



The Application of Interactive Multimedia to Improve Student's Learning Outcome in Property Appraisal Training

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Abstract: Students in The Property Appraisal Training at Financial Education and Training Agency, based on survey results, state that learning using e-books is less effective in improving learning outcomes. The study aims to evaluate the impact of multimedia interaction on the learning outcomes of property appraisal training students. The research used the research and development (R&D) that adopts the ADDIE model. Data collection was carried out through tests and questionnaires with a total of two subject matter experts, two media experts, and 28 students. Data analysis used quantitative and qualitative methods. The results of the subject matter expert assessment indicate that multimedia is suitable for use, with a rating of 91.67%. The results of the media expert assessment show that multimedia is suitable for use with a rating of 90%. Field test results show a significant positive correlation between the average learning outcomes before and after using interactive multimedia. The effectiveness test results show an N-gain value of 61%. Given the impact of multimedia-based education on learning outcomes, this approach can be used to teach other subjects and train students. This research can also be used as a basis for exploring the development of interactive multimedia learning for other subjects.

Keywords: interactive multimedia, learning outcome, property appraisal training, ministry of finance

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INTRODUCTION

The development of Industrial Revolution 4.0 affects all human life (Vaidya et al., 2018). There are rapid and significant changes during this revolution. Everything that is previously manual becomes automatic, transforming human power into mechanical power in a fast, adaptable, and creative way. (Sa'adah & Arokiasamy, 2023). The Ministry of Finance responded to this change by launching a digital transformation vision in 2018. One form of digital transformation is developing modern e-learning through the Financial Education and Training Agency (FETA) as a training facility for the Ministry of Finance's human resource development. This training has a significant impact on employees and organizations by increasing efficiency and effectiveness (Prawiradilaga & Uwes, 2018). The purpose of modern e-learning is to produce competitive Ministry of Finance human resources through learning processes that are efficient, relevant, applicative, impactful, and accessible. E-learning has transformed conventional learning methods into digital learning in terms of content and systems.

One of the digital learning programs organized by the Financial Education and Training Agency through the State Assets and Fiscal Balance Training Centre is Property Appraisal Training. The training aims to fulfil the competency requirements for appraiser positions in the Ministry of Finance so that appraiser officials can apply knowledge in property appraisal correctly in accordance with applicable regulations. Appraisal is the process of an appraiser providing a written opinion regarding the economic value of an object at a specific time (SPI, 2018). Appraisal plays a vital role in determining the economic value of assets for loan collateral or potential assets owned. A legal appraisal of property can only be carried out by someone who is an appraiser. The appraiser must have qualifications, abilities, and experience in carrying out property appraisal practices. Therefore, property appraisal training is required to obtain this qualification.

A digital learning environment can help students engage in more interaction and gain a better learning experience with the growth of computer-based multimedia (Mayer, 2005). The presence of computer-based multimedia enables the presentation of material in the form of text, words with pictures, video, and multimedia. The format of presenting information is related to student learning performance because the format affects working memory and the cognitive load implanted by students (Mayer, 2005). According to Mayer (2009), learning multimedia is defined as a medium for presenting material using words and images to improve the learning process. Azevedo (cited in Schunk et al., 2012) emphasizes that the use of multimedia and hypermedia provides significant benefits for the learning process, and the research shows that technology can play a role in developing students' learning abilities. The Generative Theory of Multimedia Learning (Kok et al., 2022; Mayer,

2009) states that the learning structure of the human brain does not function in situations where students are passive and unlimited information is transmitted through only one channel. Multimedia is an effective and engaging presentation of information consisting of various forms of sound, still and moving images, animation, graphics, infographics, tables, websites, and ordinary text (Abdulrahman et al., 2020; Guan et al., 2018; Li et al., 2014). In education, the use of materials is crucial to creating an effective learning environment, ensuring that subjects are easily understood and that desired learning outcomes can be achieved (Kok et al., 2022; Malhotra & Verma, 2020).

Learning outcomes are skills obtained by students after going through the learning process. Learning outcomes have an essential role in the educational process because the primary goal of learning activities is to achieve good learning outcomes. This is in line with the statement of Alfian et al. (2020), which states that learning outcomes provide information on a student's capacity to complete a competency's learning stage, allowing judgments to be made about the high and low levels of student learning outcomes based on the student's comprehension of the subject presented. Internal elements, such as psychological and physiological, as well as external elements, such as the environment and instruments, are among those that influence learning outcomes (Rusman, 2013). This is in line with Jude et al.'s (2014) statement that learning methods, curriculum design, and teachers influence the learning outcomes achieved by students. Learning is also influenced by individuals' perceptions of their own competence, perceptions of the difficulties of different tasks, and individual goals (Wigfield & Eccles, 2000). Ongor and Uslusoy (2023) state that learning outcome is influenced by how the presentation of information is given to the student.

The impact of including images in text-based learning materials rather than just presenting text on improving student outcomes has been the subject of many experimental studies on student learning over the last few decades. Research generally shows evidence that supports the multimedia effect, which means that students who learn with text and images show higher levels of memory and understanding on the test than students who study with text alone (Ongor & Uslusoy, 2023). These results are supported by several researches, with the assumption that the photographs have a purpose other than decoration and serve to explain information from the text. Images that provide a visual representation of textual information can help memory retention and understanding by facilitating cognitive processing. Wang et al. (2020) compared the use of multimedia, video, and text in the presentation of material in three different classes. The result shows that classes that use multimedia get higher scores than classes that use video or text only. This study aligns with Ongor and Uslusoy (2023) that by using text formats in the control class and multimedia format in the experiment class, the experiment class shows better post-test values.

However, although for decades these multimedia learning design principles have been proposed and tested in individual learning (Mayer et al., 2001), the impact of various information presentation formats in multimedia on training students is still not widely researched, especially in the context of online learning. There also has not been much research on the use of multimedia in adult learning, especially in public-sector training. Therefore, this research aims to evaluate the effect of interactive multimedia on the learning outcomes of property appraisal training students at the Financial and Education Training Agency. By understanding the influence of multimedia in training, effective learning media can be developed according to the needs of the students so that they can improve their learning outcomes.

METHODS

The research was conducted using the research and development method with the aim of creating and testing learning media using the ADDIE model. The ADDIE model was developed systematically and guided by the theoretical foundations of learning design (Tegeh & Kirna, 2013). The philosophy behind implementing the ADDIE model is to focus on students with an innovative, inspiring, and authentic approach (Branch, 2009). The first step in the ADDIE model is analysis, which includes needs analysis and performance analysis. The second step is design, namely the preparation of material and media concepts. The third step is development, where the initial multimedia product is developed, validated by a team of experts, and then improved based on input from experts. The next step is implementation, that is, the use of the product that has been developed. The final step is evaluation, where the effectiveness of the product that has been developed is tested.

The research was conducted at the State Assets and Fiscal Balance Training Centre, Financial Education and Training Agency, Ministry of Finance. Subjects in this study are subject matter experts, media experts, and 28 students in property appraisal training. The research approach used in this study was a combination of several different methods. Quantitative methods are used to analyze the suitability of a product in terms of both the media and the material contained. It is also used to analyze whether there is an improvement in student learning outcomes before and after using interactive multimedia (Sari et al., 2021). The instruments that used in product assessment by subject matter experts and media experts are shown in Table 1 and Table 2.

Table 1. Subject Matter Expert Assessment Instruments

Aspects	Indicator
Material Content	Suitability of material with essential competencies Ease of understanding Suitability and accuracy of image illustrations with the material Material Clarity
Usefulness	Suitability of material stages The use of interactive multimedia as learning multimedia Concept clarity

Table 2. Media Expert Assessment Instruments

Aspects	Indicator
Media Display	Selection and combination of cover displays Selection of text type and size Selection of supporting images Selection of button icons Selection of audio/music type Selection of animation
Media Programs	Ease of navigation Interactivity

Data collection was carried out by filling in assessment instruments from subject matter experts and media experts using a Likert scale of 1 to 5. Following that, the evaluation results were averaged, and the percentage of each question was calculated. After obtaining the multimedia suitability percentage value, then the value is interpreted based on the criteria in [Table 3](#).

Table 3. Validator Response Conversion Guide

Range (%)	Criteria	Information
80,0 – 100,0	Very Good	No need to revise
60,0 – 79,9	Good	Slightly revised
40,0 – 59,9	Bad	Many things to revised
20,0 – 39,9	Very Bad	Redevelop the product

Based on [Table 3](#), it can be concluded that the interactive multimedia product can be implemented if it is in the good or very good category, whereas it cannot be used if the results are bad or very bad category. Apart from quantitative analysis, qualitative analysis is also used to analyze validation responses from subject matter experts and media experts to consider improvements to the interactive multimedia that is being developed ([Sofyan et al., 2019](#)). Quantitative analysis was also used to analyze whether the learning outcomes of property appraisal training students had improved after using multimedia by using the two paired sample T-test to find out whether there was a difference in the value of the sample before and after specific treatments using SPSS software. Then, an effectiveness test is carried out to determine the category or level of effectiveness of the multimedia product using normalized gain (N-gain). The N-gain test is carried out by calculating the difference between the pre-test score before the treatment, and the posttest score after the treatment is applied. By calculating the difference between these values, it can be seen whether the application of a particular method or media can be said to be effective or not. Interpretation of the N-Gain scores obtained through categorized assessments refers to [Table 4](#), presented by [Meltzer \(2002\)](#).

Table 4. N-Gain Category Table

N-Gain Value	Category
$g > 0,7$	High
$0,3 \leq g \leq 0,7$	Medium
$g < 0,3$	Low

RESULT AND DISCUSSION

Based on research and development with the ADDIE model that has been carried out, the following results were obtained. First, in the analysis stage, data on learning conditions and characteristics of Property Appraisal Training students were obtained. Students are 28 employees of the Directorate General of Taxes, Ministry of Finance, with the position of assistant tax assessor with a minimum diploma education. The age range of students is between 27 to 35 years. The training is carried out using an independent asynchronous

learning model that is not bound by a strict schedule and does not require the physical presence of students, facilitators, and teachers at the same time. Participants take part in the training by accessing material through the Ministry of Finance's learning management system (LMS), namely klc2.kemenkeu.go.id, to be studied independently by the students. In addition to the characteristics of the students, this phase also analyses the learning objectives for the materials that will be presented in interactive multimedia. The objectives and learning materials are adapted from the Property Appraisal Training Learning Framework presented in [Table 5](#).

Table 5. Learning Objectives and Learning Content

Criteria	Description
Content	Property Appraisal
Learning Objectives	Students understand econometrics in property valuation Students understand property valuation using a market data comparison approach. Students understand property valuation using a revenue approach. Students understand property valuation using a cost approach. Students understand accounting knowledge in property valuation
Learning Content	Appraisal econometrics Market comparison approaches knowledge. Revenue approaches knowledge Cost approaches knowledge Accounting knowledge

After analyzing the characteristics of the participants and training materials, the next step is to carry out the multimedia design. At this stage, the concept of interactive multimedia and materials is designed. The results of the multimedia design concept are presented in [Table 6](#).

Table 6. Interactive Multimedia Design Table

Criteria	Description
Media Type	Interactive Multimedia
Objective	Develop digital learning media in the form of interactive multimedia to support learning and improve learning outcomes for property appraisal training students
Format	.html
Students	Students can access interactive multimedia for training through the learning management system either via computer/laptop or smartphone.
Activities	
Development Tools	Adobe Illustrator, Adobe Photoshop, Adobe After Effect, Wondershare Filmora, and Articulate Storyline

The third stage is the development stage. At this development stage, interactive multimedia is developed based on the design created in the previous stage. The development of interactive multimedia using articulate storyline application can be seen in [Figure 1](#). After an interactive multimedia product is developed, it is then assessed by subject matter experts and media experts. The assessment results from subject matter experts are shown in [Table 7](#).

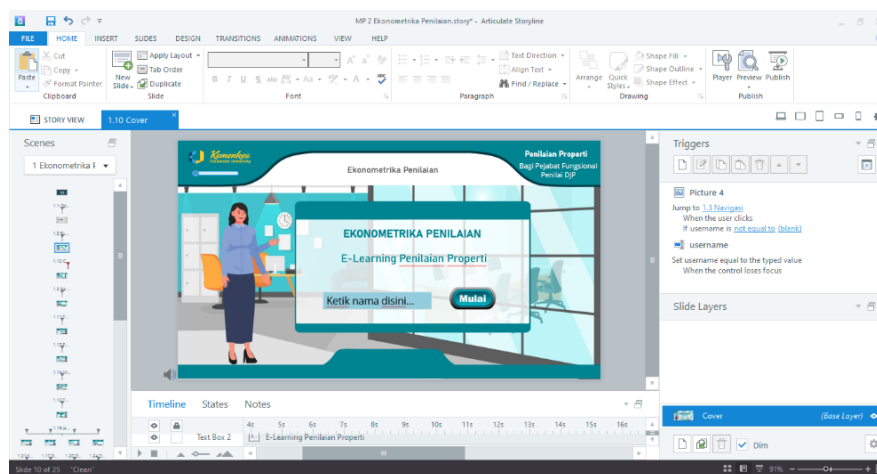


Figure 1. Development of Interactive Multimedia using Articulate Storyline
Table 7. Assessment Results by Subject Matter Experts (SME)

Expert	Mean Score	Percentage	Category
SME 1	4,67	93,33%	Very Good
SME 2	4,50	90,00%	Very Good
Average	4,58	91,67%	Very Good

Based on the results of the subject matter expert assessment presented in [Table 7](#), an average score of 4.58 or 91.67% was obtained, which means that interactive multimedia has a very good category. Several suggestions for improvement were given, such as the use of particular language that needed to be explained, adding case examples, and questions in quizzes that should be included in the material being taught. Apart from validation by material experts, validation was also carried out by media experts, namely experts who have expertise in the field of preparing and evaluating learning media, with the results presented in [Table 8](#).

Table 8. Assessment Results by Media Experts

Expert	Mean Score	Percentage	Category
Media Expert 1	4,38	87,50%	Very Good
Media Expert 2	4,63	92,50%	Very Good
Average	4,50	90,00%	Very Good

[Table 8](#) shows the results of assessments by media experts with an average score of 4.50 or 90.00%, which means that interactive learning multimedia is in the very good category. Media experts also gave several suggestions, including that navigation buttons need to be given information or names, choosing the type and size of text, and choosing colors and supporting images. Suggestions from material experts and media experts are used to make improvements to the final multimedia product. After the final interactive multimedia was developed based on input from the expert teams, the next step was the implementation stage. The implementation stage of interactive multimedia learning was carried out in one property appraisal training class with 28 students. Evaluation of learning outcomes was carried out by conducting tests before (pre-test) and after (posttest) learning with interactive multimedia provided to test whether interactive multimedia is effectively used to improve student learning outcomes. After the pre-test and posttest data were obtained, a normality test was carried out before performing the hypothesis test. Normality test results are shown in [Table 9](#).

Table 9. Normality Test Result

Test		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Learning Outcome	Pretest	0,121	28	0,200	0,965	28	0,451
	Posttest	0,221	28	0,051	0,937	28	0,091

Based on [Table 9](#), the results of the normality test concluded that the pre-test and posttest data were distributed normally, as indicated by the sig value. 0.451 on the pre-test and 0.091 on the posttest, which is greater than the p-value of 0.05. After the normality test, a hypothesis test was then carried out by performing a paired sample t-test. The results are shown in [Table 10](#).

Table 10. Paired Sample T-Test Result

		Paired Differences		Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
		Mean	Std. Deviation		Lower	Upper			
Pair 1	Pretest Posttest	-34,500	15,402	2,911	-40,472	-28,528	-11,852	27	0,000

Based on [Table 10](#), the results of the paired sample t-test have sig. of 0.000, which is smaller than 0.05. This means that there is an average difference between the pre-test and posttest learning outcomes. It can be concluded that interactive multimedia has an influence on improving the learning outcomes of property appraisal training students. The effectiveness of interactive multimedia was then tested using the N-Gain formula with the results shown in [Table 11](#).

Table 11. N-Gain Test Result

	Pretest Score	Posttest Score	Pretest Score - Posttest Score	N Gain Score	N Gain Score %	Criteria
Mean	43,14	77,64	34,50	0,61	61%	Medium

Based on Table 11, the results obtained show that the N Gain value is 61%, which belongs to the medium criteria. Therefore, it can be concluded that interactive multimedia can improve the learning outcomes of property appraisal training students in the medium category. Interactive multimedia is appropriate for use in property appraisal training because it suits the nature of the learning material and the participants' learning styles to improve the learning outcomes of the training participants. This is proven by the findings from the results of the paired sample t-test, which shows that there is a significant difference between the pre-test scores and the posttest scores after using interactive multimedia, which means that interactive multimedia can improve the learning outcomes of training participants. The test results of the effectiveness of interactive multimedia in property appraisal training show a value of 61%, which is included in the medium category. This is in line with the findings of Harianto and Sudatha (2023) and Milenia and Nurharini (2023), which state that interactive multimedia is effectively used in learning. It can significantly increase students' interest in learning and learning outcomes. The results are also consistent with Ongor and Uslusoy's (2023) research, which states that the participants accepted the critical role of multimedia as practical learning to improve academic achievement. Furthermore, Wang et al. (2020) also found that classes that used multimedia got higher grades than classes that used video or text only.

The main implication of this research is the potential for increasing student learning outcomes when using interactive multimedia. The results of this research can provide new insights and contribute further to the development of interactive multimedia as an interesting and innovative learning media. However, there are also limitations to this research. The main limitation is the generalizability of the research results. Further research is needed to find out whether interactive multimedia can be widely applied in various educational contexts or is only suitable for specific groups. Multimedia can be an innovative learning medium in public sector training. It can facilitate the learning process to be more effective and enjoyable. The potential use of multimedia in the learning process cannot be separated from previous theoretical and empirical facts that have proven that multimedia is one of the factors that improve students' learning outcomes. This research can be used as a basis for exploring the development and use of interactive learning multimedia for other subjects. The use of appropriate learning media in the learning process has a vital role in being able to create a conducive learning atmosphere so that students will feel motivated to participate in learning activities.

CONCLUSION

Based on preliminary analysis, it is known that the current condition of learning outcomes for property appraisal training students still needs improvement. One of the causes is that the presentation of material and learning is less interactive, which makes participants less able to explore learning well. Interactive multimedia can be used as an alternative media in training so that it is developed to facilitate learning and improve learning outcomes. Based on the assessment results from material experts and media experts, it was concluded that interactive multimedia was suitable for use in the very good category. The results of the test show that interactive multimedia can effectively improve student's learning outcomes. This is proven by the results of the paired sample t-test, which shows that there are significant differences in learning outcomes before and after using interactive multimedia. The effectiveness of interactive media in increasing learning achievement is 61% or in the medium category.

REFERENCES

- Abdulrahman, M. D., Faruk, N., Oloyede, A. A., Surajudeen-Bakinde, N. T., Olawoyin, L. A., Mejabi, O. V., Imam-Fulani, Y. O., Fahm, A. O., & Azeez, A. L. (2020). Multimedia tools in the teaching and learning processes: A systematic review. *Heliyon*, 6(11), 1–14.
- Alfian, E., Kaso, N., Raupu, S., & Arifanti, D. (2020). Efektivitas model pembelajaran brainstorming dalam meningkatkan hasil belajar matematika siswa. *Al Asma Journal of Islamic Education*, 2(1), 54–64.
- Branch, R. M. (2009). *Instructional design: The ADDIE approach*. University of Georgia.
- Guan, N., Song, J., & Li, D. (2018). On the advantages of computer multimedia-aided English teaching. *Procedia Computer Science*, 131, 727–732.
- Harianto, N. A., & I Gede, W. S. (2023). Interactive multimedia with problem-based learning in mathematics. *Journal of Education Technology*, 7(4), 610–618.
- Jude, T., Mughisa, K., & Paul, B. (2014). Adoption of the SAMR model to assess ICT pedagogical adoption:

- A case of Makerere University. *International Journal of Education, E-Business, E-Management and E-Learning*, 4(2), 106–115.
- Kok, D. L., Dushyanthen, S., Peters, G., Sapkaroski, D., Barrett, M., Sim, J., & Eriksen, J. G. (2022). Screen-based digital learning methods in radiation oncology and medical education. *Technical Innovations and Patient Support in Radiation Oncology*, 24, 86–93.
- Kustandi, C., & Sutjipto, B. (2011). *Media pembelajaran: Manual dan digital*. Ghalia Indonesia.
- Li, Z. N., Drew, M. S., & Liu, J. (2014). *Introduction and multimedia: Fundamentals of multimedia*. Pearson Education International.
- Logan, M., Rebecca, J., & Jeremy, W. (2020). Development of an e-learning module to facilitate student learning and outcomes. *Teaching and Learning in Nursing*, 16(2), 139–142.
- Mahajan, R., Gupta, K., Gupta, P., Kukreja, S., & Singh, T. (2020). Multimedia instructional design principles: Moving from theoretical rationale to practical applications. *Indian Pediatrics*, 57, 555–560.
- Malhotra, R., & Verma, N. (2020). An impact of using multimedia presentations on engineering education. *Procedia Computer Science*, 172, 71–76.
- Mayer, R. E. (2005). Cognitive theory of multimedia learning. In R. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 31–48). Cambridge University Press.
- Mayer, R. E. (2009). *Multimedia learning*. Cambridge University Press.
- Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology*, 93(1), 187–198.
- Meltzer, D. E. (2002). The relationship between mathematics preparation and conceptual learning gains in physics: A possible hidden variable in diagnostic pretest scores. *American Journal of Physics*, 70(12), 1259–1268.
- Milenia, R., & Atip, N. (2023). Interactive media articulate storyline to improving students' learning outcomes on traditional engklek games material. *Journal of Educational Technology*, 7(4), 707–714.
- Rusman. (2013). *Faktor-faktor yang mempengaruhi hasil belajar*. Bumi Aksara.
- Ongor, M., & Uslusoy, E. (2023). The effect of multimedia-based education in e-learning on nursing students' academic success and motivation: A randomised controlled study. *Nurse Education in Practice*, 71, 1–7.
- Prawiradilaga, D., & Uwes, A. C. (2018). *Modul hypercontent teknologi kinerja*. Prenamedia Grup.
- Sa'adah, N., & Arokiasamy, L. (2023). A qualitative study on the urgency of attitude in designing effective procurement certification training. *Journal of High Technology Management Research*, 34, 100472.
- Sari, S. G., Fauzan, A., Armianti, & Yerizon. (2021). Pengembangan media pembelajaran matematika interaktif berbasis problem based learning di kelas V SDN 22 Duku Kecamatan Koto XI Tarusan. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 5(2), 2123–2132.
- Schunk, H. (2012). *Motivation and self-regulated learning: Theory, research, and applications*. Lawrence Erlbaum Associates.
- Sofyan, H., Anggereini, E., & Saadiah, J. (2019). Development of e-modules based on local wisdom in central learning model at kindergartens in Jambi City. *European Journal of Educational Research*, 8(4), 1137–1143.
- Standar Penilaian Indonesia. (2018). *Standar penilaian Indonesia 2018*. Jakarta.
- Tegeh, I. M., & Kirna, I. M. (2013). Pengembangan bahan ajar metode penelitian pendidikan dengan ADDIE model. *Jurnal IKA*, 11(1), 16.
- Vaidya, S., Ambad, P., & Bhosle, S. (2018). Industry 4.0 - A glimpse. *Procedia Manufacturing*, 20, 233–238.
- Wang, C., Ting, F., & Yinxuan, F. (2020). Learning performance and behavioral patterns of online collaborative learning: Impact of cognitive load and affordances of different multimedia. *Computers & Education*, 143, 1–14.
- Wigfield, A., & Eccles, J. S. (2000). Expectancy value theory of achievement motivation. *Contemporary Educational Psychology*, 25(1), 68–81.