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THE EFFECTIVENESS OF MICROVIDEO CONTENT TO IMPROVE STUDENT'S LEARNING OUTCOMES IN DATABASE LEARNING

A EFICÁCIA DO CONTEÚDO DE MICROVÍDEO PARA MELHORAR OS RESULTADOS DE APRENDIZAGEM DO ALUNO NA APRENDIZAGEM DE BANCO DE DADOS

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Abstract: The 21st century has witnessed a transformative era in education, where teachers and students play crucial roles in the learning process. Innovative approaches and technology integration have become essential to ensure effective learning. Microlearning, an innovative method for all-digital learning, holds great potential. This research aims to assess the effectiveness of microlearning in delivering learning content for Database courses. A quantitative pre-experimental study employing a one-group pretest-posttest design was conducted with 27 randomly selected students from the Computer Science program at Undiksha. The results indicate a notable improvement in student learning outcomes, with an N-Gain score of 0.59 (medium category) for microvideo content. Paired sample t-test analysis revealed a pretest average of 44.973 and a post-test average of 81.091, indicating a significant increase in learning outcomes. The significance value of 0.000, smaller than $\alpha = 0.05$, further supports this finding. In conclusion, using microvideo content in the Database course demonstrated significant differences and enhanced student learning outcomes.

Keywords: Microlearning. Microvideo. Database. Effectiveness.

Resumo: The 21st century has witnessed a transformative era in education, where teachers and students play crucial roles in the learning process. Innovative approaches and technology integration have become essential to ensure effective learning. Microlearning, an innovative method for all-digital learning, holds great potential. This research aims to assess the effectiveness of microlearning in delivering learning content for Database courses. A quantitative pre-experimental study employing a one-group pretest-posttest design was conducted with 27 randomly selected students from the Computer Science program at Undiksha. The results indicate a notable improvement in student learning outcomes, with an N-Gain score of 0.59 (medium category) for microvideo content. Paired sample t-test analysis revealed a pretest average of 44.973 and a post-test average of 81.091, indicating a significant increase in learning outcomes. The significance value of 0.000, smaller than $\alpha = 0.05$, further supports this finding. In conclusion, using microvideo content in the Database course demonstrated significant differences and enhanced student learning outcomes.

Palavras-chave: Microlearning. Microvideo. Banco de Dados. Eficácia.

1. Introduction

The era of educational transformation in the 21st century is a stream of change where teachers and students simultaneously hold an essential role in the learning process. In this case, students become the center of the learning process, while the teacher is an active mediator and facilitator to develop students' self-potential (Yu et al., 2019). The teacher's vital role in 21st-century learning will be more optimal if assisted by the role of technology and information (Sumardi et al., 2020). With the utilization of technology, the learning atmosphere will become more active, creative, innovative, and entertaining (Ghavifekr & Rosdy, 2015) to create multi-interactions between teachers and students, teachers and students with learning media/resources, and among fellow students (Rusman, 2018).

The Covid-19 pandemic that hit the whole world in early 2020 (Kuhfeld et al., 2020; Ye & Law, 2021) had a massive impact on all aspects of life, especially in learning activities (Mailizar et al., 2020). Nearly 1.6 billion students from 200 countries worldwide feel its negative impact (Pokhrel & Chhetri, 2021). The pandemic forced schools, colleges, and other learning institutions worldwide to migrate to online learning models. Online learning is the best choice to replace conventional learning(Naidu, 2021; Neuwirth et al., 2021; Tabroni et al., 2022; Teräs et al., 2020). Through online learning, the learning process can still be conducted smoothly because students can study anywhere and anytime (Wardany et al., 2021) and have an impact on using fewer resources and time (Mukhtar et al., 2020). Therefore, students can easily access learning materials without the constraint of place and time. In online learning, selecting learning methods and strategies is essential (Toquero, 2020). It is also vital to comprehend that what causes the success of a lesson is the application of suitable learning methods, not the learning media itself (Mayer, 2019). The learning method is the primary variable in student achievement (Oladayo, 2021). Therefore, teachers must be able to choose and apply suitable learning methods for that purpose.

Microlearning is a form of evolution of online learning (Giurgiu, 2017) and can be considered as an innovative approach to digital 21st-century learning (Polasek & Javorcik, 2019; Singh & Banathia, 2019). Microlearning is a learning approach in which learning content is presented in the form of short, concise pieces and focuses on discussing one idea or learning topic (Leong et al., 2021; Polasek & Javorcik, 2019). Microlearning has another term, called Bite-Sized Learning (Giurgiu, 2017). Microlearning offers opportunities for students to quickly absorb

and retain information provided by teachers and activities that are easier to manage and process. Learning content by presenting smaller units helps students retain information and perform better (Giurgiu, 2017). In addition, the form of learning content presented in small units will be able to reduce students' cognitive load in the learning process (Aldaghi et al., 2022; Gerbaudo et al., 2021; Kossen & Ooi, 2021). The benefits of microlearning, namely (1) better retention of microlearning concepts, (2) better involvement of students in learning, (3) increased student motivation and student ability to engage in collaborative learning, and (5) can improve ability and learning performance of students (Leong et al., 2021).

In the Computer Science study program at the Ganesha University of Education (Undiksha), Bali-Indonesia has successfully realized microlearning-based learning content for the Database course (Marti & Tuti Ariani, 2023). Microlearning-based learning content is presented as a short-duration video called microvideo (Gerbaudo et al., 2021; Marti & Tuti Ariani, 2023). The microvideo that was successfully realized discusses four learning topics: the introduction of database concepts, database systems, data modeling with entity relationship models, and designing entity relationship diagrams. Each learning topic consists of several learning indicators that are measured. Each learning indicator contains at least one microvideo. Microvideo has a maximum duration of 6 minutes to attract students' attention and effectively store resources (Díaz Redondo et al., 2021). The results of microvideo realization can be seen in Table 1.

Table 1 List of Microvideo Content in Database Courses

Topic	**Learning indicators**	***Microvideo* Duration (Minute)**
Introduction video containing the course's Introduction		1,2
Topic 1 Introduction to database concepts	- Explain the concept of data	4,39
	- Explain the concept of a file system	4,05
	- Explain the introduction concept of the Database	3,5
Topic 2 Database system	- Explain the concept of a database system	4,36
	- Describe the data model	5,20
	- Explain data abstraction	5,56
	- Describe the language in the Database	4,09
Topic 3 Modeling Using the Entity-Relationship Model (E-R Model)	- Explain the essential components of the entity-relationship model	5,58
	- categorize entities based on the type	5,59
	- Describe attributes based on their type and critical attributes	5,37
	- Describe the relationship	5,57 and 4,54
	- Explain the cardinality ratio and participation	5,40 and 5,14

Topic	Learning indicators	*Microvideo* Duration (Minute)
Topic 4 Entity-Relationship Diagram Design (E-R Diagram)	- Explain the meaning of the component symbols of the E-R diagram	5,57; 5,50 and 3,20
	- Explain the stages in designing an E-R diagram	2,54
	- Drafting E-R diagrams for the PERUSAHAAN database	5,49; 5,53; 4,31; 5,38; 5,52; 5,18; and 5,22

This microvideo content must be evaluated to determine its effectiveness in authentic learning. Therefore, this research is essential to test the effectiveness of microvideo content for learning Database courses that have been successfully realized.

2. Research design and methods

The type of research utilized is pre-experimental quantitative research using a one-group pretest-posttest design. The research design was chosen due to the limitations of the study population. One group pretest-posttest design is still effective because the limitations do not interfere with the design (Knapp, 2016). Research design can be seen in Table 2.

Tabel 2 Research Design

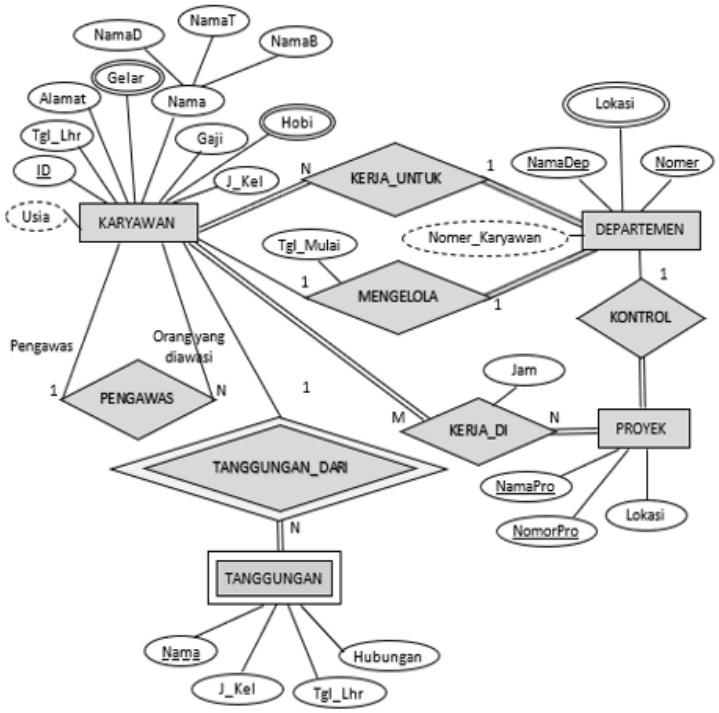
Pretest	**Treatment**	***Posttest***
O_1	X	O_2

The population for this study was students of the Computer Science study program, Department of IT-Undiksha in Indonesia. The sample was taken by random sampling technique, and 27 students were selected in the second semester. By the curriculum, a course on Database is offered in that semester.

Students take the pretest at the beginning of the meeting. After students study the four topics of microvideo content in the Database course which are completed in six learning meetings, students are given a posttest. The form of questions on the pretest and posttest is multiple choice. An example of a question can be seen in Figure 1. According to Roessger, this type of multiple-choice question is very effective in providing direct feedback to students in the form of a success score (Parker & Roumell, 2020). The pretest and posttest were done using the Google Form with randomized questions and a random option feature.

The microvideo content and multiple choice questions used in this study have certainly gone through due diligence by material experts and media/learning design experts in previous studies. Microvideo content was declared up to standard by material experts with a validity value of 93.33%, while the validity value of the media test reached 88% (Marti & Tuti Ariani, 2023). Multiple choice questions have also been tested on 316 students in the Informatics Engineering Department, Undiksha, to measure validity, reliability, question difficulty level, and question discriminating power. The type of validity test used is point biserial correlation because the data measured is dichotomous. Of the 75 multiple choice questions tested, 71 questions were declared valid. For the reliability test using Alpha Cronbach. Of the 71 questions tested, Cronbach's Alpha score was 0.932. This value indicates that 71 questions are reliable to use.

From the following picture, which shows as a weak entity is...



a. Karyawan
b. Pengawas
c. Tanggungan
d. Mengelola

Figure 1. Examples of questions in learning databases

This multiple-choice question was designed using Bloom's taxonomy cognitive level (Arneson & Offerdahl, 2018). Three questions represent each learning indicator. If the question is answered correctly, a score is given 1, whereas if the answer is wrong, a score is 0. The total score is 100. The method used to analyze the data from the pretest and posttest results are

normalized N-gain and paired sample t-test with a significance level of α =0.05. The formula used to calculate the N-Gain score is as follows:

$$N - Gain\ Score = \frac{Posttest - Pretest}{Ideal\ score - Pretest}$$

The interpretation of the N-Gain score is presented in Table 3 (A. Setiawan et al., 2018), while the percentage form of the N-Gain score (T. H. Setiawan & Aden, 2020) is shown in Table 4.

In this study, the hypothesis tested is.

H_0: There is no significant difference in learning outcomes before and after using microvideo content in the learning process of Database courses.

H_1: There are significant differences in learning outcomes before and after using microvideo content in the learning process of Database courses.

The tools used to calculate the N-Gain score and paired sample t-test are SPSS 25.

Table 3. Interpretation of N-Gain Score

No	N-Gain Score	Interpretation
1	N-gain < 0,3	Low
2	0,3 ≤ N-gain ≤ 0,7	Medium
3	N-gain > 0,7	High

Table 4. Interpretation Categories of N-Gain Effectiveness Score

No	Percentage (%)	Interpretation
1	> 76	Effective
2	56 - 75	Somewhat Effective
3	40 – 55	Less Effective
4	< 40	Not Effective

source: Hake, 1999 at *(T. H. Setiawan & Aden, 2020)*

3. Results and Discussion

After the research was completed, each student's pretest and posttest score data were processed and displayed in Table 5. Then the data was analyzed using N-Gain to determine the increase in learning outcomes for each student.

Table 5. N-Gain score from the processing of Pretest and Posttest scores from 27 students

No	Pre	Post	Post - Pre	Ideal score (100-Pre)	N-gain Score	Interpretation
1	28,57	71,05	42,48	71,43	0,59	Medium
2	57,14	52,63	9,77	57,14	0,17	Low
3	50,00	68,42	11,28	42,86	0,26	Medium
4	21,43	81,58	31,58	50,00	0,63	Medium
5	35,71	73,68	52,26	78,57	0,67	High
6	71,43	89,47	53,76	64,29	0,84	High
7	57,14	94,74	23,31	28,57	0,82	Medium
8	57,14	52,63	16,92	64,29	0,26	Medium
9	64,29	86,84	29,70	42,86	0,69	Medium
10	21,43	84,21	27,07	42,86	0,63	High
11	64,29	78,95	14,66	35,71	0,41	Low
12	64,29	78,95	57,52	78,57	0,73	Medium
13	71,43	73,68	9,40	35,71	0,26	Medium
14	28,57	84,21	19,92	35,71	0,56	High
15	35,71	84,21	12,78	28,57	0,45	High
16	42,86	42,11	27,82	85,71	0,32	High
17	35,71	78,95	50,38	71,43	0,71	Medium
18	78,57	84,21	48,50	64,29	0,75	Medium
19	42,86	92,11	49,25	57,14	0,86	High
20	7,14	65,79	30,08	64,29	0,47	High
21	28,57	86,84	8,27	21,43	0,39	High
22	42,86	84,21	41,35	57,14	0,72	High
23	42,86	81,58	74,44	92,86	0,80	High
24	57,14	81,58	53,01	71,43	0,74	Medium
25	42,86	86,84	43,98	57,14	0,77	High
26	35,71	86,84	43,98	57,14	0,77	Medium
27	28,57	76,32	19,17	42,86	0,45	Medium
Average					0,628	Medium

Based on Table 5, it was found that 44.44% of students experienced an increase in learning outcomes in the Database course in the high category, 48.15% of students experienced an increase in learning outcomes in the Database course in the medium category, and 7.41% students experience an increase in learning outcomes in the Database course with a low category. Overall, based on the average N-gain score, which is 0.628, it shows that student learning outcomes using microvideo content in the Database course increase in the medium category. The interpretation category of n-gain effectiveness states that student learning outcomes using microvideo content in the Database course increased by 62.81% in the quite effective category.

Then a paired sample t-test was conducted to obtain the effectiveness of microvideo content for the course on the Database. The prerequisite for conducting the paired sample t-test is that the data must be normally distributed, both pretest and posttest data.

Test of Normality

This study used the Shapiro-Wilk normality test with a significance value of $\alpha = 0.05$. The Shapiro-Wilk normality test was used because the number of samples was less than 30. The Test of normality results is shown in Table 6.

Table 6. Test of normality results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PreTest	0,140	27	0,188	0,970	27	0,597
PostTest	0,153	27	0,108	0,972	27	0,669

a. Lilliefors Significance Correction

According to Table 6, the significance value of the pretest data was obtained at 0.597. Meanwhile, the significance value of the posttest data was 0.669. This significant value shows that the pretest and posttest data are both greater than 0.05. This result means that the pretest and posttest data are typically distributed.

Test of hypothesis

Test the hypothesis using a paired sample t-test to test the effectiveness of using microvideo content in the Database course. The test results are shown in Table 7, the descriptive statistics, and in Table 8, the paired sample t-test results.

Based on Table 7, the pretest mean value was 44.973. After being given the treatment, namely using microvideo content in the learning process in the Database course, the posttest mean score was 81.091. This means that descriptive statistics show a difference between the pretest and posttest.

Table 7. Descriptive statistics on the results of the paired sample t-test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreTest	44,9733	27	17,81012	3,42756
	PostTest	81,0915	27	7,04041	1,35493

Table 8. Table output paired sample t-test.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PreTest - PostTest	-36,11815	17,13952	3,29850	-42,89832	-29,33798	-10,950	26	0,000

Furthermore, inferential analysis was conducted to observe the significance of the indicated differences. Based on Table 8, the value of sig = 0.000 is obtained, which means it is smaller than $\alpha = 0.05$. Thus, H_0 is rejected, and H_1 is accepted, which means that there are significant differences in student learning outcomes before and after using microvideo content in the learning process of the Database course. Suppose again we look at the average results of the pretest and posttest. In that case, it can be concluded that there was a significant increase in student learning outcomes after using microvideo content in the learning process for the Database course.

The results of this study are consistent with the results of research conducted by (Surahman et al., 2019), where the microlearning technique can improve the learning outcomes of object training participants in a blended learning environment. The research results are also in accordance with the research conducted by Yusnidar and Syahri (2022), which obtained the result that there was a difference in the implementation of case study-based microlearning in the Educational Research Methodology course in the 2019 Student Chemistry Education Study Program. These differences are shown from the average pretest results, namely 72.33 to 89.11 in the posttest results (Yusnidar & Syahri, 2022). This difference indicates an increase.

In addition, microlearning, which presents learning content that is fragmented into small units, and focuses on one learning topic, can also reduce students' cognitive load in learning (Aldaghi et al., 2022; Gerbaudo et al., 2021; Kossen & Ooi, 2021). Based on the cognitive load theory's assumptions, excessive cognitive load can hinder learning due to limited working

memory capacity (Gerbaudo et al., 2021). The impact of this reduced cognitive load is that students can prioritize and focus more on more critical learning content (Kossen & Ooi, 2021).

This microlearning approach has been implemented in both hybrid learning environments (Ghasia & Rutatola, 2021; Shamir-Inbal & Blau, 2020) and online learning environments (Gerbaudo et al., 2021; Kossen & Ooi, 2021). Microlearning has also proven beneficial for students with special needs or who have problems with concentration and dyslexia (Javorcik & Polasek, 2019).

From the several benefits that can be obtained by using microlearning, in the future, teachers need to plan to implement microlearning in learning content presentation for practicality (Park & Kim, 2018). On the other hand, faculty-level learning managers can link the experience of using microlearning with contextual experiences so that they can work in harmony with the learning objectives that need to be achieved (Major & Calandrino, 2018). Good planning needs to be done so that microlearning-based learning content is easily accessible to students from anywhere and at any time through any available device to realize effective learning [40]. This microlearning approach can be integrated with a learning management system (LMS), to facilitate the delivery of content to students (Díaz Redondo et al., 2021). In addition, effective learning management can also be implemented by utilizing cloud computing technology (Park & Kim, 2018).

When designing the presentation of learning content using the microlearning approach, it is necessary to consider the form of modality that students prefer. A video is a form of microlearning modality that students prefer (So et al., 2020). In terms of duration, it is also necessary to consider that the duration of the learning videos is brief because it can reduce students' focus on the content being discussed. This study uses a maximum duration of 6 minutes to attract students' attention so that the maximum efficiency of resources can be achieved (Díaz Redondo et al., 2021). Henceforth, it is necessary to conduct research that looks at the impact of using microlearning on different age groups, social or geographic locations (Javorcik & Polasek, 2019).

4. Conclusion

This research was conducted to test the effectiveness of microvideo content in the Database course. Sixteen microvideos were successfully realized for four learning topics in the Database course in the Computer Science study program, IT Department, Undiksha in Indonesia. The microvideo has a maximum duration of 6 minutes for the purpose of attracting students' attention in the learning process. All microvideo content has been registered as copyrighted at the Ministry of Law and Human Rights in Indonesia. The effectiveness of this microvideo content is measured by the one-group pretest-posttest design. The data analysis technique used was normalized N-Gain and paired sample t-test with a significance level of $\alpha = 0.05$.

The analysis results using normalized N-Gain with an average N-Gain score of 0.59 show that student learning outcomes using microvideo content in the Database course increase in the medium category. Based on the interpretation of the effectiveness of the n-gain of 59.06%, it is stated that the increase is classified as quite effective. Meanwhile, from the results of data analysis using the paired sample t-test, the pretest average was 44.973. After being given the treatment, the mean posttest result was 81.091. Based on the significance value obtained, namely 0.000, means it is smaller than the value $\alpha = 0.05$. From these results, it was decided that H0 was rejected and H1 was accepted, which means that there are significant differences in student learning outcomes before and after using microvideo content in the learning process of Database courses. It can be concluded that microlearning is an effective approach for presenting learning content and is able to improve student learning outcomes. The results of this study indicate that microlearning is a valid and efficient approach to developing learning content.

Microlearning has many other benefits that have been described previously. Henceforth, it is necessary to conduct research that looks at the impact of using microlearning on different age groups, social or geographic locations.

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