

Multimedia Learning Material Impact on a Bootcamp Training Program at Merdeka Campus

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Abstract – *The use of multimedia in teaching and learning activities has been a practice that has been going on for a long time, especially since COVID-19. Teaching and learning activities using multimedia seems more interesting and able to increase student's learning interest. This research highlights the use of multimedia material in technical bootcamp training program for non-technical background participants who are studying data analytics in certified independent studies program at Merdeka Campus. Data obtained by interview and discussion with Subject Matter Expert (SME) and study literature with Republic Indonesia National Standards for Higher Education, Outcome Based Education (OBE), Instructional System Design (ISD), Bloom Taxonomy, and Kirkpatrick Model to develop the program curriculum which later analyzed and processed to become the basis for multimedia material development. The evaluation of multimedia material implementation is assessed with a questionnaire which measures participants' perception of the multimedia material used in bootcamp activity to improve their knowledge and skill while studying data analytics. The conclusion of this research is to prove the impact of using multimedia material on the teaching and learning process through the results of participants' average passing score which reached at 78.01 and the engagement of participants' commitment to the program which concluded in graduated percentage, reached at 73.33%.*

Keywords: *Multimedia Technology; Material Learning; Bootcamp; Training, Online Learning; Education*

I. INTRODUCTION

The COVID 19 pandemic in 2020 has changed the living habits of almost all people in the world, including teaching and learning activities. There are many things that need to be adjusted, for example, face-to-face class sessions must be replaced virtually using video communication applications, note-taking in books is replaced by capturing screenshots on the screen or re-watching recorded broadcasts that have been done, paper assignments are switched to online assignments and many others onsite activities change into virtual or long-distance activity (Santoso, et al., 2024). This dynamic activity certainly didn't just stop when the COVID-19 pandemic was declared endemic. The new habit of online learning continues even nowadays, as is done by one of the training institutions, ZK.

Since the pandemic hit, the ZK training institute has changed all its training activities from onsite to fully online. Of course, running online training is not an easy task. In several research, it is proved that there are several common challenges from student perspectives that occur in online learning, such as poor engagement, lack of technical skill, demotivation in learning process, silent communication, poor self-learning skill, lack of digital savvy, too much distraction and unsupportive environment while learning, burdened by the heavy and too much assignment from several subjects, and so on (Xia, Hu, Wu, Yang, & Lei, 2022; Agustina, Matra, & Karimah, 2020). It was the same with what ZK training institute faced. There were several challenges that occurred, such as the

commitment of several students to attend during the learning process, the presence of students in the video communication meeting application room who appear to be there but are not focused on listening to the learning process, the level of understanding of the material is uneven, and plagiarism while doing the assignment, and so on.

In order to overcome that challenge, ZK started to use interactive multimedia technology. The use of multimedia technology was first implemented in one of ZK's online training which occurs in 2022 until 2023. On that year, ZK training institute participates in Republic Indonesia Ministry of Education, Culture, Research and Technology (KemenDikBudRisTek RI) program called Merdeka Campus, which is an initiative program of KemenDikBudRisTek RI by providing opportunities for the last year university students throughout Indonesia to be able to take another learning subject outside of the student university's study program for 2 semesters. Universities in Indonesia are also given the opportunity to carry out Merdeka Campus activities that suit to the needs and interests of their students. It is hoped that by taking part in Merdeka Campus activities, students will gain valuable experience as career preparation for their future while also ensuring students follow the current trends and apply their knowledge to the existing problems/issues in real world (Pusat Informasi Kampus Merdeka Kementerian Pendidikan, Budaya, Riset, dan Teknologi Republik Indonesia, 2022).

There are several types of Merdeka Campus activities, one of them is called Certified Independent Study (SIB). In SIB, KemenDikBudRisTek RI collaborates with various institutions and training institutions to provide real learning experience and implementation of knowledge in industry. If a student who registers and joins as a participant is to pass the SIB activity, they can convert 20 credit units in the current semester in his/her university in accordance with the policies of each participating university. The ZK Training Institute itself participates in SIB by providing a Data Analytics technical bootcamp training program with a total learning duration of around

±900 hours which can be attended by students in Indonesia from various educational backgrounds, including non-technical background.

This bootcamp training program is run once every 6 months online. The material delivery method is carried out in two ways, by asynchronous and synchronous. The asynchronous way is delivered via Video Based Learning (VBL) and several reading materials per topic. Meanwhile the synchronous way is delivered via virtual sessions by Zoom Conference session, learning materials presentation, and hands-on practice per topic. Each participant who takes part in this program will be accompanied by an instructor in big virtual classes (all participants participate in one session) and a mentor in small virtual classes (participants are divided into classes containing ± 30 participants). The learning assessment is carried out through pre-test, post-test, assignment, and final project, which is given in two ways, both asynchronously and synchronously.

Asynchronous material aims to make the participants study independently before entering a synchronous session where later participants will receive a thorough explanation of the material by an instructor in a big virtual class and can discuss further and deepen the material according to the direction of the mentor in the small virtual class. It is expected that participants can understand the theory and concepts in each topic well through the asynchronous method and then be able to practice and implement the concepts and theories through the synchronous method. In the end, the goal of the participants can follow the current trends and apply their knowledge and skill in current problem/issue can be achieved.

The use of interactive multimedia implemented on learning and assessment materials provided to participants for each topic. This aims to attract participants' attention, simplify the complex material, demonstrate fun learning, as well as increase participants' interest in learning and participants' learning commitment or retention in each learning session, and furthermore enhancing participant's

achievement to get the highest grade (Sharma, 2013; Awani, Senteni, & Singh, 2016; Ali & Sahab, 2022). Moreover, the use of interactive multimedia wants to overcome the challenges of online learning. That is why implemented the use of interactive multimedia in this bootcamp training program can run smoothly and the participants' participation can be maintained well from the beginning until graduation.

The integration of multimedia technology in technical training, as revealed in numerous studies, has shown significant benefits in improving teaching and learning activities. Multimedia tools, such as video, animation, audio, and graphics, have been shown to increase the efficiency of English language teaching (Sharma, 2013; Mambetova, 2020; Lin & Tseng, 2012), contribute to higher teaching quality in foreign language education (Bărbuleț, 2023), and increase student interaction and immersive learning in technical subjects (Affero, et al., 2019). In addition, the use of multimedia teaching devices with features such as display screens, speakers, and interactive components has been designed to increase not only student engagement and interest in learning, but also students' cognitive, affective, and psychomotor aspect (Greenberg & Zanetis, 2012; Miaz, et al., 2019). Therefore, integrating multimedia elements into technical bootcamp training program at ZK training institute potentially create a more effective and engaging learning experience, which will ultimately benefit students' educational outcomes.

In Indonesia, multimedia-based learning has been widely implemented from school to university levels. Several studies have been conducted to prove the effectiveness of implementing multimedia in teaching and learning systems, such as research conducted by Hadi et al. (2022) which examines the application of interactive multimedia to enhance student learning outcomes in Solar System science subjects. This research shows that the interactive multimedia can simplify the material, get the students interest and focus to learn the subject and has significant influence on student's level of understanding and memory. This research was carried out by developing and implementing interactive multimedia media learning to the 52 sixth grade

students at Padurenan Jaya elementary school. The method used to conduct this research was using a quantitative technique using a quasi experimental method in non equivalent control group design. The research sample consisted of 28 students as the experimental group and 26 students as the control group. This reseach using t-test to measure the student's learning result. At the end as the result, it showed that the students who using the interactive multimedia media learning has a greater result rathen than the students who learning using the conventional methods.

Research about implementing multimedia in school is also conducted by D. Suri and R. Rachmadtullah (2021) which their research wanted to show the effectiveness of the use of interactive multimedia to improve the understanding of low-grade students on mathematic subjects. This research used a quantitative approach with experimental design. The sample of this research was 40 low-grade students in elementary schools. The data analysis of this research was conducted with t-test with the help of SPSS 24 program to measure between pre-test, before the students studied using interactive multimedia, and post-test, after the students studied using interactive multimedia. The research's results showed that interactive multimedia can help students to transfer knowledge better and gain better understanding, motivation and interest in learning mathematics.

Meanwhile, the application of multimedia in higher education can be seen in research conducted by Iskandar et al. (2018) the effects of multimedia learning were clearly visible in experiments conducted on students who are studying robotics at STMIK AKBA Makassar. The sample of this research was 60 informatics engineering students for the 2016/2017 even semester academic year who took robotics courses at STMIK AKBA. This research divides into 2 groups of students who study robotics courses using multimedia material and those who study robotics courses conventionally without multimedia material. The results obtained from this research show that the group of students who studied robotics courses using multimedia material obtained higher cognitive understanding scores than the

group of students who studied robotics courses conventionally.

Nadeak & Naibaho (2019) also conducted research on the effects of learning multimedia and thinking style preferences on learning achievement on anatomy at the Faculty of Medicine, Universitas Kristen Indonesia. This is quantitative research with a quasi-experimental design. This research sample involved a population of students from the class of 2017 and 2018 who were randomly selected. Data was obtained through test and non-test instruments analyzed using descriptive statistics and inferential analysis through ANOVA test 2x2. The results obtained from this research show that the average learning achievement of students who use video is higher than students who use PowerPoint only.

From the presentation of several research above, it has been shown that the use of multimedia in formal learning such as schools and universities in Indonesia has been going on for a long time and provides good benefits for students, especially in mastering the material which leads to the final achievement of the students' own learning outcomes. This indicates that the application of multimedia in learning process shows a positive side. It also means that the use of multimedia technology is an effective and efficient learning strategy not only in the realm of formal education but can also be applied in the realm of non-formal education such as training and bootcamp, including technical and non-technical topics.

Through this research, there are three research questions that need to be answered. They are RQ1: what types of multimedia are used in the bootcamp training program?, RQ2: how is the multimedia implemented in the bootcamp training program?, and RQ3: how does the impact of multimedia material to the participants' understanding and participation in the bootcamp training program?. It is hoped that this research can answer several objectives and provide the following benefits by the three research questions before. The purposes of this research are identifying the type of multimedia used in the bootcamp training program, knowing the implementation of multimedia in the bootcamp training program, and evaluating

the effectiveness of multimedia material in increasing understanding of technical topics and participants' participation in the bootcamp training program. Meanwhile the benefits of this research are providing information about the types of multimedia that can be used in technical bootcamp training program, providing empirical evidence regarding the implementation of multimedia in technical bootcamp training program, and presenting recommendations for training institutions in developing more effective learning strategies.

II. RESEARCH METHODS

The research methodology used is depicted in Figure 1 below. It shows that the research methodology will be run into 4 steps. It starts with a problem description first. Then it continues to data collection and moves to the data analysis. After that, the last step will be an evaluation to complete the research methodology used. The detailed description of each step will be described in sub each section below.

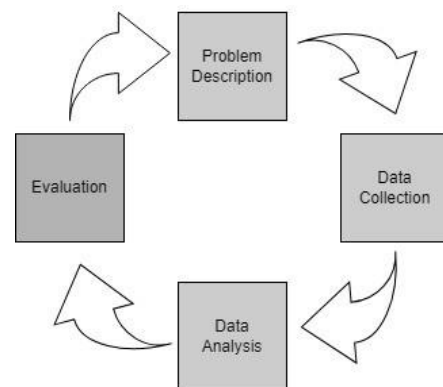


Figure 1. The Research Methodology Used

2.1 Problem Description

This research started with program provisions created by Merdeka Campus. KemenDikBudRisTek RI stated that every training institution that collaborates in implementing SIB activities is obliged to explain in detail about the learning curriculum offered which has a duration of \pm 900 hours over a period of 6 months with a total of 20 credits. Apart from that, the topics offered by training institutions must be included in one of several strategic topics of

KemenDikBudRisTek RI. The ZK training institute chose to run a technical bootcamp training program with the topic of Data Analytics which is included in one of KemenDikBudRisTek RI's strategic topics.

2.2 Data Collection

After knowing the research problem, ZK training institute began collecting data by conducting interviews and discussion sessions with several Subject Matter Experts (SME) to collect supporting data to start the curriculum design process in accordance with the provisions set by KemenDikBudRisTek RI. Not only conducting interviews and discussion sessions with several SMEs, ZK training institute also reviewed several literature studies as references that can be used to create curriculum designs, such as Republic Indonesia National Standards for Higher Education, Instructional System Design (ISD), Outcome Based Education (OBE), Bloom Taxonomy, and Kirkpatrick Model. Later, all these references will be analysed first to check whether it can be used as the basis for designing the curriculum or not.

2.3 Data Analysis

All the data collected in the previous stage is then analyzed and processed further so it can be used in creating the Merdeka Campus bootcamp training program's curriculum. The carried-out analysis was extracting all the results of interview and discussion sessions with SME and then mapping them with the Republic Indonesia National Standards for Higher Education to check graduate learning outcomes from this bootcamp training program. After that, the graduate learning outcomes will be arranged using the Bloom Taxonomy and OBE formula. Later, the graduate learning outcomes will be break down into several learning modules. The learning modules will be defined using ISD and Bloom Taxonomy, and the Kirkpatrick model will be used as the basis for assessment measurement. At the end, the results will be produced as learning curriculum design masterplan which is already in accordance with the provisions set by KemenDikBudRisTek RI.

2.4 Evaluation

The evaluation process is carried out at this stage with the aim of finding out whether the

series of lessons carried out in the Merdeka Campus bootcamp training program are effective enough for participants in helping them understand and master the material well. Data collection for this evaluation process is designed using a quantitative approach by using a questionnaire designed to obtain information relevant to the research objectives. The questionnaire will measure participants' perceptions of the use of multimedia used in each training session. Later the data from the questionnaire will be analyzed using descriptive statistics to describe the data distribution. The effectiveness of multimedia in increasing understanding concepts will be measured by participants' passing score. Participants' suggestions or feedback regarding the multimedia technology used are also recorded for the next improvement. The feedback will be addressed and followed up as a form of response to the results of the program evaluation. This stage must be done as a form of improving the quality of multimedia technology in the next batch Merdeka Campus bootcamp training program.

III. RESULTS AND DISCUSSION

This section will be shown the result of implementing multimedia learning material in the bootcamp training program. It will start with need analysis sub section as the summarize of problem description, data collection, and data analysis activities. After that, it will be continue to the planning and design sub section which explain how the multimedia learning material will be produced and used in the bootcamp training program. The implementation as the next sub section will explain what is already planned and designed before. After implementation was done, the result will be evaluated with the questionnaire that has been designed before and later will be taken as points to be discussed in discussion sub section. The detailed of each sub section will be described below.

3.1 Need Analysis

ZK training institute needs to carry out further related reviews to develop a bootcamp training program curriculum design that is in accordance

with the direction of KemenDikBudRisTek RI, which requires the learning curriculum to be \pm 900 hours in duration over a period of 6 months with 20 credits and the program topic must be included in one of the strategic topics of KemenDikBudRisTek RI. To be able to meet all these needs, the ZK training institute conducted interview and discussion sessions with related SMEs. Apart from that, the ZK training institute also conducted a literature review of Republic Indonesia National Standards for Higher Education (Kementrian Pendidikan, Kebudayaan, Riset, dan Teknologi, 2020), ISD, OBE, Bloom Taxonomy, and Kirkpatrick Model.

The implementation of OBE is carried out because OBE itself focuses on education that is results-based and centered on students as learners with expected results including knowledge or cognitive, abilities or psychomotor and behavior or affective aspects (Chan & Chan, 2009; Japee & Oza, 2021). Meanwhile, ISD was chosen because the process is systematic and iterative from the beginning of learning to the end so that the learning process can be mapped well and connected to one another (Chaeruman, Wibawa, & Syahrial, 2020). Republic Indonesia National Standards for Higher Education is also used as a graduate learning outcome of the bootcamp training program.

The graduate learning outcome depicted several competencies that need to be achieved in this bootcamp training program. The competencies consist of cognitive, affective, and psychomotor aspects. In order to achieve the competencies target, the curriculum is supported by the Bloom Taxonomy (Bloom, 1956) and Kirkpatrick Model (Smidt, Balandin, Sigafos, & Reed, 2009), which will align between the graduate learning outcomes and the composition of each learning module's activities that participants will learn. Moreover, it is expected that the curriculum can be in line with the minimum standards of each participant's university, so that the process of converting participants' credits in the current semester can be carried out smoothly and pointed at target. The result of this stage will be shown as learning curriculum design masterplan.

3.2 Planning & Design

After the need analysis is done, the process will continue to plan and design stage. The learning curriculum design masterplan has summarized the program goal of the bootcamp training program. This masterplan has been produced in accordance with the direction of KemenDikBudRisTek RI by using Republic Indonesia National Standards for Higher Education, ISD, OBE, Bloom Taxonomy, and Kirkpatrick Model. Table 1 and Table 2 below show the plan of multimedia technology used in each module for asynchronous session and synchronous session.

Table I. Mapping of Utilizing Multimedia Materials in Each Module for Asynchronous Session

Module	Asynchronous				Hours
	Video Based Learning (VBL)	Pre-Reading	Pre-Test	Assignment	
Module 1	✓	✓	✓	✓	24
Module 2	✓	✓	✓	✓	24
Module 3	✓	✓	✓	✓	24
Module 4	✓	✓	✓	✓	24
Module 5	✓	✓	✓	✓	24
Module 6	✓	✓	✓	✓	24
Module 7	✓	✓	✓	✓	24
Module 8		✓	✓	✓	24
Module 9	✓	✓	✓	✓	24
Module 10	✓	✓	✓	✓	24
Module 11	✓	✓	✓	✓	24
Module 12	✓	✓	✓	✓	24
Module 13	✓	✓	✓	✓	24
Module 14		✓	✓	✓	24
Module 15	✓	✓	✓	✓	24
Module 16	✓	✓	✓	✓	24
Module 17	✓	✓	✓	✓	24
Module 18		✓	✓	✓	24
Module 19	✓	✓	✓	✓	24
Module 20	✓	✓	✓	✓	24
Module 21	✓	✓	✓	✓	24
Module 22	✓	✓	✓	✓	24
Module 23	✓	✓	✓	✓	24
Module 24	✓	✓	✓	✓	24
Module 25		✓	✓	✓	24
Final Project		✓			156
Total Hours of Asynchronous Session					756

Table II. Mapping of Utilizing Multimedia Materials in Each Module for Synchronous Session

Module	Synchronous				Hours
	Zoom Conference	Learning Material Presentation	Hands-On Practice	Post-Test	
Module 1	✓	✓		✓	4
Module 2	✓	✓		✓	5
Module 3	✓	✓	✓	✓	5
Module 4	✓	✓	✓	✓	5
Module 5	✓	✓	✓	✓	5
Module 6	✓	✓	✓	✓	5
Module 7	✓	✓	✓	✓	5
Module 8	✓	✓		✓	5
Module 9	✓	✓	✓	✓	5
Module 10	✓	✓	✓	✓	5
Module 11	✓	✓	✓	✓	5
Module 12	✓	✓	✓	✓	5
Module 13	✓	✓	✓	✓	5
Module 14	✓	✓		✓	5
Module 15	✓	✓	✓	✓	5
Module 16	✓	✓	✓	✓	5
Module 17	✓	✓	✓	✓	5
Module 18	✓	✓		✓	5
Module 19	✓	✓	✓	✓	5
Module 20	✓	✓	✓	✓	5
Module 21	✓	✓	✓	✓	5
Module 22	✓	✓	✓	✓	5
Module 23	✓	✓	✓	✓	5
Module 24	✓	✓		✓	5
Module 25	✓	✓		✓	5
Final Project	✓				20
Total Hours of Synchronous Session					144

Table II and Table II above shows several types of multimedia technology that will be used in this bootcamp training program. In asynchronous sessions, the multimedia technology used are VBL, pre-reading material in the form of PPT slides of infographics, interactive multimedia tools such as Google Form will be used as pre-test and some other tools like Microsoft Office or Google Data Studio and BigQuery will be used for completing the assignment. Meanwhile, in synchronous sessions, multimedia technology used includes virtual class using Zoom Conference, PPT slides for learning material presentations, technical tools like Google Data Studio and BigQuery will be used as hands on

practice tools, other interactive multimedia tools like Miro will be used for group discussions in virtual class, and also a simple gamification like Quizizz is used for post-test. The design of each component of the multimedia technology used will be realized and produced according to the plans outlined before. Specifically, VBL is realized by designing a storyboard first, then continuing with the filming, editing and quality check processes so that the results are optimal and in accordance with the plan that has been outlined before. In both tables above, the total hour for asynchronous session is 756 hours and the total hour for synchronous session is 144 hours. So, the overall total learning hours for ZK bootcamp training program is 900 hours as same as with KemeDikBudRisTek RI asked.

3.3 Development & Implementation

After each multimedia learning material has been successfully produced, the next step is to implement it into the bootcamp program training activities. The implementation starts with an asynchronous session first, where all participants are given a pre-test first to test their initial understanding of the module. After successfully completing the pre-test, participants will be directed to watch the VBL from the module. After participants successfully complete VBL, participants will usually be given the next process for the module, for example participants are asked to read pre-reading material or complete a simple task and later will be discussed in a synchronous session. Participants can also access pre-read material before they watch the VBL to support their knowledge of the module. Figure 2 until Figure 4 below will show several samples of the implementation of each multimedia learning material in asynchronous sessions.

Relational DataBase Management System

...

2. Which of the following is not one of the advantages of using Database instead of Excel? *

Collaborative working

Readable data

Larger data storage

Faster data processing

3. What is the syntax to do filtering/retrieving specific data based on condition in SQL? *

select

limit

where

order by

4. What is the syntax to do sorting after the data is retrieved in SQL? *

select

limit

...

6. What are the types of data sources that are available to use in Looker Studio? *

Embedded

Reusable

Both are True

Both are False

...

7. These are some built-in charts in Looker Studio. Identify one that isn't available by default: *

Table

Scorecard

Pivot Table

Word Cloud

8. Identify which one of these features isn't part of the Control feature in Looker Studio: *

Input Box

Query

Slider

Drop-down List

Figure 2. Sample of Pre-Test From Two Different Modules

Probability Distribution

shape of a distribution

- normal distribution: unimodal, symmetric, aka bell curve
- skewed distribution: positively skewed, skewed right
- skewed distribution: negatively skewed, skewed left
- uniform distribution: equally spread, no peaks
- bimodal distribution: two modes, asymmetric
- skewed distribution: two modes, non-symmetric

7. Move to the credentials menu in APIs & Services

8. And then, click "create credentials" and choose the service account

```
df.info()
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5 entries, 0 to 4
Data columns (total 3 columns):
 #   Column      Non-Null Count  Dtype
---  -
 0   cust_id     5 non-null      object
 1   item_bought 5 non-null      int64
 2   city        5 non-null      object
dtypes: int64(1), object(2)
memory usage: 248.0+ bytes
```

Figure 3. Sample of Two Different Modules VBL

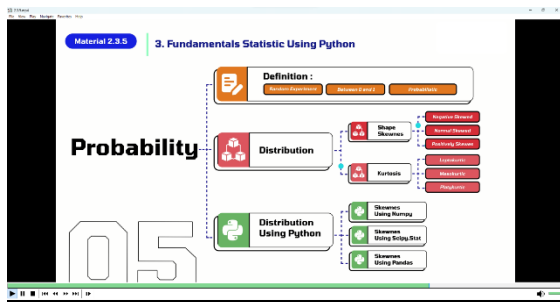
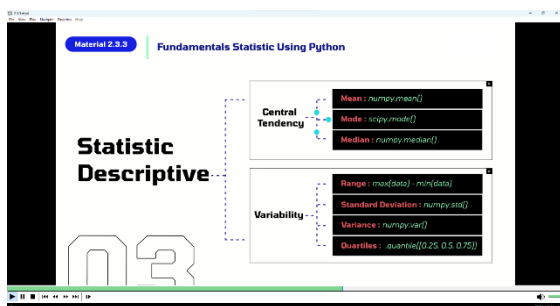
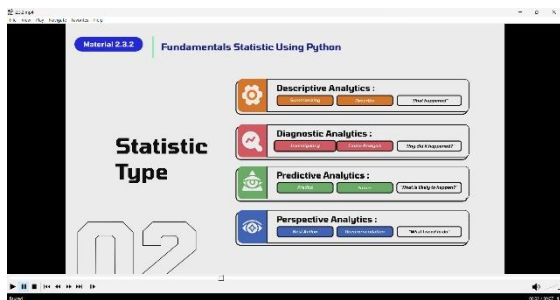
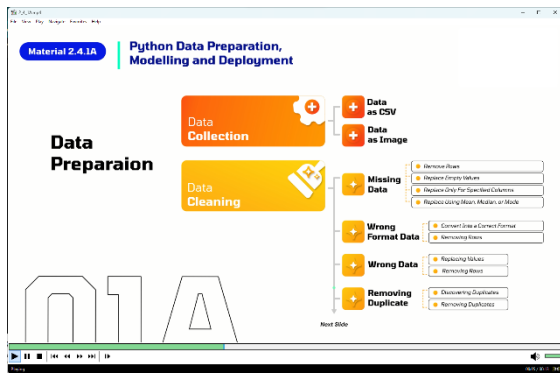


Figure 4. Sample of Infographics as Pre-Reading Material From Two Different Modules

The next stage after the asynchronous session of a module is completed, the synchronous session will start. The synchronous session will begin with a big virtual class meeting via Zoom Conference led by an instructor. In this session, participants will learn further about the discussed module. After this session, participants will be divided into several small virtual classes via Zoom Conference led by a mentor in each class. In this small virtual class

session, participants will join the hands-on practice in depth regarding the discussed module. Finally, before participants continue learning the next module, participants are required to complete the post-test for the discussed module. Figures 5 until Figure 7 below will show the sample of the implementation of multimedia learning material of several modules in synchronous sessions mode.

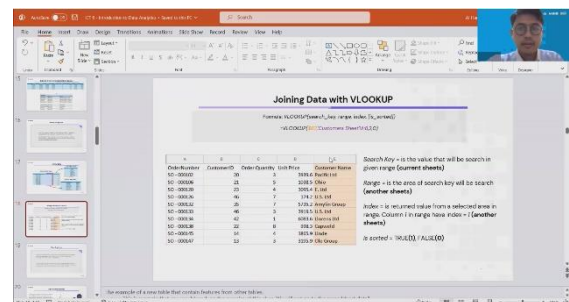
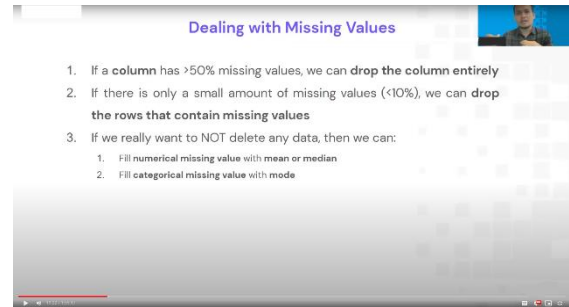



Figure 5. Sample of Synchronous Session with Instructor and Mentor via Zoom Conference From Two Different Modules

Python Variable and Data Type

Variable Concept

A variable is simply a name to which a value can be assigned.

The simplest way to assign a value to a variable is through the "=" operator.



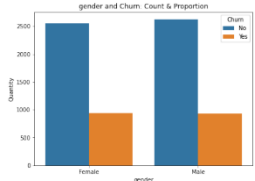
A big advantage of variables is that they allow us to store data so that we can use it later to perform operations in the code.

Variables are **mutable**. Hence, the value of a variable can always be updated or replaced.

Column Understanding

In this bar plot, we can see that:

- There are equal number of males and female customers in the data
- The proportion of Churn vs Not-Churn customers are also equal in female and male group




What does this tell us?
Gender don't seem to have a strong relationship with Churn status of a customer.

Exploratory Data Analysis

Why EDA?

(cont).

Last but not least, through EDA, we can also get insights on which column is 'useful' and contains relevant information, and which column is 'not relevant'.



We'll see an example about it in our hands-on session later.

Differences between Data, Analytics, and Insight

Data = a collection of facts.
Analytics = organizing and examining data.
Insights = discovering patterns in data.

There's also a linear aspect to these terms that differentiates them. Data is collected and organized, then analysis is performed, and insights are generated as follows:




Figure 6. Sample of Learning Material Presentation From Two Different Modules

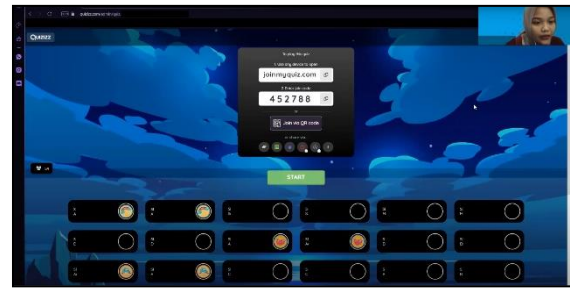


Figure 7. Sample of Post-Test From Two Different Modules

3.4 Result

The results of implementation of multimedia learning materials in Merdeka Campus bootcamp training program are obtained in the evaluation of the activities and final study results of each participant. Evaluation activities are carried out by distributing evaluation questionnaires to 150 participants to check the participants' perceptions of the use of multimedia used in each training session. Figure 8 below shows the descriptive statistics to describe the distribution of quantitative responses from participants about multimedia learning materials used as learning materials throughout the program activities.

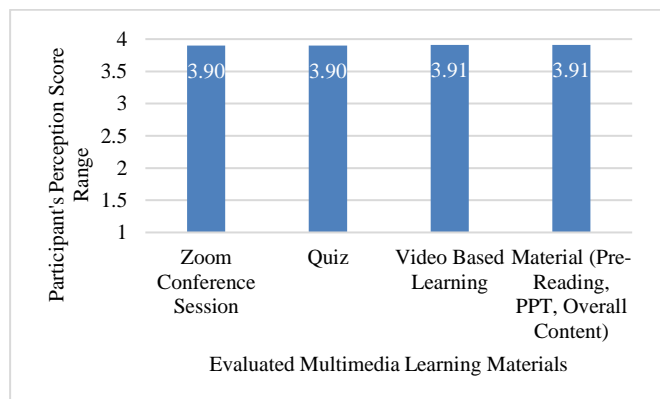


Figure 8. Descriptive Statistics from Participants' Quantitative Response

Figure 8 above shows several multimedia learning materials that were evaluated for

participants' perception of the use of multimedia used in each training session. In the questionnaire, Participants are asked to rate the multimedia learning materials used between the range of score 1 to score 4, where the score 1 is the lowest number which means it is difficult to accept or is not satisfied with the use of multimedia learning materials because it does not support their understanding in studying the discussed module, while the score 4 is the highest number which means the participant is really accept or very satisfied with the use of multimedia learning materials because it really supports their understanding in studying the discussed module. The results showed that the average response from participants was 3.90 out of 4.00. Meanwhile, a summary of participant feedback and responses from the ZK training institute can be seen in Table III below.

Table III. Summary of Quantitative Participant Feedback and ZK Institute Response

Feedback from Bootcamp Participants	Response from ZK Institute
If the material is too dense and heavy, can be divided it into 2 meetings for a Zoom Conference session	In the next batch it could be considered to break down the high-level difficulty material into 2 meetings with each session lasting around 2.5 - 3 hours each of Zoom Conference sessions
So far the presented material is quite good, but examples and case studies with explanations need to be provided	In the next batch, we will provide several relevant examples and discuss the examples in detail on Zoom Conference sessions with mentors' guidance to improve the quality of learning
There are some VBLs that have a short duration and some that have a long duration, so it would be better to make it standard. Sometimes the long duration makes you bored.	In the next batch, we will review the duration of the VBL again and ensure that it is made in bite size and simple so that participants can understand the material well and maintain participant focus span time in asynchronous session
It would be better if there was a 2 week break for participants to understand the material well and consult a mentor	There was a break during the consultation session with the mentor and weekend time where there was no teaching learning activities can be considered as break time, because the curriculum presented was already approved and in accordance with the

Feedback from Bootcamp Participants	Response from ZK Institute
	provision of KemenDikBudRisTek RI
VBL is better for theory only, there is no need for coding techniques	This can be done for the next batch. The best VBL theory will be selected as the best practice in this batch and serve as the best reference for VBL development in the next batch
The duration of the Zoom Conference for technical material with a high level of difficulty must be increased due to lack of time	In the next batch of especially technical material with a high level of difficulty will break down into 2 meetings, for each session lasting around 2.5 - 3 hours of Zoom Conference sessions
The goals between the Zoom Conference and Hands On Practice sessions must be aligned and agreed upon at the start between instructor and mentor	It is necessary to provide a detailed outline of the activities of the Zoom Conference and Hands-On Practice sessions. A lesson plan will be made as a record of the material points, exercises and case studies presented by the mentor. This lesson plan will be provided by the instructor. Plus using ratings feature via Zoom poll to quickly check about participants' understanding
There needs to be a handout at the Hands-On Practice session so that it is standardized with other mentors during consultations	The instructor must provide a lesson plan to all mentors so that they can align with each other about the consultation topic in detail

Table 3 above is a summary of 150 participants' feedback and classified into several points regarding the use of multimedia technology in this training. This feedback is important for the sustainability and improvement of the quality of learning at the ZK training institution. As a form of response to feedback provided by participants, in Table 3 is also included the response from the ZK training institution. This shows how the ZK training institute wants to maintain good relations with all participants as

well as to show a commitment to improving the quality of learning at ZK training institute. On the other hand, the effectiveness of multimedia technology in enhancing the understanding of each module is measured through the results of Merdeka Campus bootcamp training program which can be seen in Table IV below.

Table IV. Results of Merdeka Campus Bootcamp Training Program

Total Participants	150 participants
Graduated Participants	110 participants
Failed Participants	38 participants
Passing Grade Average	78.01
Graduated Percentage	73.33%

From Table IV above, we can see that of 150 participants who took part in the Merdeka Campus bootcamp training program, there were 110 participants who graduated with an average passing score of 78.01. This shows that the multimedia materials presented provide good understanding for the participants. Meanwhile, the graduated percentage was recorded at 73.33%, which means that the multimedia material presented was sufficient to engage the participants to fully commit completing this program from the beginning until graduation. So, from the results shown in Figure 8 and Table 4, it can be concluded that the multimedia learning materials can bring a positive impact on this bootcamp training program.

3.5 Discussion

After looking at the results regarding the implementation of multimedia learning materials, there are several lessons and suggestions that can be obtained as improvement or recommendations for more effective learning development strategies in the future. First, the VBL should be given in bite size durations so that participants can understand the concepts simply and quickly absorb the essence of the material discussed (Koh, Gottipati, & Shankararaman, 2018). VBL with bite size duration, for example 10 minutes video or less, can also increase the time span for participants to learn, enhance participant's motivation to learn, maintain participant retention, and enjoy the next following asynchronous session well with fun mood

without any burden (Weinert, et al., 2024; Tan, et al., 2023).

Second, it is better to do some research about how to design the best interactive video as an interactive media learning. As the bite size videos are recommended in some research, it is also necessary to consider the standardization of the video design. With standardization video design, it can reduce the cognitive load while the participants use VBL. Moreover, it also can increase motivation, learning success and interaction of learners as the content composition is adjusted (Weinert, Thiel de Gafenco, & Börner, *Fostering Interaction in Higher Education with Deliberate Design of Interactive Learning Videos*, 2020). As for this research, the participants give feedback about the content of the VBL. They stated that the VBL is better to contain more theoretical material or concepts so that participants do not have difficulty understanding the material discussed by themselves. This feedback is in line with the research conducted by Noor (2014) which the learners can get a good mark after studying using a video embedded with cognitive theory. In addition, for the feedback, if we need to attach the technical content, it will be better to be broken down into a separate tutorial video which is longer in duration because it must explain step by step in detail.

Third, especially for the technical topic, there must be a Zoom Conference session in each module after an asynchronous session to explain in depth. These aims for the participants can get confirmation from instructors and mentors who already have experience and are experts in their fields. Plus, the participants also can confirm their understanding about the module they learnt by themselves. This wants to answer about one of the challenges of online learning in section 1 introduction, which is poor self-learning skill.

Fourth, we need to ensure the duration and the composition between asynchronous and synchronous learning. It is better to consider the division of duration and composition between asynchronous and synchronous by the module's learning objectives, level of material difficulty, and comprehension assessment. This aims for the participant understanding and mastering the

material well. Moreover, this also aims for the instructors and mentors' successful teaching flow, so that they can prepare themselves for delivering the modules very well based on their expertise.

The last, Fifth, as for the interactive quizzes for this research using multimedia tools like Google Form and Quizizz. It can be considered to design interactive quizzes can also be created in the form of gamification. In some research, it showed that the effect of gamification for learning shows some positive result, such as participants are more enthusiastic, enjoying the learning process, not stressed when undergoing a long bootcamp training program, motivated to learn and enhance student learning outcome (Lukman, Agustiani, & Setiani, 2023; Fernandez-Antolin, del Río, & Gonzalez-Lezcano, 2020; Yildirim, 2017). It is hoped that by implementing gamification as interactive quizzes the learning process can be fun and enjoyable not only for the participants but also for the instructors and mentors.

IV. CONCLUSION

This research wants to answer the research question presented in section 1 introduction. The first research question, RQ1, is what types of multimedia are used in the bootcamp training program? The answer is: the types of multimedia that are used in this bootcamp training program diversified in several type such as VBL, pre-reading material in the form of PPT slides or infographics, multimedia tools that were used to create an interactive learning such as interactive quiz using Google Form and Quizizz, Zoom Conference for synchronous learning sessions and hands-on practice, and several other tools such as Microsoft Office, Google Data Studio and Big Query for technical hands-on practice, Miro for group discussion, and so on. It is hoped by using diversified type of multimedia, we can manage the participants' retention while they learn.

The second research question, RQ2, that needed to be answered is how is the multimedia implemented in the bootcamp training program? The answer is: it is implemented in two way, asynchronous and synchronous. First will be started with asynchronous session,

which it started with participants completed the pre-test using Google Form, then they continued to watch VBL and then accessed the pre-reading material in the form of PPT slides or infographics. After the asynchronous session is done, then it continued to synchronous session, which started with big virtual class via Zoom Conference led by an instructor. After that, participants will be divided into small virtual class which led by a mentor for joining hands-on practice via Zoom Conference. In hands-on practice session, participants used several tools such as Google Data Studio and Big Query. Other interactive tools also used such as Miro for group discussion, and simple gamification like Quizizz is used for post-test.

The last, the third research question, RQ3, that need to be answered is how does the impact of multimedia material to the participants' understanding and participation in the bootcamp training program? The answer is: the impact of multimedia material to the participants' understanding and participation in the bootcamp training program is depicted in the average participants passing score report and the percentage of graduated participant. As shown in Table 4, it is showed that the average participants passing score is 78.01 and the percentage of graduated participant reached at 73.33%. So, it can conclude that the use of multimedia material is giving a positive impact on a bootcamp training program especially to the non-technical background participants to learn technical topic.

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