Design of an Augmented Reality Based Learning Module for the Financial Management Course for Accounting Education Students at Universitas Negeri Medan

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Abstract. This study aims to assess the extent of the development process and outcomes of the Augmented Reality-based learning module for the Financial Management course, as well as its feasibility in terms of validity, practicality, and effectiveness. Through this approach, the research aims to evaluate both the process and results of developing the Augmented Reality-based Financial Management module and its feasibility in terms of being valid, practical, and effective. The results of this development research indicate that the Financial Management course module is deemed feasible based on the assessment results from media experts and content/material experts. The module is considered practical based on trial assessments by users. The effectiveness of using the Augmented Reality-based Financial Management module was shown to improve learning outcomes, with a t-test score of 0.00, indicating that the significance value is less than 0.05 (significance level of 5%).

Keywords: Augmented Reality Financial Management, Augmented Reality, 4-D development

1 Introduction

Education is one of the most important aspects of human life. A well-structured and effectively implemented education system is key to producing intelligent, character-driven, and high-quality future generations. Through education, a more advanced and refined civilization can emerge within society. As time progresses, technology has influenced various aspects of life, including the field of education.

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The involvement of information technology in education has brought about changes in the learning process. Higher education institutions, as centers of advanced learning, need to provide a learning process that leverages information and communication technology. Through digitalization, the academic community in higher education has access to a broader range of materials, unrestricted by the boundaries of formal education. Digitalization can enhance accessibility, increase the effectiveness, and improve the efficiency of learning. The use of technology enables more sophisticated teaching and learning activities by providing a variety of learning media. For example, audio and video media displayed through computers, LCD screens, tablets, or mobile phones.

Accounting is a study of systems that produce financial information useful for making financial decisions, and the Financial Management course requires certain learning outcomes that involve knowledge, skills, and abilities for decision-making. This course covers financial management functions, including investment decisions (selecting profitable investments while considering risks), financing decisions (choosing the composition of funding sources that result in the lowest costs), and dividend decisions (deciding on dividend distribution and stock splits). The ultimate goal of this course is for students to perform financial calculations that can serve as input for companies in making decisions. In the teaching process of the Financial Management course, the lecturer has been using printed teaching materials and other modules sourced from the internet. However, these modules lack engaging designs, such as the use of smartphone technology. This has made the learning experience appear more monotonous, leading to lower student engagement in the learning process. The course instructor also emphasizes the importance of using modules as teaching materials because they are systematically organized, containing the essential content that students must master, along with example problems, exercises, and summaries that make it easier for students to understand the course material. Additionally, modules are designed to allow students to learn independently according to the guidelines provided in the module.

According to Sanjaya[1], a module is a self-contained unit of learning activities that is specifically and clearly designed to help students achieve particular learning objectives. The module functions as a tool for independent learning, enabling students to learn at their own pace. Furthermore, research by Lasala[2] shows that student learning outcomes improve by 51.38% with the use of interactive learning modules, compared to a 38.62% improvement with conventional (non-interactive) learning methods. This indicates that learning with modules can enhance learning outcomes.

Based on this research, the researcher has chosen to use a module as the teaching material for the topic of polyhedrons because it is a comprehensive teaching tool that is systematically organized and written in language that is easy for students to understand, study, and absorb individually or independently. It is expected that this approach will help overcome students' learning difficulties, particularly in understanding the topic of polyhedrons.

The application of technology can also facilitate students' understanding of the material and enhance their spatial abilities. One technology that can improve the learning of geometric topics by displaying objects concretely is Augmented Reality. According to Mustaqim and Kurniawan[3], Augmented Reality is an application that combines the real world with the virtual world in two-dimensional or three-dimensional forms, projected in a real environment simultaneously. Augmented Reality technology enables the merging of the real and virtual

(digital) worlds by displaying three-dimensional (3D) objects in the real world through a camera, making it appear as though the 3D object exists in the real world. Additionally, Augmented Reality allows for the presentation of illustrations that are difficult to realize concretely[4]. Moreover, according to Kariadinata[5], students often struggle to construct geometric shapes, particularly when solving problems that require visualization. Visualization is one of the indicators of spatial ability. Therefore, one technology that can potentially enhance spatial ability is Augmented Reality.

Several studies and developments in the field of education have also been conducted, demonstrating positive results that Augmented Reality technology can be effectively implemented in the educational sector. This is supported by research conducted by Yusro and Purwito[6], which concluded that Augmented Reality-based learning modules meet the requirements with good quality and are suitable for use as supplementary modules in learning, as well as an alternative learning resource.

2 Method

2. 1. Development Model

The development model in this research adheres to the 4D research and development model. The 4D model was originally introduced by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melyn I. Semmel. The 4D model involves four stages in its development process: Define, Design, Develop, and Disseminate[7].

2. 2. Data Collection and Data Analysis Techniques

The data collection technique in this research uses questionnaires. The data analysis technique employed in this research and development study is the Likert scale. The use of the Likert scale is intended to measure the behavior, opinions, and views of individuals or groups[8]. The Likert scale technique is designed to assess the degree of agreement of respondents with a given statement or question. The validity and reliability of the constructed questionnaire will then be tested.

The questionnaire will also be used to evaluate the efficiency and effectiveness of the product by surveying students from the 2021/2022 cohort of Accounting Education at Universitas Negeri Medan. The purpose is to determine whether the augmented reality-based e-learning module for the Financial Management course can improve student learning outcomes. To further reinforce the findings, a gain normality test will be included to identify differences in learning outcomes before and after using the augmented reality-based e-learning module for the Financial Management course.

The data analysis technique used to process the data obtained from the questionnaires is to calculate the percentage for each subject using the following formula:

$$\text{Percentage of Assessment}=\frac{\text{Maximum possible score from all validators}}{\text{validators}\text{Total score given by validators}}\times 100\% \qquad (1)$$

To calculate the overall percentage for all subjects or components, you can use the following formula:

$$\text{Overall Percentage} = \frac{\text{Total score obtained by all subjects}}{\text{Total maximum possible score:}} \times \quad 100\% \qquad (2)$$

This formula provides a comprehensive view of the performance across all subjects or components, expressed as a percentage, allowing for a clearer evaluation of overall effectiveness or achievement.

Descriptive Quantitative Analysis is used to calculate the data from student responses regarding the Augmented Reality-based Financial Management learning. This type of analysis focuses on summarizing and describing the features of the data collected, providing a clear overview of students' perceptions and experiences with the learning module.

$$\text{Mean} = \frac{\Sigma x}{\text{N}} \times 100\% \qquad (3)$$

To determine the qualification of the media to be applied based on the average scores, the results can be categorized into specific achievement levels. This helps in evaluating the effectiveness of the Augmented Reality-based Financial Management learning module.

Table 2.1 Average Score Qualification Criteria

No.	Score range	Score range	Category
4	X > Mi + 1,5 Sdi	X > 4,2	Very Good
3	*Mi + 1,5 SDi > x ≥ Mi*	3,4 < X ≤ 4,2	Good
2	*Mi > x ≥ Mi – 1,5 Sdi*	2,6 < X ≤ 3,4	Not Good
1	*x≤ Mi – 1,5 Sdi*	1,8 < X ≤ 2,6	Very Bad

In addition to the above criteria, the overall product feasibility criteria can be determined by multiplying the assessment score by the number of indicators measured in each evaluated aspect. For further analysis, such as comparing the assessment results of each aspect with the expected feasibility level, the percentage technique can be used to analyze the data with the following formula:

$$\text{Percentage of Feasibility} = \frac{Total\ Score}{\text{Total Maximum Score}} \times 100\% \qquad (4)$$

This percentage allows for a clear understanding of how well each aspect meets the expected feasibility criteria, enabling effective comparisons and informed decision-making regarding the product's overall quality and effectiveness.

Here's how you might structure a table to present the feasibility assessment percentages:

Table 2.2 Feasibility assessment percentages

Assessment percentages	Interpretation
76 - 100%	Very Feasible
51 - 75%	Feasible
26 - 50%	Not Feasible
<25%	Very Not Feasible

In addition to descriptive analysis, this study also employs quantitative analysis as a means of testing the effectiveness of the Augmented Reality-based Financial Management learning. The

statistical analysis technique used is to compare the results of the pre-test and post-test. To analyze the differences between the pre-test and post-test scores of both classes, a one-sample t-test is utilized

$$g = \frac{\text{Post–Test Score–Pre–Test Score}}{Maximum\ \ Score – Pre–Test\ Score} \quad (5)$$

Table 2.3 Criteria Gain Score

Gain Score	Criteria
g > 0,7	High
0,7 ≥ g > 0,3	Medium
g ≤ 0,3	Low

3 Results and Discussion

3.1 Validity of Augmented Reality-Based Modules

The validity criteria for the Augmented Reality-based module can be measured through the analysis of material validation questionnaires and design validation questionnaires. The validation process begins with material validation, followed by design validation of the Augmented Reality-based module for Financial Management learning

Here's how you might structure the evaluation and feedback from media design experts, subject matter experts, and students regarding the Augmented Reality-based module

Table 3.1 Material validation

No.	Indicator	Score		Criteria
		Average Score	%	
1.	Overall Aspect	3,5	87,5	Very Feasible
2.	Relevance of Material	4,00	100	Very Feasible
3.	Organization of Material	3,5	87,5	Very Feasible
4.	Evaluation/Practice Questions	3	75	Feasible
5.	Language	4,00	100	Very Feasible
6.	Effect on Learning Strategy	3,5	87,5	Very Feasible

Table 3.2 Media design experts validation

No.	Indicator	value		Criteria
		Average Score	%	
1.	Overall Aspect	3,5	87,5	Very Feasible
2	Language	4,00	100	Very Feasible
3.	Effect on Learning Strategy	3,5	87,5	Very Feasible
4	Software Engineering Aspect	3,5	87,5	Very Feasible
5.	Visual Appearance Aspect	3,5	87,5	Very Feasible

Table 3.3 Course instructors validation

No.	Indicator	Score		Criteria
		Score	%	
1.	Overall Aspect	3,5	87,5	Very Feasible
2.	Relevance of Material	4,00	100	Very Feasible
3.	Organization of Material	3,5	87,5	Very Feasible
4.	Evaluation/Practice Questions	3	75	Feasible
5.	Language	4,00	100	Very Feasible
6.	Effect on Learning Strategy	3,5	87,5	Very Feasible
7.	Software Engineering Aspect:	3	75	Feasible
8.	Visual Appearance Aspect	3	75	Feasible

Table 3.4 Course instructors validation

No.	Indicator	Answers		Sum	Percentage of yes answers
		Yes	No		
1	Ease of Understanding Learning	27	3	30	90%
2	Clarity of Provided Examples	25	5	30	83%
3	Clarity of Question Formulation	25	5	30	83%
4	Completeness of Material	24	6	30	80%
5	Media's Ability to Enhance Understanding**:**	25	5	30	83%

Overall, the developed learning media design is very good/appropriate/feasible/suitable for use in the learning process within the same context that affects the quality of learning. Based on the assessments and feedback from media design experts, subject matter experts, and students, the next step in the development of the learning media design will involve broader testing.

The effectiveness score of the learning module design for the Financial Management course based on Augmented Reality for students of the Accounting Education Program at Universitas Negeri Medan falls into the category of "very good." In other words, the developed learning media is effective.

4 Conclusion

The conclusion in this research is: The Augmented Reality-based Financial Management module is suitable for use as a teaching material based on its validity, practicality, and effectiveness. The results of this study indicate that the Augmented Reality-based module for Financial Management material can be used by lecturers as supplementary teaching material to explain the subject matter and create a more engaging and enjoyable learning environment due to the presence of augmented reality technology as an innovation in learning.

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