APPLICATION OF THE FLIPPED CLASSROOM METHOD IN DEVELOPING A LEARNING MANAGEMENT SYSTEM FOR TRAINING PROGRAMS AT PT. XYZ

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Abstrak

Munculnya pandemi COVID-19 membuat banyak institusi melakukan migrasi dan menggunakan platform daring untuk melakukan aktivitas. Oleh karena itu, penggunaan platform daring meningkat secara signifikan untuk mengimbangi trend saat ini. Sebuah platform learning management system yang ideal dan konten e-learning baik sangat penting untuk keberhasilan proses pembelajaran. Oleh karena itu, riset ini bertujuan untuk mendesain dan mengembangkan materi *e-learning* yang digunakan untuk program pelatihan di PT. XYZ, dengan menggunakan metodologi *flipped class*. Permasalahan yang ada saat ini adalah platform dan konten pelatihan yang dimiliki PT. XYZ masih kurang baik dan belum dikembangkan secara optimal. Oleh karena itu, riset ini digunakan sebagai perbaikan dan peningkatan dari program pelatihan yang ada saat ini di perusahaan. Tujuan dari riset ini adalah untuk mengembangkan konten e-learning dengan topik pemograman Python (*Python Programming*) dengan menggunakan metodologi flipped class. Setelah pengembangan dilakukan, evaluasi dilakukan dan hasilnya, penerapan metodologi flipped class dapat meningkatkan efektivitas proses pembelajaran untuk topik *Python Programming*. Berdasarkan User acceptance test, total nilai dari konten dan *e-learning* yang sudah diperbaiki dan ditingkatkan adalah 68%.

Kata kunci : Learning Management System; Manajemen Pengetahuan; Pemograman Python; Flipped Class; E-Learning.

Abstract

The rise of the COVID-19 pandemic has forced many institutions to migrate to online platforms to conduct their activities. Therefore, the use of online platforms is rising significantly in order to compensate the current trend. An ideal learning management system platform and proper e-learning contents are crucial for the success of the learning process. Thus, this research is intended to design and develop e-learning materials with the adaptation of flipped class methodology, which will be used as a training program at PT. XYZ. The current problem is that the platform and the training content at PT. XYZ are still underdeveloped. Therefore, this research will act as an improvement to the current training program at the company. The objectives of this research will point toward the development of e-learning contents regarding Python programming with the adaptation of flipped class methodology to the learning modules.

The implementation of flipped class methodology was shown to improve the effectiveness of the learning process for this particular subject. According to the User Acceptance test, the total score of the improved content is 68%.

Keywords*: Learning Management System; Knowledge Management; Python Programming; Flipped Class Methodology; E-Learning.*

I.   Introduction

E-learning is an educational system concept that focuses on the use of computer-based technology and the internet to facilitate the educational process (Connolly & Stansfield, 2006; Ghirardini, 2011). The concept of e-learning began to be widely implemented in Indonesia's current education system with the COVID-19 pandemic. With e-learning and distance learning in the learning model due to the pandemic, all educational institutions in Indonesia need to make major changes to the learning system and curriculum (Kartika et al., 2021; Kusumaningrum et al., 2020; Mailizar et al., 2021). The pandemic has forced distance learning to be incorporated into the existing learning model, and because the concept of e-learning itself is still relatively foreign to some people, there are still many things that can be improved regarding the application of e-learning and distance learning in Indonesia (Irene et al., 2021; Mailizar et al., 2021).

Knowledge management is one of the most popular topics in the industrialized world today (Gunjal, 2019). Knowledge management is a process that focuses on the creation, capture, management, storage, and use of knowledge owned by the company as a corporate asset using a platform that aims to shape business value and competitive advantage (Dalkir, 2013; Tiwana, 1999). Knowledge management is a top priority because of the value it provides to a company or business. By implementing proper knowledge management in the company, the resilience and sustainability of the company are considered guaranteed (Dalkir, 2013; Gunjal, 2019).

Another objective of knowledge management is to homogenize the knowledge shared for learners or trainees (Dalkir, 2013; Tiwana, 1999). Without proper knowledge management, trainers or teachers may provide different materials when teaching, leading to different understandings of knowledge among learners. Thus, it can be said that knowledge management, in the form of e-learning systems, is mandatory to standardize and validate the knowledge taught and shared with learners (Sammour et al., 2008).

In addition, knowledge management will also bring benefits to the learners. Learners have limited time with teachers in regular training sessions, and this does not guarantee understanding of the material provided. With the right e-learning and knowledge management techniques, learners can learn and understand knowledge at their own pace and needs. This ensures a better understanding from learners in general as the time provided is unlimited and flexible (Ghirardini, 2011; Sammour et al., 2008).

The use of the flipped classroom method for e-learning materials has a significant impact on students and trainees in terms of improving the delivery aspect of the learning process (Hendrik, 2019; Korkmaz & Mirici, 2021). Flipped class is a two-way learning method, which involves more interaction between the learner and the instructor. It is a student-centered method, focusing on the learner's active pursuit and acquisition of information. The flipped classroom method is also a blended learning method, which involves both synchronous and asynchronous learning processes (Korkmaz & Mirici, 2021; Mok, 2014).

Due to the pandemic, many institutions and organizations have shifted to using online training and learning for their employee training process. PT. XYZ, a system integrator company, has to switch to an online platform for its routine employee training process and training for new employees. PT. XYZ currently has a training module and an online platform, but both are underdeveloped, so they cannot be used optimally. Therefore, this research aims to develop training modules and e-learning by applying the flipped class methodology to improve knowledge delivery between trainers or teachers and students or learners and increase the effectiveness and efficiency of the Python programming training program at PT. XYZ.

II.   Research Methods

The development of training modules and e-learning was conducted using the ADDIE method (Analysis, Design, Development, Implementation, Evaluation). The ADDIE method is commonly used as an instructional design model and is used by many institutions to help create learning content, including e-learning (Branch, 2009; Ghirardini, 2011; Nada, 2015). The flowchart of the research methodology can be seen in Figure 1.

The first stage is to analyze the current condition, which aims to find existing problems with the current system in the company. The problem identified is that the existing e-learning content is not well developed and causes difficulties in the knowledge delivery system and training in the company. Therefore, the research objectives were set to develop modules and e-learning. The limitations of the research were also determined, focusing only on the Python programming module and using the flipped class method. Next, a literature review was conducted to help find solutions based on previous research, especially related to e-learning, the ADDIE method, and the flipped class method. Data collection was also conducted to define the needs of users, both learners and teachers, in the company.

Analysis	Strart
	↓
	Problem identification
	↓
	Determination of Objectives and Scope
	↓
	Literature Study
	↓
	Data Collection
Design	↓
	Data Analysis
	↓
	E-Learning Curriculum Design
Development	↓
	Curriculum development
	↓
	Content Development
	↓
	E-Learning Implementation
	↓
Implementation	User Acceptance Test
	↓
	Hasil tes dapat diterima ? / Penyesuaian

Ya Tidak

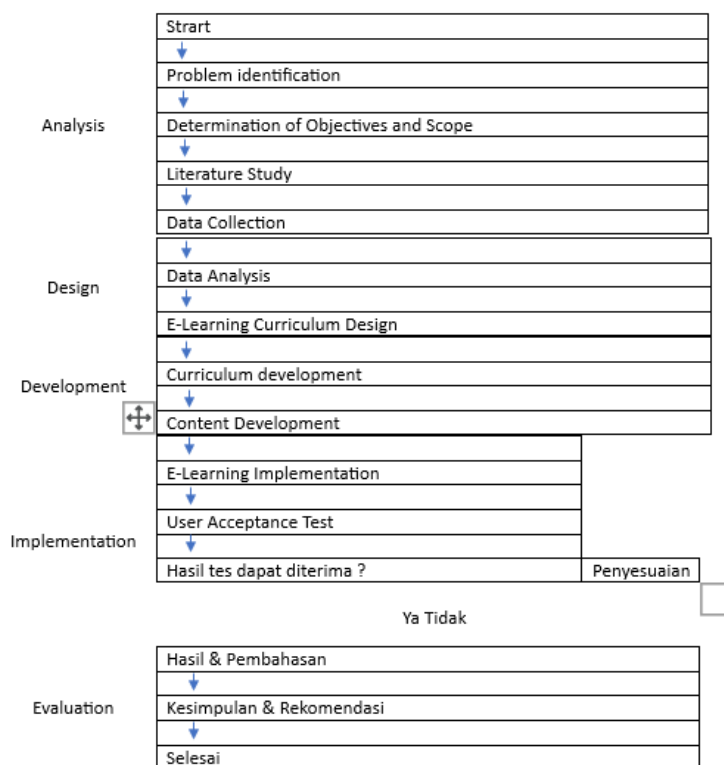| Evaluation	Hasil & Pembahasan
	↓
	Kesimpulan & Rekomendasi
	↓
	Selesai

Image 1. Flowchart of Research Methodology

After the problem is identified and data collection is conducted in the first stage, the analysis stage, the next stage is the design stage, which focuses on two processes, namely analyzing the data collection data and designing the e-learning curriculum. Based on these two processes, results were obtained related to the choice of e-learning platform, the determination of 12 e-learning topics, and the creation of an e-learning syllabus that divides topics into three parts or chapters, along with determining the type of content developed. After that, the third stage, the development stage, is carried out by developing materials in various forms of content by adjusting learning styles and adapting the flipped class.

After all the content has been developed, the fourth stage is the implementation stage, which implements the learning process with the developed module and e-learning, conducts a user acceptance test, and makes adjustments to the content and e-learning based on the results of the user acceptance test. Finally, the evaluation process evaluates the results of the e-learning and the content that has been developed. In this process, the results, conclusions, and recommendations of the research are discussed.

III.   Result and Discussion

The presentation of research results starts from the description of the results of data collection and analysis, syllabus and content development, e-learning implementation, and e-learning evaluation.

A. Data collection and data analysis

The data needed is mostly obtained from the company through several online meetings, related to the needs and objectives of the e-learning module being developed. Some of the data obtained includes e-learning targeted for use by employees at PT XYZ, aiming to educate employees about Python programming, where the material used is adapted from the offline bootcamp module that has been used as a company training program and requested to use Indonesian. The development of this e-learning is expected as an improvement and an extension of the existing training program in the company, and aims to serve as a training platform and module storage so as to facilitate knowledge management.

The data that has been obtained is then analyzed. The results were analyzed qualitatively, and several results were obtained, namely the topic analysis and the needs of the e-learning platform used. Related to topic analysis, there are 12 topics selected and developed materials and content based on analysis and discussion, namely:

1. Input dan Output
2. Expression dan Variabel
3. String Operations
4. List dan Tuples
5. Dictionaries
6. Sets
7. Conditionals
8. Loops
9. Functions
10. Exception handling
11. Object dan Class

Next, an analysis is conducted to select the right platform to be used as an e-learning platform or knowledge management system. The platform used is a learning management system (LMS) platform (Mailizar et al., 2021). Some criteria in determining the LMS platform used are web-based platforms, easy to use and user-friendly, can store scores and points from activities carried out by participants, and can be used by all types of users. After various reviews of various LMSs, it was decided to use Moodle as the LMS.

A. E-learning Curriculum Design

The curriculum design is based on the results of the analysis and determination of topics. The material obtained from data collection has been divided into 12 topics, and then in the preparation of the curriculum, divided into three chapters containing the twelve topics that have been determined. The curriculum design is outlined in the form of a syllabus. The syllabus consists of chapter names, topics, and learning resources. The syllabus of the Python programming class can be seen in Table 1.

Chapter	Topik	Sumber Pembelajaran
Chapter 1 – Basic Python	*Data Types*	Modul, Video
	Input and Output	Modul, Video
	Expressions and Variables	Modul, Video
	String Operations	Modul, Video
Chapter 2 – Data Structure	*List and Tuples*	Modul, Video
	Dictionaries	Modul, Video
	Sets	Modul, Video
Chapter 3 – Python Fundamentals	*Conditionals*	Modul, Video
	Loops	Modul, Video
	Functions	Modul, Video
	Exception Handling	Modul, Video
	Objects and Classes	Modul, Video

The curriculum design in the form of the developed syllabus, as shown in Table 1, was further developed by dividing the class into several activities by applying the concept of the flipped classroom cycle. The learning activities are also structured to meet the learning needs of learners with different learning styles based on the VARK (Visual, Aural, Read/Write, Kinaesthetic) model (Othman & Amiruddin, 2010). The learning sequence and flow of the Python programming class, by adapting the flipped classroom methodology, can be seen in Table 2.

From Table 2, it can be seen that the class is designed with various activities that support the learning process and activities that meet the needs of various learners with different learning styles. Details and descriptions of each activity and content developed are discussed in the next section.

A. Content Development

Various contents are developed based on the activities specified in the curriculum design. In the content creation process, various media were used to create sophisticated learning materials to meet the needs of the learners. The learning styles of each learner are also considered in the content development phase of this research. For example, learners with kinesthetic learning styles would be more interested in learning in a more interactive learning situation. Therefore, a discussion forum is created in the LMS platform to enhance the interactivity of kinesthetic learners.Tabel 2. Rangkaian Aktivitas Kelas Pemograman Python

No	Name	Objective	*Flipped Class Cycle*	Learning Style
1	Discussion Forum	Used by students to discuss related topics	Eksploration	Kinesthetic
2	*Reading Module*	Explanatory modules of related topics	*Explanation* (Penjelasan)	Read & Write, Visual
3	Video Session	Explainer videos of related topics	*Explanation* (Penjelasan)	Visual, Aural

4	*Pre-Session Quiz*	Testing the learner's knowledge	*Elaboration*	-
5	Synchronous Session	Engage learners in interactive activities	*Engagement*	Kinesthetic, Visual
6	*Post-Session Quiz*	Evaluate learner knowledge	*Evaluation*	-
7	*Final Project*	Final student evaluation	*Evaluation*	-

In addition to using various media and considering learning styles, the flipped class methodology is also applied to the design of classroom activities. The application of flipped class in the classroom can be seen from the various contents and activities used in the classroom, such as discussion forums, interactive videos, learning modules, and others created for each topic. The following is the content developed for the Python programming class in this research.

1. Learning Resources

The main resources or subject matter are written modules and video presentations. These resources are used in all topics in the Python programming class. The use of these learning materials is part of the adaptation of the flipped class methodology, where the concept of "I do it, You do it, We do it" is applied to all learning material content. Here are the details of each activity or learning material developed.

- Learning Module

The main focus of using learning modules as a resource is to give an edge in the learning process to learners with visual, reading, and writing learning styles. Learners with both learning styles (visual or read and write) will greatly benefit from modules as they can satisfy their learning preferences to absorb the material. The main focus of the module is to provide and explain the theory of the topic.Video presentasi

The main purpose of developing the video presentation is to provide a brief summary of the material and a discussion of the problem. The content is of great benefit to learners with aural and visual learning styles as it focuses on video and audio. The presentation video is also beneficial for kinesthetic learners, although the benefits are not as great for aural learners. This is because the video presentations are made to emphasize the verbal and visual explanations of each topic in the Python programming class.

- Forum Discussion

The discussion forum was developed in addition to the video presentations and modules, with the main purpose of serving as a medium for discussion between students and teachers regarding the topics in the class. The forum is open to all learners and is easily accessible as it is located at the top of the course page. This forum is very useful for kinesthetic learners because of the interactivity nature of the discussion forum. The discussion forum can be a good source of learning for learners

because they can exchange opinions and gain new knowledge from discussions based on questions and answers from each learner.

- Synchronous Session

Synchronous sessions are conducted on every topic in every class. These sessions are mandatory for and required by every learner so that the learning process can proceed to the post-session quiz. Synchronous sessions mainly involve practical activities or application of knowledge to enhance the learner's understanding of the topic in a particular chapter.

2. Assessment/Evaluation Activities and Methods

The assessment methods used in this class are pre-session quiz, post-session quiz and final project. The details of each assessment method are as follows.*Pre-Session Quiz*

A pre-session quiz is given before the learner takes the synchronous session for each chapter. The quiz is based on the module provided to the learner. The purpose of the assessment, with the pre-session quiz, is to determine the learner's level of understanding of the topics that have been learned from the modules provided. For this quiz, the pass mark is 50, and learners who score below 50 will have to restudy the material and retake the quiz. The learner can proceed to the next activity only if they have achieved a quiz score of 50 or above. This is to ensure that the learner has read or watched and understood the material and is ready to move on to the next topic. The pre-session quiz can be repeated a maximum of three times. If, after three attempts, the learner still does not pass, or the score is still below 50, then the learner will not pass the class.

- *Post-Session Quiz*

The post-session quiz is given after the synchronous session. This quiz is based on the material given to the learner in the synchronous session and through modules and videos. The purpose of this quiz is to determine the learner's level of understanding of the topic or material after learning the material in its entirety through synchronous sessions and asynchronous media (modules or videos). The passing score for the post-session quiz is 70, and students who score below 70 will have to retake the quiz. The learner can proceed to the next chapter only if they have scored 70 or above. This is to ensure that the learner understands the material of a topic in its entirety and is ready to move on to the next topic. The post-session quiz can be repeated a maximum of three times. If, after three attempts, the learner still does not pass, or the score is still below 70, then the learner is declared not to have passed the class.

- Project Final

Students are given a final project at the end of the Python programming class. The final project is a large project that determines the learner's understanding of the entire course. The final project is developed based on all the material from the Python programming class. The purpose of the final project is to determine the learner's level of understanding of the topics learned. The learner must submit the project on the LMS platform

2. Course Flow

Course flow is a part of e-learning content support developed to ensure that learners follow the class with a structured process. Course flow consists of several steps or activities that must be done by each learner in learning the material in e-learning, so that the learning process and experience of the learners can be improved. Course flow can be seen in Figure 2.

In general, the learning process or sequence based on the course flow is as follows. First, learners need to read the module on each topic to understand and have a basic understanding of the material. Next, the learner needs to watch the video presentation to complete the basic understanding gained from the module. After learning the material from the module and video, the learner then has to take the pre-session quiz to test the learner's understanding of the material contained in the video and module. The learner must get at least a score of 50 in order to join the synchronous session. If the learner scores below 50, then the learner must retake the quiz. A learner who has scored 50 or above is declared a pass and can join the synchronous session. Synchronous sessions are held on a specific schedule online. After the synchronous session is complete, the learner then takes a post-session quiz to test their deeper understanding of the material presented either through the synchronous session or through the videos and modules. The learner will pass the quiz if they score 70 or above. If the learner has passed the post-session quiz, then the learner can continue learning and can study the next chapter.
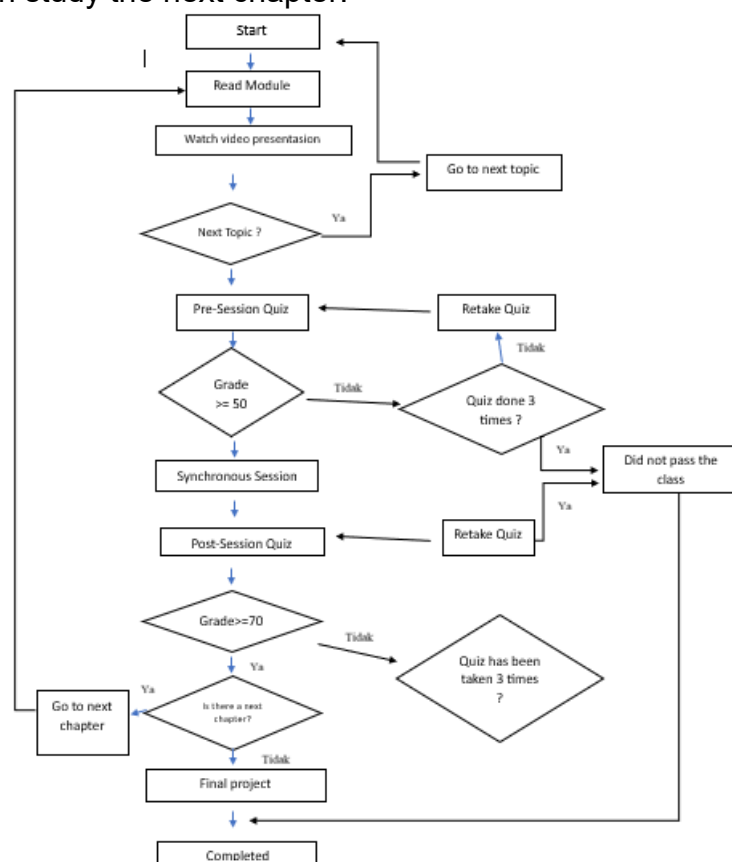

Image 2. *Course Flow*

This process repeats for each topic studied until all material has been covered. Once all chapters have been covered, the learner must do a final project. The final project must then be submitted on the LMS platform before the deadline given by the system. The final project is then graded, and if the learner scores higher than the pass mark, then the learner passes the class and receives a Python programming class certificate.

The structure of this learning process is developed by adapting the flipped classroom methodology to ensure that the learner fully understands the material provided through the various activities, and the learner can apply the knowledge gained.

3. Restriction System

To support the course flow, a system is needed to ensure that learners follow the developed course flow. Therefore, a restriction system is used on the LMS platform. This restriction system prevents some materials and activities from being accessed directly before the learner completes or performs the previous activities, thus making the learner follow the learning process in a structured manner. Figure 3 shows an example of a restriction system in Chapter 1 of the Python programming class.
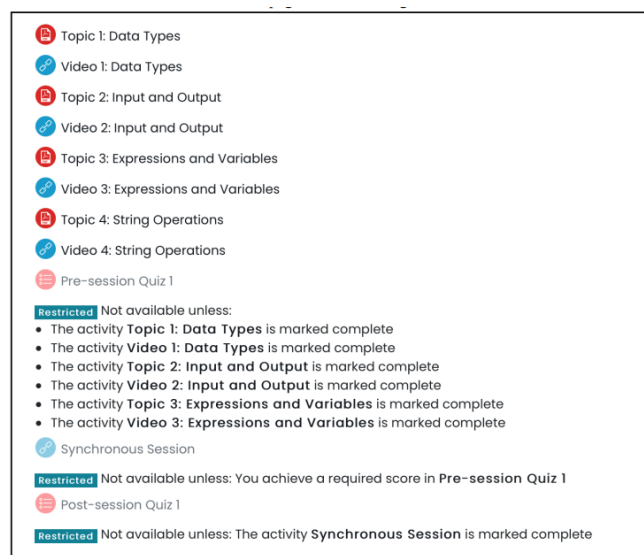

Image 3. Restriction System Bab 1

From Figure 3, it can be seen that some activities are not accessible, and there are restrictions and prerequisites that must be met in order for the activity to be accessed. Activities can be accessed only if the learner has fulfilled the prerequisites of the activity, which generally involves learning the previous material by reading the module and watching the presentation video. With this restriction system, the learner follows the class according to a series of processes that have been made and is expected to understand and understand the material through various activities as a whole..

B. Implementation *E-Learning*

The content or materials that have been developed are uploaded and arranged on the LMS located on the website of the Industrial Engineering Study Program-SGU. The materials are structured, and to make the materials and activities organized to

follow the course flow, a restriction system is set up on the LMS platform for each topic of the Python programming class. After everything is set up on the LMS platform, a User Acceptance Test is conducted to test whether the e-learning system that has been developed is in accordance with user needs. After the User Acceptance Test is conducted and the results are good, then e-learning can be used as a training program at PT XYZ.

C. Evaluasi *E-Learning*

Evaluation of the e-learning system is done with a user acceptance test after the e-learning implementation is completed. User Acceptance Test (UAT) is conducted by distributing questionnaires to participants or students containing statements to evaluate e-learning. Evaluation of e-learning is done by analyzing the results of the questionnaire and through feedback from participants, to determine whether the e-learning that has been developed can be accepted by the participants. A user acceptance test was conducted to determine the effectiveness of the modules and activities that have been developed with the flipped class methodology.

The questionnaire developed for the UAT contains questions and statements that must be answered by participants related to the e-learning content developed, as well as questions related to demographics. From the results of the questionnaire, most of the participants were students of the Industrial Engineering Study Program-SGU (around 50%), the rest were students from other departments, and there were also lecturers involved in the UAT.

Next, there are seven statements related to e-learning content that must be rated on a Likert scale of 1 to 5, to measure the effectiveness of the flipped class concept applied to the Python programming online class. The following are the statements on the questionnaire.

1. Explanation - Explanations provided through learning modules and videos are good and clear.

2. Informativeness - The information provided in the module is informative.

3. Understandable - The material to be learned is easy to understand or comprehend by me as a participant

4. Overall Experience of the Course - My overall learning experience in this class was good

5. Flow of the Course - The flow of learning with the flipped class methodology in this class is interesting and good

6. Effectiveness - The implementation of the flipped class method in online learning is effective

7. Knowledge Improvement - I feel that my knowledge has improved after learning in this Python programming class.

These seven statements are rated on a Likert scale of one to five, with a Likert scale value of one meaning strongly disagree and a Likert scale of five meaning strongly agree with the statements in the questionnaire. After the questionnaire results are obtained, the data is then processed, and the summarized results of the UAT related to the seven statements are used for quantitative analysis for e-learning. The results of UAT for seven statements related to the effectiveness of e-learning can be seen in Table 3.

First, from the results obtained for statements related to explanation, the majority of respondents answered four on the Likert scale, which means they agree that the explanations provided through learning modules and videos are good and clear. Then, related to the informative criteria, the majority of the votes were divided into two, with some answering neutral and others answering strongly agreeing to the statement "the information available in the module is informative". It can be said that, in general, participants have a neutral-positive impression of the informative criteria, or generally think that the material on e-learning is informative. Furthermore, for the material understanding criteria, with the statement "the material to be learned is easy to understand or comprehend by me as a participant", the majority of participants answered in the affirmative. This means that, in general, the material provided can be understood quite well by students or participants

Furthermore, there is an overall learning experience category with the statement "My overall learning experience in this class is good". The majority of respondents answered four or agree regarding this statement, so it can be said that the participants had a good overall learning experience, and it can be said that the class and materials that have been developed are quite good. Regarding the flow of the class, the majority of respondents agreed with the statement that the flow of learning with the flipped class methodology in this class was interesting and good. The majority of participants also agreed to the statement that the application of the flipped class method in online learning is effective. From the response results to the statements of these two criteria, it can be said that the application of the flipped class method can be said to be quite good, interesting, and effective for online learning.

Finally, related to knowledge improvement, the majority of respondents gave a neutral score or three on the statement "I feel my knowledge has improved after learning in the Python programming class", or it can be said, the majority of respondents did not feel a significant increase in knowledge. This could be due to the limited training time.

Table 3. Summary of UAT Questionnaire Results

Criteria Category	1	2	3	4	5	Average	Rounding	Description
Explanation	0	0	5	10	1	3.75	4	Accept

Informative	0	0	6	2	5	3.92	4	Accept
Understanding	0	1	6	8	1	3.56	4	Accept
Overall experience	0	0	5	10	1	3.75	4	Accept
Learning Flow	0	0	4	10	2	3.88	4	Accept
Effectiveness	0	0	5	9	2	3.81	4	Accept
Knowledge Enhancement	0	1	10	4	1	3.31	3	Netral
Total Average						3.71	4	Accept

The summary of the e-learning evaluation results in Table 3 also shows that the total average value of the e-learning evaluation is 3.71 from a 5-point Likert scale. The results obtained state that the e-learning developed is quite good. The evaluation results are generally quite good, and only one aspect needs attention because the value is quite low compared to other criteria, namely the criteria for increasing knowledge. The low value of knowledge enhancement is caused by several things, including the limited time of learning test or training, as well as the class material, namely programming, which is generally not considered easy by some people. Further research needs to be done to test the knowledge enhancement aspect with a longer test time and applying certain criteria to test participants, such as participants who evaluate should at least have a basic understanding of programming.

Despite the lower results on knowledge improvement, the general evaluation results show that the implementation of Python programming classes by adapting the flipped class method can be said to be quite good and successful. The system, platform, and e-learning materials that have been developed have good UAT evaluation results.

IV.   Conclusion

This research focuses on designing and developing e-learning for training programs at PT XYZ. The e-learning was developed using the ADDIE model and adapting the flipped class methodology, making it an effective learning system for students.

The development of e-learning modules using flipped class methodology allows students to learn with a new approach to Python programming learning, because the use of flipped class in online modules is still rare. Generally, e-learning materials are only one-way interaction, but with the application of flipped class on the material and learning flow, the class becomes interactive (two-way). The flipped class methodology's interactive side positively impacts all learners with different learning styles

The development of e-learning with flipped class methodology can be used to help learners, including trainees and employees at PT XYZ, to learn more and get a better understanding of Python programming topics. With an average score of 3.71 from the evaluation, the development of e-learning materials can be concluded as good and satisfactory.

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