The goal of this research is to enhance learning and critical thinking abilities of Cosmetology and Beauty students in e-commerce courses through the implementation of interactive e-commerce e-modules. This study uses a quasi-experimental approach with control groups for the pretest and posttest. Data collection was carried out using instruments in the form of open questionnaires and tests. The study's data analysis method is quantitative descriptive analysis, differentiation power analysis using T-Test and qualitative descriptive analysis. The independent sample t test findings describe a Sig [2 Tailed] greater in the experimental class compared to the control class, it can be inferred that there is a substantial difference between the two groups. The overall findings support the usage of the e-module in e-commerce courses because it has been shown to enhance critical thinking abilities and learning outcomes.
A. Introduction

Innovation in the world of education is being intensively carried out by various parties as one form of the Merdeka Belajar Kampus Merdeka program. (Wirawan, 2019) This is what prompted changes to the 2021 curriculum in the cosmetology and beauty department. In addition, The Covid-19 epidemic, which transforms the prevalent educational model into blended learning, which integrates online and offline learning, supports it as well with the help of a Learning Management System (LMS)[1], [2]. The learning process, which was originally in the form of face-to-face activities, has now changed. Learning is done from home using various technologies. Technology advancements in the educational sector provides abundant benefits for students.[3] Most in-person face-to-face learning has transitioned to online learning mode by using virtual meeting platforms.[4] The trend of using virtual meeting platforms is also applied in several university environments, one of which is in the Department of Cosmetology and Beauty, Faculty of Hospitality Tourism, Padang State University. In addition to using a virtual meeting platform, UNP also implements learning through an e-learning portal that makes learning easy for learners and teaching materials that is available whenever and whenever. With their e-learning portal, students can access all course materials without space and time limitations. To support the achievement of good lecture material, it is necessary to fulfill aspects of use, media aspects and aspects of material that are in accordance with the needs in accordance with the applicable curriculum.

There are forms of change that occur and ways and patterns of learning in terms of the effect of developing an independent learning curriculum. [5] To enhance the caliber and results of students’ learning, new courses are being added, one of which is electronic commerce courses. This course certainly does not have adequate learning facilities and infrastructure to support learning, resulting in not optimal learning process in e-commerce courses. In addition, the only instructional materials remaining available are textbooks, printed modules, and presentation files, all of which are incomplete that have not become a complete learning tool to help students have cognitive skills as a form of improving the quality of learning and teaching materials, ability to think critically and student independence.[6], [7].

Using a project-based learning (PjBL) learning model, the new curriculum is implemented. Students can develop their critical thinking abilities and achieve their best academic results by using this PjBL [8], [9]. The change in the face-to-face learning model to online (online) provides its own challenges, namely the lack of material reinforcement to students as a whole.[10]. So that to achieve learning objectives, the PjBL learning model is required and deliver material thoroughly in the E-commerce course, the development of PjBL-based e-modules in the e-commerce course is expected to be able to contribute in order to provide optimal services to students. To help students have cognitive skills as a form of improving the quality of learning and teaching materials, critical thinking abilities and academic results for students.
B. Research Method

The present study is a quasi-experimental study. Pretest Posttest Control Group was the chosen research design. The group doing the experiment and the control group were both participants in this study. Interactive e-modules are used as both a teaching tool and a learning resource in experimental classes. While the control class uses traditional teaching methods like printed modules. The participant in this study was a student at Padang State University's Faculty of Tourism and Hospitality's Department of Cosmetology and Beauty. There were eighteen learners in the experimental section and 18 students in the control class of the E-commerce course that participated in this study.

This study will contrast the experimental class and the control class in terms of critical thinking proficiency and student learning outcomes. Three different types of instruments are used in data collection. The first tool, a closed questionnaire, is used to gauge how well students are using critical thinking while learning, while the second tool, a test, is used to gauge how well students are learning. The third tool is an open questionnaire designed to examine student responses in experimental classes to the use of interactive e-modules to enhance the results of student learning and analytical thinking.

Based on the type of data acquired, the data analysis employed in this study was divided into three categories. Quantitative descriptive data analysis is the initial type of data analysis. This data analysis was used to describe the amount of critical thinking among students using data from a closed questionnaire. The analysis’ findings will outline the critical thinking abilities of students in experimental classes as well as control classes before and after learning.

T Test analysis, specifically the paired sample t test and the independent sample t test, is used in the second data analysis. This test is used to assess test outcomes that gauge learning outcomes. Test results from the experimental class and the control class include the pretest and posttest. This T test examines whether there are statistically significant variations between each test data element. A data normality test and a data homogeneity test are performed as part of the analysis prerequisite test before the T Test is run.

The difference between pretest and posttest data is examined in both the experimental class and the control class using the paired sample t test. The following figure illustrates the paired sample t test design:

Further, the significance of the difference between the posttest results in the experimental class and the control class is examined using the independent sample t test. The following figure shows how the independent sample t test is set up:

C. Result and Discussion

The results of quantitative description data analysis describe the level of students’ analytical thinking. This condition is measured after students participate in a series of lecture activities both in the control category and the experimental one. In the lecture process, students will experience firsthand the implementation of the interactive e-commerce module in the experimental class and also the print module in the control group. As a result of descriptive evaluation, the average critical thinking score of students was determined to be as follows:
The students’ critical thinking level data is then compared with the category table. Through this comparison process, it can be known the category of critical thinking level of student learning. The category table can be observed as follows:

<table>
<thead>
<tr>
<th>Categories</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>81-100</td>
</tr>
<tr>
<td>Good</td>
<td>61-80</td>
</tr>
<tr>
<td>Enough</td>
<td>41-60</td>
</tr>
<tr>
<td>Less</td>
<td>21-40</td>
</tr>
<tr>
<td>Very Lacking</td>
<td>0-20</td>
</tr>
</tbody>
</table>

The diagram data describes the level of critical thinking of students before treatment and after treatment in both experimental and control classes. The statistics also revealed that in the experimental class, student understanding of critical thinking increased by 11.76%. Prior to treatment, students’ critical thinking levels were in the good category. Following treatment, however, their critical thinking levels improved to the very good category. Students in the control group showed an increase in critical thinking of 2.29% as well. However, when it comes to categories, students in the control class critical thinking did not improve; in fact, their level of critical thinking before and after the treatment remained in the good category.

Prerequisite test for analysis Prior to conducting the hypothesis test step, the prerequisite analytical test is conducted. In this study, normality tests and homogeneity tests were utilized as preliminary analysis tests. The IBM SPSS application program was used to perform the normality and homogeneity tests on the research data. The Shapiro-Wilk test is used for the Normality test. The following table shows the results of the normalcy test:

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Sig.</th>
<th>Sig. Level</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-test of Control</td>
<td>0.58</td>
<td>0.05</td>
<td>Normal</td>
</tr>
</tbody>
</table>

**Figure 1. Diagram of students’ critical thinking levels**

Commented [A1]: Fig 1?
The normality test data describe that the value of sig. On all data items greater than the significance level value which is 0.05. The conclusion is that all research data items are normally distributed. The next stage in the pre-analysis test is the data homogeneity test. The data homogeneity test findings show that the sig value was 0.948. After then, the value is checked using a significance level of 0.05. The data demonstrates the significance of sig. It can be said that the research data is homogeneous because the homogeneity test findings are greater than the significance level value. The next stage of data analysis is the hypothesis test of research data. This test can be performed because the prerequisite test of the analysis has been met. Hypothesis testing is performed using the t test. The series of hypothesis tests begins with the presentation of descriptive data from student learning outcomes based on the outcomes of the experiments that have been performed. The descriptive data is illustrated as follows: The normality test data describe that the value of sig. On all data items greater than the significance level value which is 0.05. The conclusion is that the distribution of all research data items is normal. The data homogeneity test is the next phase of the pre-analysis test. The sig value is described by the data homogeneity test findings amounted to 0.948. After then, the value is checked using a significance level of 0.05. The information demonstrates that sig. The homogeneity test results are greater than the significance level value so that the research’s data can be said to be homogeneous. The next stage of data analysis is the hypothesis test of research data. This test can be performed because the prerequisite test of the analysis has been met. Hypothesis testing is performed using the t test. The series of hypothesis tests begins with the presentation of descriptive data from student learning outcomes based on the outcomes of the experiments that have been performed. The descriptive data is illustrated as follows:

<table>
<thead>
<tr>
<th>No</th>
<th>Class</th>
<th>Average Value</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Experimental Class</td>
<td>55,83</td>
<td>72,79</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Control Class</td>
<td>56,67</td>
<td>59,80</td>
<td></td>
</tr>
</tbody>
</table>

The average value of student learning outcomes at the pre-test and post-test phases in the experimental class and the control class are described in the description of test result data. Without a doubt, the descriptive facts cannot serve as a foundation for drawing judgments about the hypothesis put forth. The stage of testing hypotheses using a t test is the next phase. The paired sample t test is the
initial t test to be run. This test was run to see if there was a difference between the pre-test and post-test data pairings in each experimental class and control class that was statistically significant. The outcomes of the paired sample t test are as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>Class</th>
<th>Result of Sig. (2-tailed)</th>
<th>Significant Level</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Experimental</td>
<td>0.000</td>
<td>0.05</td>
<td>There is a significant difference</td>
</tr>
<tr>
<td>2</td>
<td>Control Class</td>
<td>0.689</td>
<td>0.05</td>
<td>There is no a significant difference</td>
</tr>
</tbody>
</table>

The paired sample t test results show that the experimental class’s Sig (2-tailed) value is 0.00. After then, the value is checked using a significance level of 0.05. The findings indicate that there is a significant difference between the pre-test and post-test in the experimental class since the sig (2-tailed) value is less than the significance level value. The test data also states that the control class’s Sig (2-tailed) value was 0.689. The results were also examined with a significance level value of 0.05 in accordance with the earlier data. The control class has no difference between pre-and post-test if the Sig (2-tailed) value is bigger than the significance level value.

An independent sample t test is conducted after the hypothesis test. By comparing the final learning outcomes of students in the experimental class with the control class, this test seeks to determine whether there is a discernible difference. The post-test findings from the experimental class and the control class were subjected to this independent sample t test. Here are the test results:

<table>
<thead>
<tr>
<th>Item</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal variances</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td></td>
<td>Significant Level</td>
</tr>
<tr>
<td></td>
<td>Mean Difference</td>
</tr>
<tr>
<td>Equal variances</td>
<td>0.689</td>
</tr>
<tr>
<td>assumed</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>13.04</td>
</tr>
</tbody>
</table>

According to the analysis’s findings, the Sig (2 Tailed) value was 0.038. The value is then contrasted with 0.05 as the significance level. The comparison results demonstrate that there is a significant difference between the experimental class posttest and the control class since the Sig (2-tailed) value is less than the significance level value. The data from the test results also revealed a mean difference value of 13.04. This amount represents the difference between the experimental class post-test score (72.79) and the control class post-test value (59.80), as seen in table 3. According to the overall findings of the hypothesis test, there is no statistically significant difference between the pre-test and post-test results of the learning outcomes of students in experimental classes. While there is no discernible difference between pre-test and post-test student learning results in
the control class. Thus, the conclusion that a significant improvement in learning outcomes only happened in experimental groups and did not happen in control classes. The post-test results of students' learning outcomes in the experimental class and the control class show a substantial difference, which leads to the following conclusion. Descriptive data that demonstrate that the average post-test value of students' learning outcomes in the experimental class is higher than in the control class support this as well.

The findings of the previous study describe how students reacted when the e-commerce module was implemented. The responses of all students are grouped and categorized into three, namely responses related to access to use, material aspects and media aspects. The first response category states that the e-commerce module provides convenience in terms of access because it can be used anytime and anywhere. The second response category states that the material of the e-module can be learned and understood easily with the support of the e-module's video content. Then, the third response category describes that the media aspect in the e-module has been very adapted to technological developments. The results of the quiz work completed by students will appear as an assessment at the end of the type of evaluation that is offered in the form of a quiz.

The study's findings were introduced with a presentation of data regarding students' critical thinking abilities. According to the findings, critical thinking among students in the experimental class increased significantly by 11.76%. However, critical thinking among students in the control group also went up by 2.29%. The adoption of the e-commerce module has undoubtedly had a favorable effect on classroom learning as seen by the experimental class's significantly higher level of critical thinking. E-modules are created with specific learning objectives in mind and supported by a variety of resources and practice problems that both help students understand the topic and make it easier for teachers to explain it [11]-[13].

Studies that have already been done using several e-module types have demonstrated that using e-modules can increase critical thinking. According to the study's findings, a critical thinking module can enhance students' learning [14]-[16]. The PjBL paradigm is more successful at enhancing learners' learning outcomes and critical thinking abilities. PjBL instruction has helped students answer issues requiring their critical thinking abilities with higher average results [17]-[19]. The study's findings center on students' capacity for learning outcomes and critical thinking [20]. Prior research on high school students has demonstrated the impact of PjBL learning on critical thinking abilities and learning outcomes [21]-[23]. The findings of studies referencing the project-based learning paradigm can help students' critical thinking abilities [24]. The outcomes of studies done by utilizing the project-based learning paradigm can enhance students' capacity for critical thought [25].

The findings of the following study outline the learning results attained by students in the experimental class and control class. Through this study, it is demonstrated that some of the research findings are consistent with the effects of e-module implementation that can enhance student learning outcomes. Early
research proves improved learning outcomes through the implementation of e-modules. The increase occurred due to the role of e-modules in creating student-centered learning.[26] The next research is that e-module contributes effectively in improving student learning outcomes because e-module can function as a flexible and interactive learning medium and resource that can also be utilized in distance learning [8], [27], [28]. One of the features in the e-module that contributes maximally in improving learning outcomes is quizzes. Quizzes can be used as a characteristic in e-modules that embody an element of assessment for students to evaluate if learning objectives were met and this is also an alternative to provide assessment to students.[29], [30] With some of the advantages of modules that have been presented so that modules can be used for e-commerce learning. With limited time, this module still needs refinement and input for the next research related to the e-commerce module.

D. Conclusion

There are several conclusions in this study. First, the implementation of the e-commerce module is able to significantly improve students’ critical thinking. Both implementations of the e-commerce module have also proven effective in significantly enhancing learning outcomes for students. The three students responded well to the implementation of the e-commerce module, especially in access to use it can make it easier, the material aspect is more complete and adequate and the media aspect there are videos and quizzes as assistance material for learning.

E. Acknowledgment

Thank you to those involved in the Project Based Learning (Pjbl) Model In E-Module As An Improvement Of Critical Thinking In The Department Of Cosmetology And Beauty research, especially the lecturers of the cosmetology and beauty department, Faculty of Tourism and Hospitality, Padang State University.

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