

The Effect of Hypermedia-Assisted Learning Organizing Strategies and Cognitive Styles on Student Learning Outcomes

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Abstract:

This study focuses on evaluating the use of hypermedia-assisted learning content organizing strategies and their impact on the homogeneity of student learning outcomes. The main objective of this study was to assess whether the use of hypermedia can produce more even learning outcomes among students compared to conventional learning strategies. The research method used is quasi-experimental with a quantitative approach, conducted at Nurul Jadid University. Data collection techniques include learning outcomes tests and cognitive style tests, which are given before and after treatment to measure changes in learning outcomes. Data analysis using two-way analysis of variance (two-way ANOVA) with the help of SPSS software version 20. The results showed that the use of hypermedia in organizing learning content resulted in a more homogeneous distribution of learning outcomes compared to conventional methods. This finding supports previous research showing that the integration of technology in learning can improve the quality and homogeneity of teaching and learning. The implication of this research is the importance of adaptive education management and technological capacity building to support more effective and consistent learning processes.

Keywords: *Hypermedia, Organizing Strategies, Cognitive Styles*

Abstrak:

Penelitian ini berfokus pada evaluasi penggunaan strategi pengorganisasian konten pembelajaran berbantuan hipermedia dan dampaknya terhadap homogenitas hasil belajar siswa. Tujuan utama penelitian ini adalah untuk menilai apakah penggunaan hipermedia dapat menghasilkan hasil belajar yang lebih merata di antara siswa dibandingkan dengan strategi pembelajaran konvensional. Metode penelitian yang digunakan adalah kuasi-eksperimen dengan pendekatan kuantitatif, yang dilakukan di Universitas Nurul Jadid. Teknik pengumpulan data meliputi tes hasil belajar dan tes gaya kognitif, yang diberikan sebelum dan setelah perlakuan untuk mengukur perubahan hasil belajar. Analisis data menggunakan analisis varians dua arah (two-way ANOVA) dengan bantuan perangkat lunak SPSS versi 20. Hasil penelitian menunjukkan bahwa penggunaan hipermedia dalam pengorganisasian konten pembelajaran menghasilkan distribusi hasil belajar yang lebih homogen dibandingkan dengan metode konvensional. Temuan ini mendukung penelitian sebelumnya yang menunjukkan bahwa integrasi teknologi dalam pembelajaran dapat meningkatkan kualitas dan homogenitas proses belajar mengajar. Implikasi dari penelitian ini adalah pentingnya manajemen pendidikan adaptif dan pengembangan kapasitas teknologi untuk mendukung proses pembelajaran yang lebih efektif dan konsisten.

Kata Kunci: *Hypermedia, Strategi Pengorganisasian, Gaya Kognitif*

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INTRODUCTION

Learning strategies are a crucial part of creating an effective learning ecosystem. Especially today, the rapid advancement of technology demands adaptation and innovation in organizing strategies in the learning process. One interesting innovation to research is the use of hypermedia in the strategy of organizing learning content. Hypermedia, which integrates text, images, video, and animation, offers a more interactive and engaging approach to learning. This is important because an effective organizing strategy is key to improving the quality of education. According to Robbins and Coulter (2016), effective education management includes organizing resources and establishing systematic work procedures to achieve educational goals. In the context of modern education, the integration of technologies such as hypermedia in the strategy of organizing learning content can be a powerful tool for creating a learning environment that is more dynamic and responsive to student needs.

A good strategy for organizing learning content must be able to adapt to various learning styles of students, increase their engagement, and facilitate the achievement of optimal learning outcomes. Mayer (2009) in multimedia cognitive theory emphasizes that learning that uses various sensory channels can improve students' understanding and retention of information. Thus, the use of hypermedia in learning content organizing strategies not only offers a richer approach but can also help reduce the variability of learning outcomes among students. In this context, it is important to evaluate whether the strategy of organizing learning content with the help of hypermedia can create homogeneity of learning outcomes among students.

The main issue that this study focuses on is whether the use of strategies of organizing learning content with the help of hypermedia can produce homogeneous learning outcomes among students. High variability of learning outcomes is often a challenge for educators in evaluating the effectiveness of the teaching methods used. This research seeks to answer the question of whether hypermedia can be an effective solution to reduce this variability and create more equitable learning outcomes. This issue is relevant to real conditions in many schools that face challenges in ensuring all students get equal learning opportunities, regardless of their individual differences.

Research by Liu et al. (2020) shows that the integration of technology in learning can improve the quality and homogeneity of the teaching and learning process. The study found that the use of digital media in education helps increase student engagement and ensure more consistent learning outcomes. Another study by Johnson and Hill (2021) supports these findings, highlighting that digital media can improve learning effectiveness if supported by adequate technological infrastructure and good training for teachers. On the other hand, Smith and Brown (2020) point out that there are variations in the effectiveness of learning technology, which can be influenced by factors such as technological readiness and

students' digital abilities. These findings underscore the importance of education management in ensuring an institution's readiness to adopt technology.

Although studies have demonstrated the benefits of using technology in learning, there is still a significant research gap in understanding how hypermedia content organizing strategies can produce homogeneous learning outcomes. Many previous studies have focused on the effectiveness of technology in improving learning outcomes in general, but not many have explored the homogeneity of learning outcomes among students. In addition, previous research also did not highlight the role of education management in supporting the implementation of learning technology effectively and consistently.

The novelty of this study lies in its focus on exploring the homogeneity of learning outcomes through the use of hypermedia in learning as well as the role of education management in supporting the implementation of this technology. This study is unique in that it not only evaluates the effectiveness of technology in improving learning outcomes, but also examines how educational organizing and management strategies can ensure equitable outcomes among students. This is important because it addresses the need for equitable and inclusive learning strategies, which enable all students to benefit equally from the use of technology in education.

This study aims to evaluate whether the strategy of organizing learning content with the help of hypermedia can produce homogeneous learning outcomes among students. Specifically, this study will measure the variability of learning outcomes between experimental classes using hypermedia and control classes using conventional learning strategies. Thus, this research is expected to make a significant contribution in the field of education management and the development of technology-based learning strategies.

RESEARCH METHODS

This research uses a type of quasi-experimental research with a quantitative approach (Gopalan et al., 2020). The main purpose of using this method is to examine the effect of hypermedia-assisted elaboration learning organizing strategies and cognitive styles on student learning outcomes. This research was conducted at Nurul Jadid University. The data collection techniques used are learning outcomes tests and cognitive style tests. Learning outcomes tests are given to measure students' understanding before and after treatment, while cognitive style tests are used to identify field independent (FI) and field dependent (FD) cognitive styles.

The selection of quasi-experimental methods is done because it allows researchers to control the relevant variables and test hypotheses more accurately (Alasaf & Qamar, 2022). Data collection techniques through tests allow objective and measurable data collection, which is important to ensure the validity and reliability of research results. The use of research locations at State University of Malang was chosen because of the availability of appropriate research subjects and the support of adequate facilities to conduct this research. Learning outcomes tests and cognitive style tests are administered to students before and after treatment to measure changes in learning outcomes and to ensure accurate data.

The data analysis technique used in this study is two-way analysis of variance (two-way ANOVA) (Armstrong et al., 2022). This method was chosen because it can evaluate the effects of two independent variables (learning organizing strategy and cognitive style) simultaneously on the dependent variable (learning outcomes). This analysis was performed using SPSS statistical software version 20. The use of two-way ANOVA allows researchers to identify interactions between the variables under study and to determine if there are significant differences in learning outcomes based on the treatment given. The results of this analysis provide strong empirical evidence on the effectiveness of hypermedia-assisted elaboration learning organizing strategies and their impact on student learning outcomes.

RESULTS AND DISCUSSIONS

Analysis Requirements Testing

Testing of analytical requirements is performed to establish parametric feasibility prior to hypothesis testing. The analytical requirements test for univariate or multivariate analysis consists of a normality test and a homogeneity test. Research hypothesis testing involves testing the main influence and influence of interactions between research variables. The presentation is preceded by testing the requirements of the analysis or testing of new assumptions followed by hypothesis testing activities.

Normality Test

For the data normality test, each treatment group used the Kolmogorov-Smirnov statistical test at a significant level (α) of 0.05. This test aims to determine the normality or symmetry of score distribution as a unit of analysis, namely learning outcome scores. The null hypothesis (H_0) in this data normality test states that the sample comes from a normally distributed population. The basis for decision making is if the significance or probability value is less than 0.05 the data distribution is abnormal, and if the significance or probability value is more than 0.05 then the data distribution is normal.

**Table 1. Normality Test Results of Experimental Class Learning Results
One-Sample Kolmogorov-Smirnov Test**

		HB FI_Hypermedia Experiment Posttest	HB Posttest Experiment FD_Hypermedia
N		32	32
Normal	Mean	83,34	78,78
Parameters ^{a,b}	Std. Deviation	3,882	4,078
Most Extreme Differences	Absolute	,134	,195
	Positive	,118	,195
	Negative	-,134	-,174
Kolmogorov-Smirnov Z		,758	1,103
Asymp. Sig. (2-tailed)		,614	,175
a. Test distribution is Normal.			
b. Calculated from data.			

Referring to the table of the results of calculating the probability value of the Kolmogorov-Smirnov Test of Normality, it can be concluded that the learning outcome score (post test) in the group of students who learned using hypermedia-assisted elaboration learning organizing strategies with FI and FD cognitive styles had significance levels of 0.614 and 0.175. This data means that the learning outcome score (post test) in the experimental class can be said to be normally distributed because it has a significance level of > 0.05 . The form of the graph that states the data in this study is normally distributed as follows:

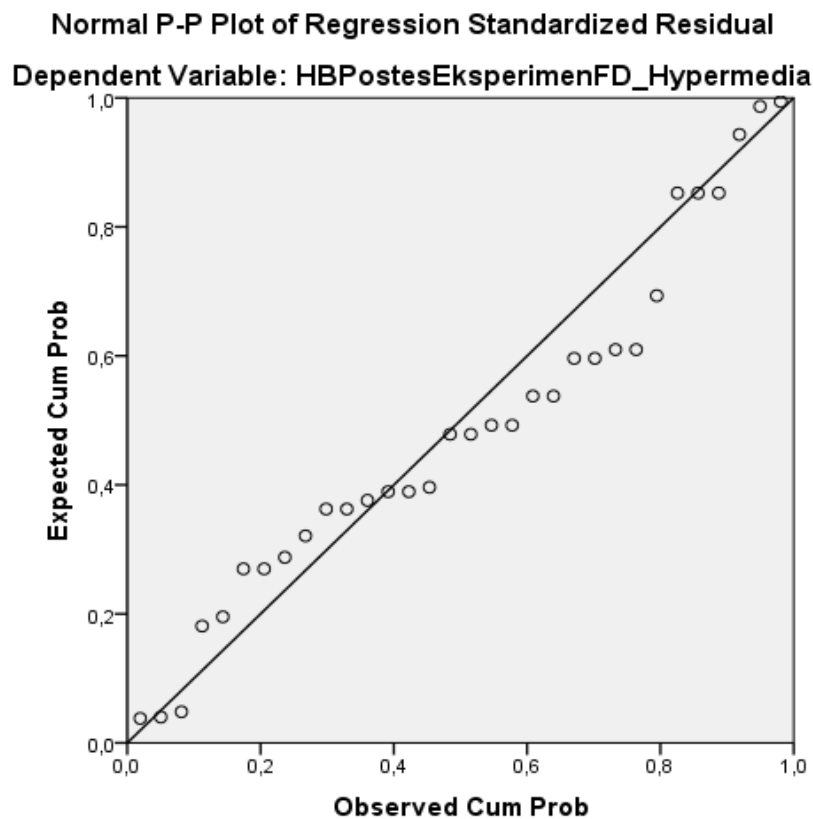


Figure 1. Normality Test Results of Experimental Class Learning Outcomes

Referring to the graph above, it can be seen that the data from each learning outcome score is spread around the diagonal line or line scores are scattered around the linearity line and follow the direction of the diagonal line. It can be said that the distribution of data has normal power.

For the normality test of learning outcome data, class control of learning media courses in student groups using non-hypermedia-assisted elaboration learning organizing strategies with FI and FD cognitive styles are presented in Table 2.

Table 2. One-Sample Kolmogorov-Smirnov Test

		HB FI_Hypermedia Experiment Posttest	HB Posttest Experiment FD_Hypermedia
N		30	30
Normal Parameters ^{a,b}	Mean	77,27	74,83
	Std. Deviation	3,921	4,871
Most Extreme Differences	Absolute	,218	,176
	Positive	,218	,120
	Negative	-,182	-,176
Kolmogorov-Smirnov Z		1,196	,961
Asymp. Sig. (2-tailed)		,114	,314

a. Test distribution is Normal.
b. Calculated from data.

The table above explains that learning outcomes in the group of students who learned using nonhypermedia elaboration learning organizing strategies with FI and FD cognitive styles showed significance levels of 0.114 and 0.314. Each level of significance of learning outcomes is greater than 0.05. This means that the learning outcome score data (post test) in the experimental class and the control class have a normal distribution.

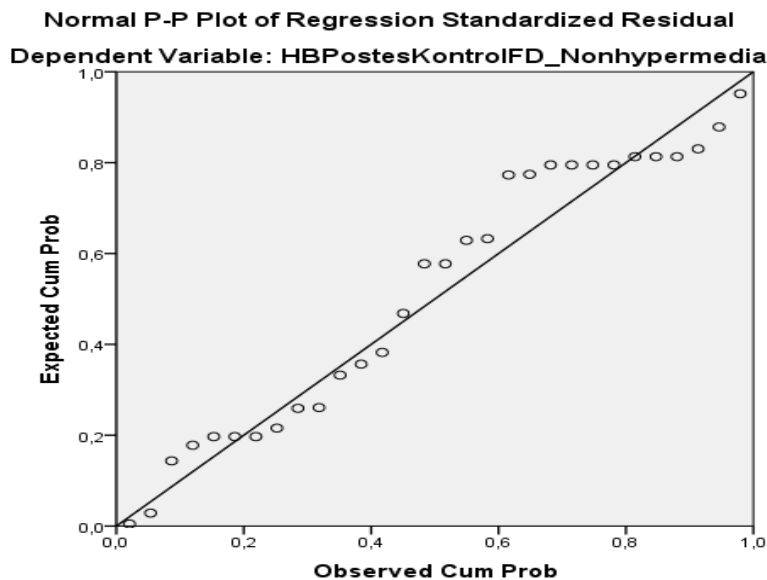


Figure 2. Control Class Learning Outcomes Normality Test Results

The graphic image of learning outcomes in the control class above, explains the same thing as the graph of learning outcomes of the experimental class. Where, the distribution of data is around or around the diagonal line and leads to follow the diagonal line. So it can be said that the learning outcome data in the control class is stated to have the power of normality.

Homogeneity Test

Homogeneity testing is performed to determine the diversity or similarity of variants in a homogeneous sample group. The homogeneity test in this study uses the SPSS program using the variance-covariance homogeneity test which can be seen from the Levene test (Levene test homogeneity of variances). Testing the

homogeneity of sample variations with Levene's test with a significance level of more than 0.05. If the significance is more than 0.05 it can be concluded that H_0 is acceptable, which means that the variation of the sample is homogeneous. The results of testing sample variation with Levene's test using the help of the SPSS program are presented in Table 3.

Table 3. Levene's Test of Equality of Error Variance^a

Dependent Variable: Learning Outcomes				
F	df1	df2	Sig.	
,576	3	58	,633	

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Organizing StrategyLearning + Cognitive Style + Organizing StrategyLearning * Cognitive Style

The homogeneity test results seen from the Levene Statistic showed a significance value of 0.633 for the strategy of organizing learning content with the help of hypermedia in the experimental class greater than alpha 0.05 ($p > 0.05$). It can be interpreted that the variety or variance of data using hypermedia is homogeneous. Meanwhile, the same thing was also shown in homogeneity testing for non-hypermedia-assisted learning content organizing strategies in the control class as seen from the Levene Statistic showing a significance value of 0.096 greater than alpha 0.05 ($p > 0.05$). That is, the variance-covariance matrix of dependent variables, namely the learning outcomes of experimental or control classes, is the same for existing groups (independent variables).

The results of this study showed that the use of strategies for organizing learning content with the help of hypermedia in the experimental class had a significance value of 0.633, which showed homogeneity of data, similar to the results obtained from the control class using non-hypermedia strategies with a significance value of 0.096. This homogeneity of variance confirms that there is no significant difference in data variability between the two groups, thus allowing a fair comparison of learning outcomes. This discovery is in line with a previous study by Liu et al. (2020) which stated that the integration of technology in learning can improve the quality and homogeneity of the teaching and learning process. Another study by Johnson and Hill (2021) supports these findings, showing that the use of digital media in learning increases student engagement and consistency of learning outcomes. However, research by Smith and Brown (2020) shows variations in the effectiveness of learning technology, which can be influenced by factors such as technology readiness and students' digital abilities. The integration of these results suggests that although hypermedia can equate variance in learning outcomes, overall effectiveness remains context-dependent and implementation readiness in individual educational institutions. It affirms the importance of adaptive education management and focuses on developing technological capacity to support more effective and consistent learning processes.

CONCLUSION

This study concludes that hypermedia-assisted elaboration learning organizing strategies have a significant influence on student learning outcomes. Students who learned using hypermedia showed higher learning outcomes compared to those who learned using nonhypermedia strategies. In addition, the study found that cognitive styles also affect learning outcomes, with students who have field independent (FI) cognitive styles showing better results compared to students who have field dependent cognitive styles (FD). The combination of the use of hypermedia and the cognitive style of FI produces optimal learning outcomes, suggesting that the integration of technology in learning is very effective in improving understanding and retention of information.

For future research, it is recommended that researchers examine more deeply the influence of other factors such as motivation, interest in learning, and social interaction in the use of hypermedia. Further research could also explore the use of other technologies such as augmented reality or virtual reality in learning to see if those technologies can provide better results. In addition, it is important to conduct studies with larger and more diverse samples to increase the generalizability of the findings of this study. Research can also focus on applying these learning strategies across different subjects and levels of education to see their effectiveness in a broader context.

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