Learning Application Design Using Predict Observe Explain (POE) Model for Computer Practicum in the COVID-19 Pandemic Period in Higher Education

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Abstract

The COVID-19 pandemic forced STIE & STMIK Jayakarta to use the distance learning process for students. Institutional policies to use the Google Workspace for Education application as a Learning Management System (LMS) are deemed appropriate, but they are still experiencing difficulties in learning computer practicums. The use of the Google Forms feature as a computer practicum worksheet is considered less effective in increasing student independence in completing their practicum assignments. This study aims to design a web-based learning application that uses the Predict-Observe-Explain (POE) learning model which has advantages, such as being used to express students' initial ideas, generate discussion, provide information to lecturers about students' thoughts and motivate students to want to explore concepts, and arouse the desire to investigate. The application development method in this study uses Extreme Programming (XP) as an agile approach model for responsive application programming, with user needs that are rapidly changing and always changing. The result of this research is the design of a web-based application that uses a POE card as a computer practicum worksheet with a web page link from the LMS so that it can accommodate the learning outcomes of computer practicum courses.

Keywords
COVID-19, Google Workspace for Education, Predict Observe Explain Model, Extreme Programming.

1. Introduction

The COVID-19 pandemic at the beginning of the 2019/2020 Even Semester forced the STIE & STMIK Jayakarta campus to adapt quickly to the conditions of Large-Scale Social Restrictions (local lockdown). Lecture activities that have been running for 2 (two) weeks are forced to carry out a learning model from home for the entire campus academic community. Of course, at that time, campus academics were not fully prepared, but fortunately the campus had prepared a Blended Learning model using Google Suite for Education as a LMS for certain courses and lecturers in the previous semester.

The implementation of the local lockdown was tightened at the beginning of the 2020/2021 Odd semester, disrupting the campus' plans to carry out practicum course classes in the campus computer laboratory. In the last semester, many students complained, especially on the implementation of practicum courses whose results were not acceptable to students. Student complaints also include the unavailability of computers/notebooks including the infrastructure in students' homes. There are also students who have computers who complain because their computers/notebooks do not match the application specifications required for certain practical courses.

COVID19 influences traditional learning methods. Academic institutional school management, universities, and universities around the world are choosing online lectures / classes as an alternative way to continue their education. While online learning has been shown to help maintain the health of students and faculty, the COVID 19 pandemic is not as effective as traditional learning on technical and social issues (Adnan and Anwar 2020). In order for universities around the world to compete, proof of undergraduate expertise is required. Online education is an important part of such professional preparation, but it is not the only one. Universities today need to invest more than ever in developing their faculty expertise so that they can effectively update their teaching methods, with or without the use of online technology (Rapanta et al. 2020).

1.1 Objectives

From considerations above, this research focuses on how to design a web-based application that can implement the POE learning model by integrating it into Google Workspace for Education applications. Due to the COVID-19 condition, Lecturers, Lab assistants and Academic staff can collaborate online to create, validate and assess practicum assignments. The design of this application must quickly produce a prototype that can be used as soon as possible with several repeated improvements.

2. Literature Review

The Predict-Observe-Explain (POE) model is effective for improving students' critical thinking skills This model is effective for improving students' critical thinking skills. This is shown from the results of five indicators of critical thinking ability (Explanation, Analysis, Interpretation, Inference and Evaluation) after learning and the post-test score is higher than the pre-test score, which means that there is an increase in students' critical thinking skills (Alfiyanti et al. 2020). By adding this POE card, all students, whether they have a computer / notebook or not, are expected to improve their critical thinking skills after learning, and the post-test results are better than the pre-test results, which means there is an increase in students' critical thinking skills. This is very important for students because this pandemic is predicted to still occur next year even though a COVID-19 vaccine is available (Kompas.com 2020). Student skills in mastering computer practicum material become an important role to compete when these students enter the industrial world.

The COVID-19 pandemic has resulted in increased use of Google apps in schools and colleges (De Vynck and Bergen 2020), the company has renamed G Suite for Education to Google Workspace for Education Google includes all the products already in use, such as Classroom, Meet, Gmail, Docs, Sheets, Slides, Drive, Calendar and more (Sinha 2021), and the company recognizes that the Google Classroom application functions as a LMS for multiple classes (Lazare 2021). Educators and scholars are expected to more closely interrogate the applications of Google and other technology companies to move towards more democratic and fair use of technology in schools (Krutka et al. 2021).

Mobile applications enable the interaction and visualization of learning content and its implementation during internships, as well as the analysis of student cognitive abilities, by assessing developed project criteria. In addition, these activities can provide a framework for the didactic design of systematic systems in online education. Mobile application development aims to select the right learning method and approach for each student's situation (Nurbekova et al. 2020). There are benefits to designing mobile-based applications that allow access to a variety of devices with internet channels and web browsers, including personal computers, laptops, smartphones, and many other devices.

The online learning application is also being developed in versions of Android that can be installed on mobile devices running the Android operating system to expand the list of options available to teachers and students (Juanda 2020).

3. Methods

This study uses a system development method using Extreme Programming (XP) which implements the POE learning model into a web-based application that is integrated with Google Workspace for Education applications. XP is a software development methodology for improving software quality and responsiveness to changing customer requirements (Beck 1999). The two main implications of defining XP are: 1) Internally, object-oriented programming replaces procedural programming as the programming paradigm of choice for some developers. 2) Apparently, the advent of the Internet and the dot-com boom emphasized the speed of time to market and corporate growth as a competitive business driver (McBreen 2003). The rapidly changing requirements require shorter product lifecycles and often conflict with traditional methods of software development (Rosenberg and Stephens 2003).

This method was chosen because it allows for rapid innovation in the form of application prototypes that can be used with continuous updates without being disturbed by unbuilt features (da Silva 2020). Below is a model of the XP phase in Figure 1, which consists of five phases: planning, design, coding, testing, and software increments. This is an agile software development model for responsive application programming with rapidly changing and constantly changing user requirements (Sudarsono 2020).

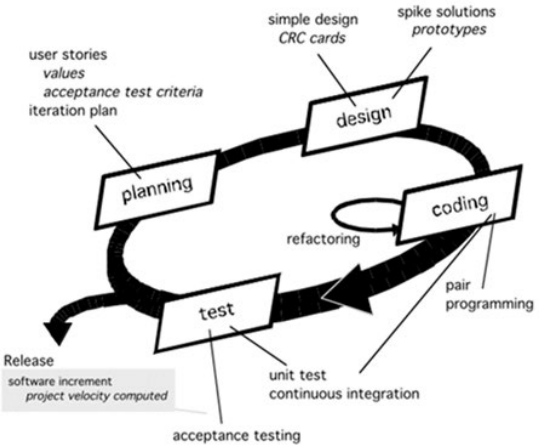

Figure 1. Extreme Programming Model (Beck 1999).

The POE model has 3 stages, namely Prediction: the preparation stage to create an initial understanding by giving freedom to make initial guesses, Observation: this stage is used to test the correctness of predictions by observing and collecting information, Explanation: stage to present the results of the analysis that has been done (Syamsiana et al. 2019) which is depicted in Figure 2 below.

Figure 2. Predict-Observe-Explain Model

The POE model is based on constructivist learning theory. This assumes that the cognitive structure is well developed through the prediction, observation, and explanation of observations (Warsono and Hariyanto 2019). Therefore, this POE learning model allows students to build knowledge through interaction with teachers and peers (Alamsyah et al. 2021). The POE learning model has the following advantages: For example, it reveals a student's initial ideas, generates discussions, informs the teacher of the student's thoughts, and motivates the student to explore

concepts and desires for research (Algiranto et al. 2019). Students' cognitive structure is well formed through activities that make predictions with POE models, observe and explain observations (Warsono and Hariyanto 2019).

4. Data Collection

STIE & STMIK Jayakarta is a university in Central Jakarta, Indonesia, which was established in 1993. STIE Jayakarta consists of 3 study programs, namely 1) Bachelor of Management; 2) Bachelor of Accounting; and 3) Diploma in Accounting with a total number of 986 students. STIE Jayakarta has 4 computer practicum courses with the following details: 1) Basic Accounting Lab; 2) Advanced Accounting Lab; 3) E-Business Lab; and 4) Statistics & Probability Lab.

Meanwhile, STMIK Jayakarta consists of 3 Study Programs, namely: 1) Bachelor of Information Systems; 2) Bachelor of Informatics Engineering; and 3) Diploma in Information Management with a total number of 678 students. STMIK Jayakarta has 12 computer practicum courses with the following details: 1) Information Technology Application Lab; 2) Graphic Design Lab; 3) Multimedia System Lab; 4) Basic Programming Lab; 5) Visual Programming Lab; 6) Web Programming Lab; 7) Mobile Programming Lab; 8) Statistics & Probability Lab; 9) Operating System Lab; 10) Computer Network Lab; 11) Database System Lab; and 12) Accounting & Finance System Lab.

The data collected in the evaluation of online learning the last two semester in Table 1 concludes that most students already have smartphones above the minimum requirement. However, some students do not have a computer or do not meet the minimum requirements of course. It is proven that the implementation of online learning last two semester using the Learning Management System (LMS) Google Workspace for Education with Google Classroom and Google Meet features went well, especially in theory courses. In the computer practicum course, all lecturers replace the Mid-Semester Exam (UTS) and Final Semester Exam (UAS) questions with multiple choice questions and or description questions for students who do not have (or does not meet the minimum requirements) computers/notebooks, while students who have computers/notebooks continue to use computers practicum project-based problem model.

Table 1: Smartphone & Computer Readiness

Course Name	**Readiness Percentage**	
	Smartphone	***Computer***
Basic Accounting Lab	100	94
Advanced Accounting Lab	100	86
E-Business Lab	90	90
Statistics & Probability Lab	100	84
Information Technology Application Lab	89	81
Graphic Design Lab	92	83
Multimedia System Lab	100	71
Basic Programming Lab	92	94
Visual Programming Lab	100	86
Web Programming Lab	100	79
Mobile Programming Lab	100	53
Operating System Lab	100	74
Computer Network Lab	100	90
Database System Lab	100	88
Accounting & Finance System Lab	100	93

5. Results and Discussion

5.1 XP Implementation

As explained in the method section, this research uses the XP method which consists of five phases: planning, design, coding, testing, and software increments. Planning is the stage of collecting data from the current system using observation and interview methods to the Academic Staff, Lecturers, Lab Assistants and Students. This stage focuses on identifying the functional and non-functional requirements of the application to be made. This stage produces user activity mapping and application menu system mapping according to user needs (Beck and Fowler 2004). The following (Figure 3) is the user activity mapping that has been created.

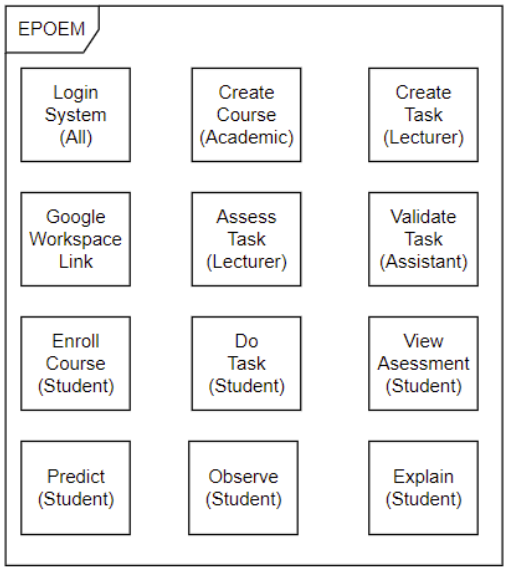

Figure 3. User Activity Mapping

The design stage processes functional and non-functional requirements as well as user activities into CRC Cards (Class Responsibility Collaborator) by identifying a class doing what activities and who are associated with these activities (Rosenberg and Stephens 2003). Furthermore, all of the CRC Cards are processed into class mappings that function as data storage from user activities as well as input and output designs. The following (Figure 4) are CRCs that has been created.

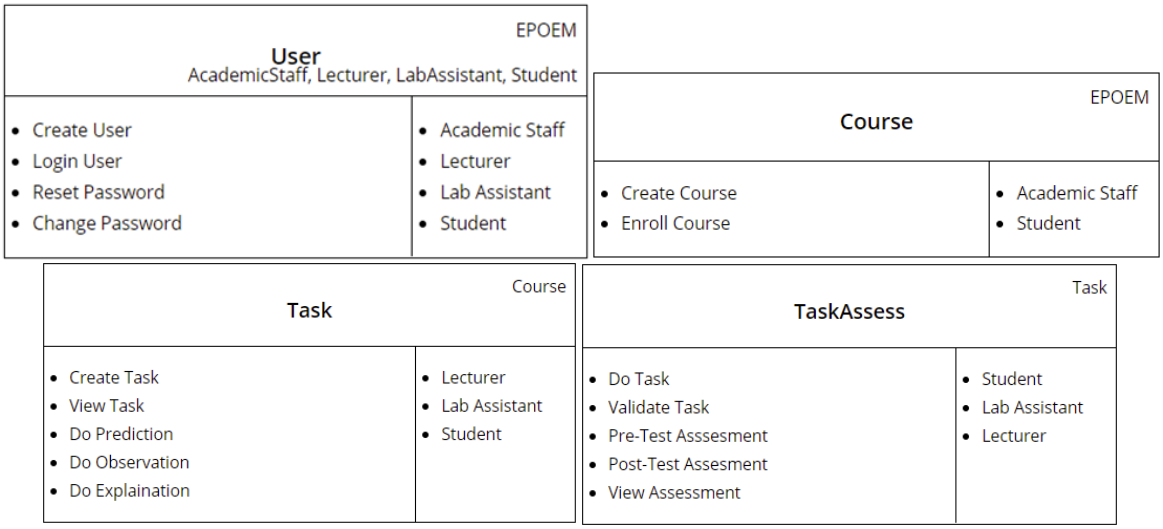

Figure 4. Class Responsibility Collaborator Card

After making the CRC, proceed with making a Use Case diagram that describes the interaction relationship between the system and the actors. Use Case can describe the type of interaction between the user of the system and the system. The following (Figure 5) is a use case diagram that has been created.

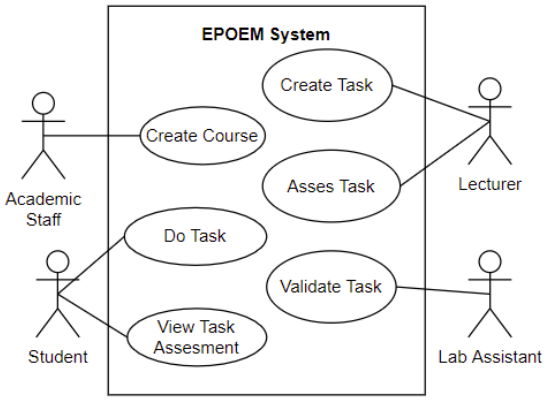

Figure 5. Use Case Diagram

From the CRC card above, we can create Class Diagrams that are useful for mapping the structure of a particular system by modeling classes, attributes, operations and relationships between objects. Describes class diagrams, classes, attributes, object descriptions and images, and interrelationships such as inheritance and associations. The following (Figure 6) is a class diagram that has been created.

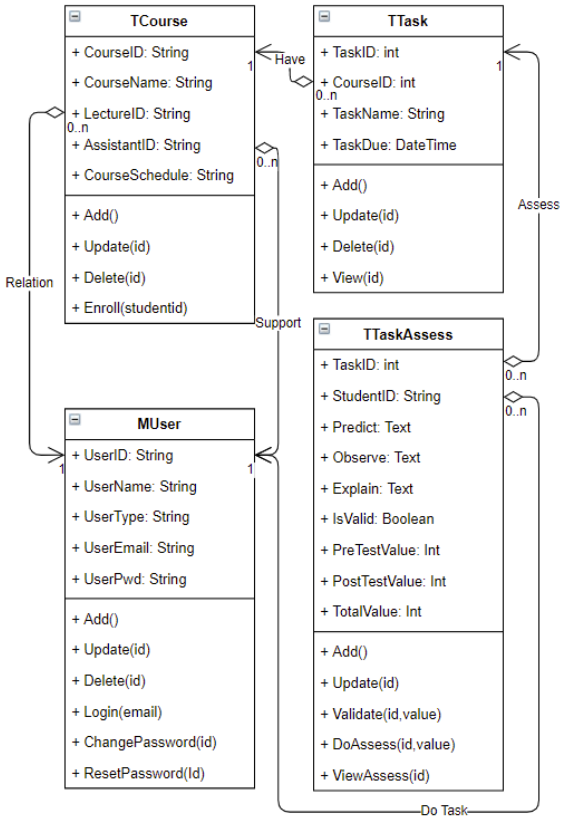

Figure 6. Class Diagram

The class diagram above is then implemented into a database system that can store data and information for this system. Implementation of a database system using the MariaDB database into a set of interconnected tables. The database system is also useful for retrieving data and information from the system, for example displaying the form of a POE card.

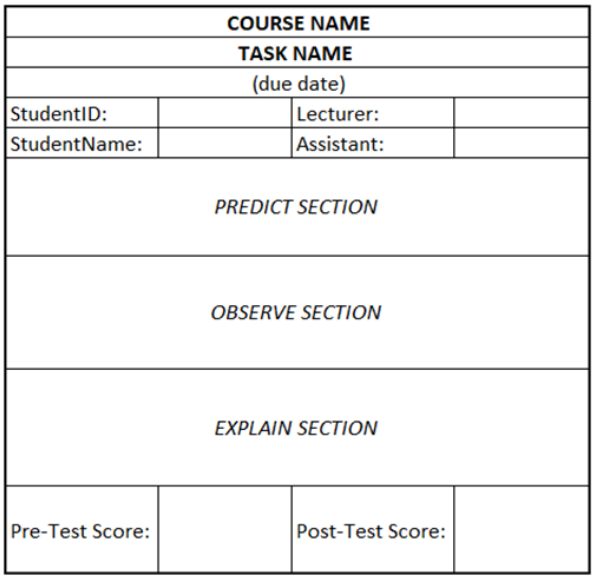

Figure 7. POE Card Design

In Figure 7, the POE card design includes course identity, assignment name, student identity, POE section and Pre-Test & Post-Test scores. In the Explain section it can contain Pre-Test in the form of true and false choice questions, multiple choice or descriptions that were done at the beginning of the practicum hours. The Observe section can contain practicum material in the form of web page links and or multimedia material (text, audio, video, meetings or Google Meet recordings). After students observe the practicum material, they continue to work on the Explain section which can contain Post-Test in the form of true and false choice questions, multiple choice or descriptions that are done at the end of practicum hours. The lab assistant will validate the POE card before continuing the assessment process by the lecturer. A Google Classroom application recommendation layout design for integrating POE Cards has also been created. Lecturers can insert a POE card link in Forums in Google Classroom in addition to learning materials and learning video links. The POE card link is an URL from the system server with parameters that have been encrypted so that it is safer to use. The following (Figure 8) is an example of a recommended layout for the Google Classroom application.

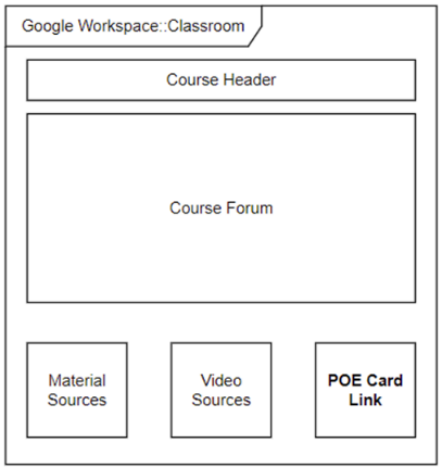

Figure 8. Google Classroom Layout Recommendation

After the design stage, it is continued with the coding stage which will implement the CRC Card as an input and output report form and Class Map as a database system. This coding stage uses PHP with the CodeIgniter framework for responsive web-based applications. As for Android-based applications, Android Studio uses Android Studio to create WebView-based mobile applications from pages generated by the CodeIgniter framework. Testing will be carried out on Release #1-n applications generated from the previous stage (Beck 1999).

The Relase#1 application will be tested using the White-Box method in the Alpha-Testing test conducted by the Proposing Team (Crispin 2003). While in Beta-Testing using the Black-Box method which will be carried out by some users (Beck 2014). After the Release#1 application is deployed, improvements will be continuously made at the software increment stage. This stage begins with finding problems or limitations in the previous Release application and the Planning-Design-Coding-Testing process will be repeated to produce the next Release Application. This stage ensures that the application will always be updated continuously in accordance with changing user needs (Rosenberg and Stephens 2003).

5.2 Discussion

The design of the online learning application has been made using the POE learning model. It uses the XP system development model which is suitable for responsive applications and rapidly changing user needs (Beck 1999). It is made to add features to the LMS with a POE card as a computer practicum worksheet so that it can accommodate the learning outcomes of computer practicum courses. A link to the web page of this application design is embedded in the Google Workspace for education LMS. POE card is expected to create initial understanding by providing the freedom to make initial guesses (Syamsiana et al. 2018), improve critical thinking skills (Alfiyanti et al. 2020), improve students' thinking process abilities to solve problems (Alamsyah et al. 2021), and improve cognitive learning outcomes (Algiranto et al. 2019).

6. Conclusion

Online computer practicum courses in collaboration with Lecturers, Lab Assistants and academic staff can be done by adding features to the LMS such as Google Workspace for Education. This feature is in the form of a POE card link as a practicum worksheet that leads to a web-based learning application with the POE Model. The POE card is designed in such a way that with Predict, Observe and Explain stages which ultimately accommodate the learning outcome of the computer practicum courses for all students who have or do not have a computer at home during the COVID-19 pandemic. Using an agile approach to system development such as XP can ensure continuous improvement in the COVID-19 situation that requires flexibility in changing system requirements.

Further research is expected to produce an application that is ready to use and has been well tested. The application of the POE model can also be used in theoretical courses that can increase student learning independence during the COVID-19 pandemic. The results of the assessment of the POE card are expected to be integrated with the LMS. This application design using POE learning model can be embedded into other LMS such as Moodle, Edmodo, Schoology, etc.

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