided, the course can be equipped with session chat with instructors. Forum is recommended in any online course, as students can easily ask for help and enhance connectivity. Feedback can be attached at the end of the course to review user experience.

4.5.2 Content

The SQL course has initially generated by the teachers at LAB University of Applied Sciences with lessons and assignments. This thesis work will only improve the course by transferring exercises into VPL form, as well as contributing utilities for user experience enhancement.

Using VPL for assignment instead of submitting file not only helps students easily test their codes from the same learning platform, and get evaluated in real-time, but also minimizes teachers' effort in handling abundant files from students. Especially with SQL, students get started with queries quickly with VPL, without setting up a database server on their own. Within this part, steps for generating VPL will be described.

Below is an example of the SQL assignment. Regularly, the assignment will be followed with other database setting up files and students need to set up the database tables themselves to test the codes.

Image 6 SQL exercise description

When transferring to VPL, instructors can set up database tables and students can perform and test SQL queries directly in a SQL file provided in the user interface. An assignment conducted with VPL will look like below (Image 6).

Image 6 VPL exercise example

The left area in the VPL exercise (Image 6) is an editor section where students can edit within a SQL file (ex1_4.sql). On top of the file, there are several buttons to perform functions such as Save file, Run file, Debug, and Evaluate. The right area describes the tasks as well as other information necessary for the exercise. On the occasion that test cases are provided for evaluation, the left board also shows the evaluation of submitted tasks when Evaluate button is invoked.

The following parts will demonstrate steps to create a VPL for an SQL assignment. The generation starts with adding activities with a Virtual programming lab (VPL).
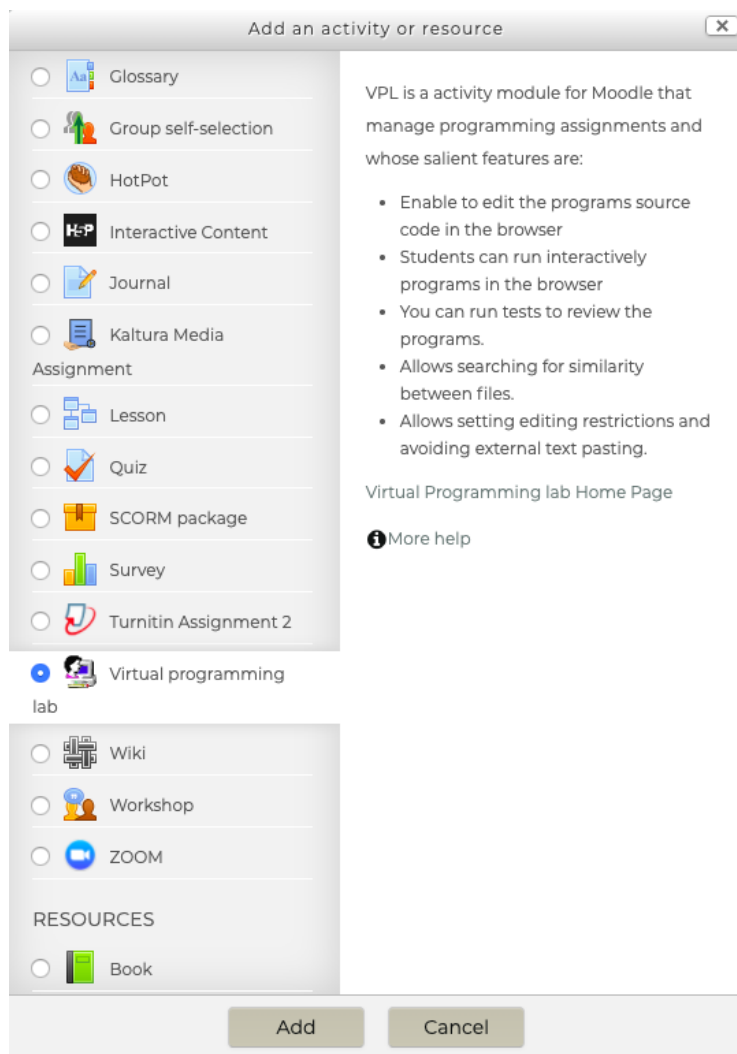
Image 7 Adding VPL as an activity

"Add" button from the previous step (Image 7) leads to the assignment setting including task description, submission setting, access restriction, and other activities (Image 8). Instructors can modify settings depending on different purposes. In this particular SQL course, description and submission restriction should be focused on. The "Name" field in "General" section is compulsory to fill in. A full description is important as it appears as a definition of the task with context explanation and questions. Regarding "Submission Restriction", it is recommended to disable the ability to submit external files and content. This action ensures students to edit and evaluate the task in VPL editor and reduce extra file handling tasks for instructors.

Image 8 Edit Setting for a VPL task

When the setting information has been complete, the exercise will look like the image below (Image 9). So far, the VPL has not shown the extraordinary than a usual assignment task, as it only contains task description. In order to enable SQL queries editing, the VPL is required to hold the database. VPL tool uses SQLite3 as the database engine and stores database in vpl.db file. SQL files will be run and executed in "Executed files" and student editor respectively. However, the database is temporary in the current VPL task. Thus, there is one way to store a database table for student performance is to embed the database creation file in "Executed files" section. Every "Run" or "Evaluation" button hit will invoke the database re-creation for the one-time usage. The next three

pictures indicate the process of storing database creation files in "Executed files" and enable the file to get run during execution.
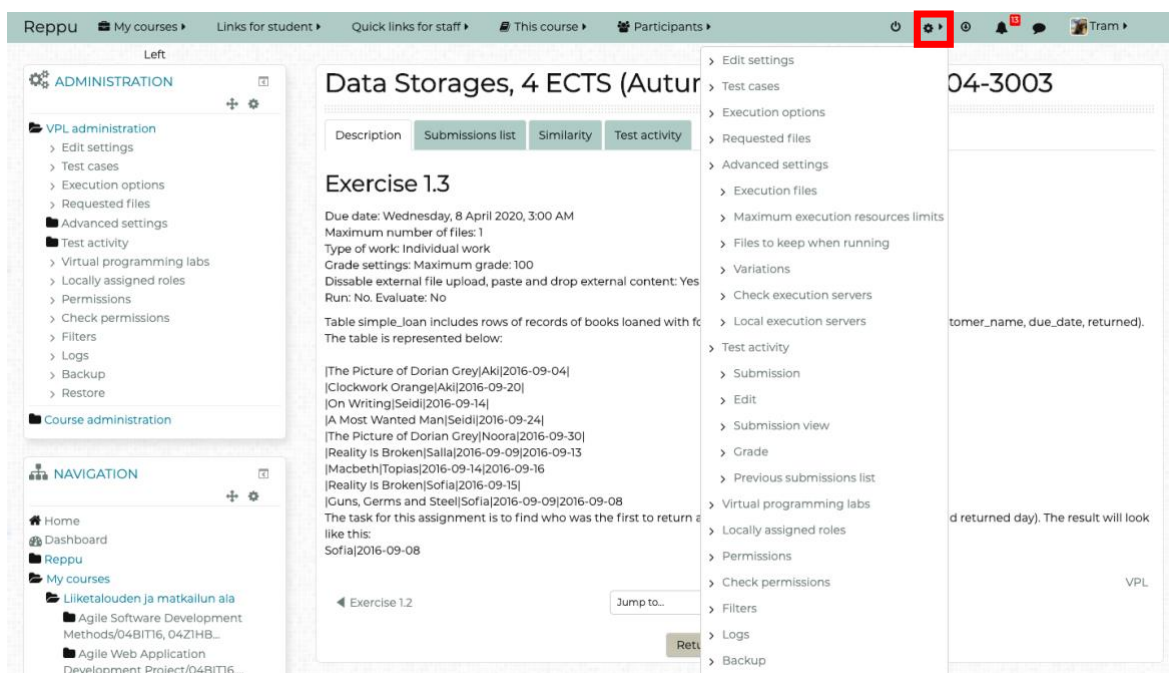
Image 9 VPL task in the first implementation stage

The "Executed files" section is hidden in the red highlighted button on the top of the Image 9 (Module settings button). When "Executed files" has been clicked, an editor with four default files (vpl_run.sh, vpl_debug.sh, vpl_evaluate.sh and vpl_evaluate.cases) will appears (Image 10). The database creation file will be added in the same folder with other files in the form of the SQL file (with ".sql" extension). In the below picture (Image 10), a "simple_loan" table is created in the "simple_loans.sql" file.

Image 10 Creating simple_loans.sql file in Execution files

In order to enable the database creation file (simple_loans.sql) to run in the execution, the file has to be saved for the execution. In the module setting button, the "Files to keep when running" within the "Advanced settings" will lead to the below picture (Image 11). The SQL file should be marked and saved in this step.

Image 11 "Files to keep when running" option

Up to this point, students are able to perform SQL queries to the simple_loan database table in the VPL interface. Nevertheless, the user experience of a VPL assignment can be enhanced with evaluation function. Test cases can be set up in vpl_evaluate.cases in the "Executed files". Within the file, several test cases with name, input, and output are written. In this SQL exercise, only output is used to evaluated and will be displayed like the picture below (Image 12).
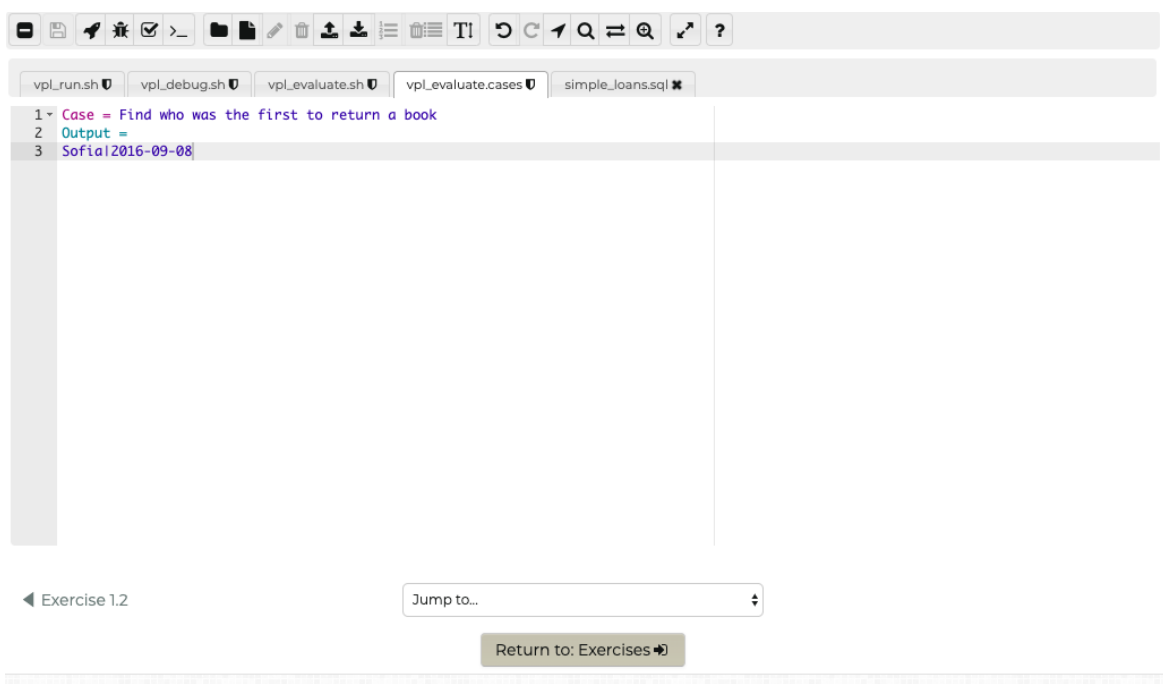

Image 12 Adding test cases

When the test cases are created, the task has to set up the ability to get run, debug and evaluate in "Execution Options" which can be found in Module settings.

Image 13 Enable the VPL exercise to Run, Debug and Evaluate

The setting for run, debug, and evaluation, as well as execution files, are now visible in the task description.

Image 14 VPL task description in the final stage of implementation

When the SQL file in the students' editor is saved and run, a console window with returned data will be displayed similar to the picture below.

Image 15 Console log in a VPL task

The file can also be evaluated with the "Evaluation" button. Results and comments for the task implementation will be shown on the right board. The next two pictures (Image 16 & Image 17) describe result samples for a passed test and a failed test respectively.

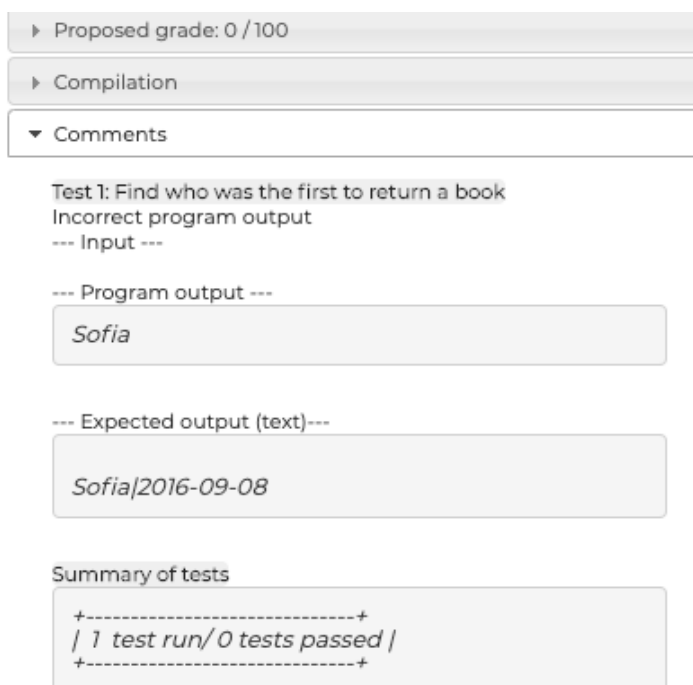Image 16 VPL editor when correct solution is evaluated

Image 17 Evaluation section in VPL task when the incorrect solution is evaluated

VPL is a good utility for exercises relating to technical performance such as conducting queries on the database. Other types of exercise may fit with other activity arrangements. In this course, for example, Quiz is suitable to test students' understanding on the basics of SQL and database in general. The similar strength of VPL and Quiz is that they offer immediate responses, which enhances user interaction. However, Quiz is not suitable for activities demanding deep understanding or analytic skills. File submission is recommended for the circumstances.

4.5.3 Strategies

The course is organized with the 'Direct Instruction' teaching model based on Hirumi teaching model tables (Image 4). By which, the course approaches the students' orientation section where the course overview and guidelines are introduced and students' goals are set. In this stage, two emails will be sent to students, which are 'Welcome to the Course' and 'Orientation'. The email contents will be revealed later in this part. Each chapter in the syllabus follows a pattern which is knowledge and skills establishment and exercise implementation. Self-practice is encouraged with optional exercises and solutions, as well as open-source materials. In addition, continuous development for data skills can be supported by other project courses provided by LAB University of Applied Sciences.

Grading is evaluated based on students' effort and expertise in the course implementation. Each lesson provides a variety of assessing exercise. The more and better implementation is, the greater result a student can earn. Additionally, the final exam is provided in the course and contributes considerably to students' grades. Grading can be flexible depending on students' situations, however, generally, it is calculated on the amount of work students pay throughout the whole course and the competence in the final exam.

Regarding communication channels, direct meetings and emails are adopted. The direct meeting can be approached during in-class lessons or by arranging private meetings with the instructor. Email is a simpler means of communication. However, the instructor needs to ensure that the response is within a certain amount of time which is announced in 'Welcome to the course' letter. Occasionally, the instructor needs to send emails to notify the possibility of delaying responses if more time is needed. Email Archival is a valuable feature guiding the right direction for students and assisting in teaching performance and effort.

Email Archival is a reusable collection of emails that teachers conduct in different courses for general purposes. List and content structure for common emails in Archival have been mentioned in section "4.1 Feature of a good MOOC" in this thesis work. This part will re-cover only emails requiring the course customized information.

'Welcome to the Course letter' for this particular course will contain prerequisites, the course syllabus, course handling description, grading, communication methods, timetables, and materials. Relating to prerequisites, the course is aimed at second-year BIT/ IT students as they have already had the basics of web or app development. However, the course is not necessary only for students who have experienced at least one year or in the IT department. Students can still take part in the course if the content is interesting and suitable for their levels. The syllabus currently available in the course can be attached in the email to give students an initial understanding of course content before they actually participate in the course. Relating to course handling, each chapter in the course consists of lessons, exercises in VPL formats, "Addition Information" providing database constructing files and other materials for optional self-practice, and solutions for the given exercises. The exercise is required to implement after lessons in a certain time period and contributed to the course grading. The solutions for exercises are hidden for students until the deadlines are passed. Students can use them to review their own assignments. During online learning, students can ask for help from the teacher or learning community through the "General Forum" provided in the course. The grading description mentioned in the previous paragraph will also be included in the letter. Communication channel directing to the instructor should also be described with contact and location details. The instructor is recommended to announce the maximum time period for the response. For matters not required privacy, the "General Forum" is encouraged to enhance community interaction. Timetable for the course should be well informed. Materials relating to technology or knowledge in the course should also be mentioned. In the course, in particular, SQLite documentation should be mentioned as VPL tools used for SQL assignments adopting the SQLite system. A "Welcome to the Course" letter is sent to every student before the start of the course. Thus, warm-welcoming and friendly characteristics are the letter's noteworthy features.

"Orientation" letter is used as instruction books for students. In the course, several subjects should be instructed including how to use the "General Forum" for information exchange and how to handle SQL assignments in VPL. Screenshots for the implementation are recommended thanks to its easy-to-interpret nature. The SQL language to implement in the VPL assignments- SQLite should be highlighted to enable students to execute the tasks smoothly.

Although the instruction for the handling VPL assignments has been mentioned in the "Orientation" letter. It is recommended to send a Help email to instruct how to implement it again in the first course assignment conducting in VPL. The content is simply copied from the "Orientation" letter of the particular part, however, it provides supports for students who have missed information in the "Orientation" letter and minimizes students' questions about the matter for the instructor.

Enabling the course to be tested and resolved before deploying as an online course is necessary. Even when the course is qualified enough for education, continuous development is constantly required. Students' feedback is the guild for the development. As a result, attaching feedback section at the end of the course is essential.

4.5.4 Evaluation

Organizing tests before launch an online course is necessary. It not only helps to debug unexpected errors but also improves course quality in the eyes of targeted users. In order to achieve these goals, tests should be handled by targeted audiences which are LAB UAS students (especially in BIT fields) and evaluated different aspects of the course.

The evaluation stage may undergo the repetitive cycle of testing, feedback analyzing and improving before the course becomes qualified to teach students. The more effort it takes for evaluation, the fewer errors will be troubleshot during lessons, thus, the more positive experience students will gain. The details of the evaluation stage for the course will be explained in chapter five.

4.5.5 Materials

Online courses should be expanded with additional materials and learning resources to support students' further learning and adapt to different learning styles. Thus, these material resources vary from different aspects such as level, and media. Materials encouraging after-the-course learning can be attached at the end of the course syllabus, while, resources acting as lessons' alternatives or additional information should be included in the same lessons' section.

The targeted SQL course has originally been attached to materials quite effectively. The available materials are diversified, as they can be in the form of books or online courses, and the knowledge content fluctuates from basic to advance. Among each section, additional databases are given to promote students' self-study. Although the given materials are productive for advanced learning, they are not satisfying to be alternatives to the lessons, as there is a limited amount of resources given for each lesson. In order to

boost the alternation function, more lessons related resources should be included in each section.

5   COURSE EVALUATION

In this chapter, empirical research is conducted to test the usability of VPL exercises in the SQL course and improve them based on users' feedbacks. In order to operate the research, students are invited to perform the tests and give feedbacks. The research setup, analysis, and course improvement will be discussed further in sections below.

5.1   General information of empirical research

The research examines nine students at LAB University of Applied Sciences and includes two parts which are interviews and surveys. The interview part is handled during the period of time when students implement the course and the survey is collected as feedbacks at the end of course implementation. The six invited students will be divided into two groups equally which are initial testing and improvement testing groups. The former will evaluate the first finishing version of the course, and give feedback for course improvement. The latter will test the course after the improvement has been enforced.

All participants for the evaluation are given an instruction to handle the course which later will be served as the "Orientation" email. Each group has three weeks to implement the course. During the first week, the interview will be conducted among participants. Supports and instant improvement are required so the course can be continuously carried out. The surveys are required to be completed by participants at the end of the course. The results collected from the surveys will be utilized for course improvement.

The purpose of conducting interviews during the course implementation is to examine the strengths and weaknesses of the courses' properties, and difficulties in course handling. Meanwhile, the survey is used to evaluate the course content and quality in general and collect feedback for the later improvement. The aim of separating testers into two groups is to enable the course to be evaluated and enhanced twice before the actual course launch.

5.2   Interview analysis

As being mentioned above, the purpose of the interviews is to assess properties utilized in the course, and inspect students' difficulties in course management. Therefore, the course can be customized upon the feedbacks to support the ongoing learning process, as well as to improve the course for later usage. In order to achieve the purpose, interview questions and methods should be planned in advance. The following sub-sections will describe the design of the interview and the collected results.

5.2.1 Design structure of the interview

The interview will be conducted one week after the students participate the course. As the evaluation process is separated into two periods, the interview data will be collected twice. The interview contains four questions which will be listed below.

- Do you have any difficulty in using materials and doing exercises? What are they?

- Do you need further help besides the given instruction?

- Do you think one week is appropriate timing for the number of tasks in one lesson? If not, what would it be?

- Do you have any suggestions for improvement?

The first question is used to debug the errors students meet during course implementation relating to course materials and properties. It helps to provide students supports to continue the course smoothly. The second question helps to improve the instructing document to the most possible comprehension and details. The third question is to evaluate whether the timing for tasks is sufficient for participants to implement the course in the agreed time period. Finally, the participants are interviewed for improvement suggestions for what they have done so far. However, the answer to this last question will be collected until the end of the test session for consideration.

5.2.2 Results

The first testing group encounters three challenges when handling the course. Firstly, VPL access was denied due to the use of encrypted connections. Secondly, the VPL workspace for assignments is unable to be modified because the due time had passed. Lastly, a few mistakes in task description has led to confusion while implementing. In terms of further helps in instruction, instruction to manage the problem relating to encrypted connection was recommended, as it frequently occurs during the course. Considering the time period, one week was reported as sufficient time for the number of tasks in a normal lesson by all participants. However, two out of three testers also emphasized the importance of time flexibility depending on students' situations. For example, if the course is taught together with massive project courses, the time period for implementation should be considered to be extended.

Relating to difficulties, two participants in the second testing group were unable to conduct automatic evaluations in the VPL exercise due to the not having a careful check of the the instruction guild. All participants agreed that the content in instruction guild is sufficient to

carry out the course. Relating to schedule, similar to the previous result, the majority of participants in this group so far were able to complete the given tasks within a week period, however, they also suggested the possibility to negotiate the time period with the instructor. The interview has collected an improvement suggestion for the course which is providing more lessons in media formats for better experiences.

5.3   Survey analysis

An online course is required to be always up to date and suitable for students' needed skills and purposes. Survey is a noticeable method supporting student-oriented development. Being aware of the fact, surveys will also be conducted in the course implementation process to improve the quality of the course to fit users' expectations. This section will describe the survey operation from designing to analyzing data and extracting results.

5.3.1   Design structure of the survey

The survey part will be carried out at the end of the course implementation. The aim of the survey is to collect the course's general feedback. This survey will utilize the question sets that have been created previously in the course. The rating scale can be from one to five, in which one implies bad experience or totally disagreement and five indicates excellent experience or totally agreement, or in the scale of three which will be described further in the survey list. The construction of the survey is described in the following list:

- General grade about the course (grading from 1 to 5)

- "The teaching methods were good and helped me learn" (grading from 1 to 5)

- The content of the course is up-to-date and comprehensive (grading from 1 to 5)

- Course schedule (slow/ suitable/ too fast)

- Theory and Practice balance (too much theory/ good balance/ too much practice)

- "I know how my learning was accessed in this course" (grading from 1 to 5)

- Free words

The survey focuses on different aspects of an online course, respectively, general quality, teaching methods, content, timetable, balance of theory and practice, learning accessibility, and students' personal feedbacks. The average rate in each criterion from all

collected surveys decides whether that specific criterion needs to be modified and improved.

5.3.2 Data analysis

This section will analyze the survey data into two parts. The first part provides a collection of criteria's data that require evaluation in the scale from one to five. These criteria include general course grade, teaching methods, content, and learning accessibility. The second part covers the rest of the survey questions. The collection of one-to-five scaled data is described in the below table.

Scale Criterion	1	2	3	4	5	Average
General course grade			1		5	4.67
Teaching methods			1	1	4	4.5
Course content				1	5	4.83
Learning accessibility				1	5	4.83

Table 18 Survey data of one-to-five scale criteria

In terms of the course schedule, 100% of participants agreed that it is suitable. Considering the theory and practice balance, five out of six participants (83.33%) reported that the course is in good balance. Meanwhile, one participant informed the exceed of practice compared to theory. In the "Free words" section, the surveys have collected some comments which can be summed up into four main points. Firstly, the course was reported to have a gradual increment of difficulty which enables students to perform the tasks without confusion. Secondly, VPL tasks using SQLite were informed to make the learning process convenient. Thirdly, one participant commented on the inconvenience of copyright prevention in VPL tasks which does not allow students to paste solutions into

the editor. Lastly, the materials are advised to cover the knowledge assignments demanded.

5.3.3 Results

In general, the users' feedbacks toward the course is positive. All the criteria are evaluated to be in good to excellent range. Based on the scores given, the course teaching methods, learning accessibility, and schedule do not need modification. In terms of theory and practice balance, even though there is a report on the overwhelm of practice over theory. However, the majority of participants agreed that the course obtains the balance between theory and practice. As a result, the changes will not occur on this criterion either until there are more students reporting the same issue.

Regarding the course content, although it was evaluated with a good score, updates, and improvement on the material will be reviewed and provided as there was one feedback discussing the absence of lessons for assignment implementation. The ability to pasting on the editor can be equipped for students' convenience of switching among VPL and their own workspace.

5.4 Implement and improve the course

The empirical activities have provided awareness of which factors positively influence students' learning experiences and which aspects need to be improved. This chapter will sum up and plan the improvement process based on the interviews and surveys' results. Generally, there are three main aspects requiring modification which are learning instruction (orientation letter), VPL workspace settings, the course content, and schedule.

Regarding learning instruction, guidance on solving the problem when using VPL in the encryption network should be added, as it is a frequent issue. In term of VPL settings, there are two elements should be changed or considered when launching the course. Firstly, the copyright setting can be removed. Although the setting helps to prevent cheating and support fair evaluation, it creates inconvenience for students to transfer their solutions from their own database setup. Secondly, the VPL assignments should allow students to implement the tasks after the due date has passed. There are two ways to enact this target which are setting the VPL tasks without limitation for editing or manually providing the editing access for students who are late from the submission deadlines during the course ongoing. Thirdly, the content will be modified and added to cover all the problems giving in the assignments. Even though schedule were reported to be sufficient in both interview and survey results. It should be concerned from time to time, as students'

own schedules may not be the same. Giving a flexible time based on different situations not only improves students' experience, but also saves the instructor's time from enabling manual access to students frequently.

5.5   Limitations and recommendations for the future work

The course evaluation process contains two main limitations. Firstly, as having been conducted during Covid-19 pandemic occurrence, the course was only able to invite a limited number of testers. Although the current participant groups is able to generate useful feedback for course development, the greater the number of participants is, the more objective the feedbacks would be. Another limitation in evaluation work is the lack of student inputs into the course. The majority of the invited students were reported not having ability to complete the research for the whole course, but instead only some parts of it, due to time unavailability and busy study- and work schedule. Understanding the fact, the testing work assigned for participants was designed to cover the most possible content in the course.

Relating to future work, continuous development is undoubtable task in education, especially in the era of Internet of Things. Due to the limitations mentioned above and changes in students' objectives in different time period, the course can be improved and tailored upon the requirements. The feedbacks collected at the end of course should be considered for changes if they are reasonable.

6 CONCLUSIONS

The thesis has covered two main segments which are literature and empirical. In the literature part, the thesis introduced and analyzed the definition and history of Structured Query Language (SQL) and Massive Open Online Courses (MOOCs) and their importance in real life. The suggestion for approach SQL knowledge was also suggested, and MOOC is a primary path to get along with thanks to its numerous benefits. The usefulness of MOOCs was also explained in the study. Additionally, the literature part also discovered three crucial elements for the SQL course improvement and implementation, which are factors and methods contributing to an online course's efficiency, Moodle and VPL as an online course platform used in LAB UAS and SQL knowledge as a foundation for the online course content.

The empirical segment was divided into three stages which are applying researches for SQL course generation, evaluating by users, and improving the course based on user feedback. In the first stage, the course designing and implementing process were described. The design process based on the recommended steps discovered in theoretical research, namely, audience analyzing, content constructing, strategies adopting, evaluating, and materials selecting. The audience analysis described the characteristics and required supports for the targeted students. In the content construction step, the manual instruction on how to generate a VPL task was described to support future creation and maintainability. The strategies adoption part gave detailed on the teaching model and utilities the course would be made use of. The evaluation part appeared as an important step in the designing process and implemented in the evaluation stage of the study. Finally, the selection of materials is conducted in the course design to support students' further learning and a variety of learning styles.

The second stage of the empirical segment comprises activities of delivering the course and implementing instruction for users to test, setting up and collecting interviews and surveys, and analyzing users' evaluation results. This stage was separated into two periods with the total number of six participants. The average rate for the course, in general, was reported to be positive, and the given feedbacks were constructive for the course improvement. Similar to the evaluation stage, the improvement stage was also carried out twice and positive, after each evaluating session. In this stage, students' feedbacks were weighed and determined the changes in the course. The obstacle of lacking user data and input was also mentioned in the evaluation stage. As a result, continuous evaluation and improvement were encouraged for future work on the course.

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APPENDICES

Appendix 1 Interview questions on user experience

- Do you have any difficulty in using materials and doing exercises? What are they?

- Do you need further help besides the given instruction?

- Do you think one week is appropriate timing for the number of tasks in one lesson? If not, what would it be?

- Do you have any suggestions for improvement?

Appendix 2 Survey questions on user experience

- General grade about the course (grading from 1 to 5)

- "The teaching methods were good and helped me learn" (grading from 1 to 5)

- The content of the course is up-to-date and comprehensive (grading from 1 to 5)

- Course schedule (slow/ suitable/ too fast)

- Theory and Practice balance (too much theory/ good balance/ too much practice)

- "I know how my learning was accessed in this course" (grading from 1 to 5)

- Free words