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Understanding Students' Conceptual Learning in Digital Environments: The Role of Learning Styles and E-Learning Utilization

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ABSTRACT

The advancement of information technology has encouraged transformations in educational systems, particularly through the implementation of e-learning as a digital learning medium. The effectiveness of e-learning is influenced not only by technological availability but also by students' characteristics, including learning styles. This study aims to examine the effect of learning styles and e-learning utilization on the conceptual understanding of eleventh-grade students at SMKN 8 Makassar. A quantitative correlational approach was employed in this study. The population consisted of 31 students, with 29 students selected as samples using the Slovin formula. Data were collected through Likert-scale questionnaires that had passed validity and reliability testing. Data analysis included descriptive statistics, validity tests, reliability tests, normality tests, linearity tests, multicollinearity tests, Pearson correlation, and multiple linear regression. The findings indicate that all research instruments were valid and reliable. Correlation analysis revealed that learning styles had a positive relationship with conceptual understanding (r = 0.605), while e-learning utilization had a positive relationship with conceptual understanding (r = 0.622). Multiple linear regression analysis demonstrated that learning styles and e-learning utilization simultaneously had a significant effect on conceptual understanding, with an R value of 0.693 and a coefficient of determination of 0.481. These findings indicate that 48.1% of the variation in conceptual understanding can be explained by learning styles and e-learning utilization, while the remaining percentage is influenced by other factors outside the research model. The study highlights the importance of aligning instructional strategies with students' learning characteristics and optimizing e-learning implementation to improve conceptual understanding.

Keywords: learning styles, e-learning, conceptual understanding, digital learning, vocational education

INTRODUCTION

The development of information and communication technology has brought very significant changes in various sectors of life, including the education sector. Digitization of education has changed the pattern of interaction between teachers and students, learning resources, and methods of delivering learning materials. One form of transformation is the use of e-learning as a learning medium that allows the learning process to take place flexibly without being limited by space and time. The use of e-learning is growing as the need for adaptive learning to technological developments and the demands of the 21st century increases.

E-learning is a learning system that utilizes the internet network and digital technology to support the learning process. Through e-learning, students can access various learning resources independently, interact with teachers and peers through discussion forums, and do assignments and evaluations online (Darwis et al., 2021; Gashi et al., 2024; Timbi-Sisalima,

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2022). E-learning is the use of internet technology to distribute various learning solutions that aim to improve students' knowledge and skills. The presence of e-learning provides opportunities for students to learn more independently and actively in building their understanding of the learning material.

The technological aspect does not solely determine the success of e-learning implementation. Various studies indicate that the effectiveness of digital learning is also influenced by the individual characteristics of learners (Koohang et al., 2009; Okamoto, 2008; Sugandini et al., 2022). One of the factors that is often studied in the field of educational psychology is learning style (Akib et al., 2024). Learning style is an individual's tendency to receive, process, and understand information obtained during the learning process. Each student has different learning characteristics, so it requires a different learning approach.

In general, learning styles can be classified into several categories, including visual, auditory, and kinesthetic. Students with visual learning styles tend to understand the information presented in the form of pictures, diagrams, graphs, and videos more easily. Students with an auditory learning style are more likely to understand the material through oral explanations, discussions, and voice recordings. Meanwhile, students with kinesthetic learning styles are more effective at understanding the material through practical activities, simulations, and hands-on experience. These differences in characteristics show that the learning strategies applied need to consider the learning needs of each student.

In the context of digital learning, understanding learning styles is becoming increasingly important because e-learning platforms provide various forms of learning media that can be tailored to the needs of students (Faradilla T et al., 2018; Okafor, 2025; Saphira et al., 2024; Sharma, 2024; ter Horst et al., 2024). Materials can be presented in the form of text, audio, video, animation, interactive simulations, or a combination of these various media (Arhas et al., 2023; Darwis et al., 2023; Lestari et al., 2025; Niswaty & Arhas, 2019). The availability of various learning formats allows students to get a learning experience that is more in line with their learning preferences so that they can improve their understanding of the concepts learned.

Understanding concepts is one of the important indicators of learning success. Concept comprehension is not only related to the ability to remember information but also includes the ability to reinterpret concepts in one's own language, connect concepts that have been learned with other concepts, and apply those concepts in various relevant situations. Students who have a thorough understanding of concepts tend to be able to develop critical thinking, problem-solving, and decision-making skills more effectively.

Research on the relationship between learning style and the use of e-learning for concept understanding has been conducted. However, the research results still show variations. Several studies have found that learning styles make a significant contribution to improving learning outcomes and understanding of students' concepts. Other research indicates that the effectiveness of digital learning is more influenced by the quality of learning design and the level of student involvement during the learning process. The difference in the results of the study indicates that the relationship between learning style, e-learning, and concept understanding still needs to be further studied in various educational contexts.

SMKN 8 Makassar is one of the schools that has implemented technology-based learning through the use of e-learning in the learning process. Even with the same learning materials, students have different levels of understanding. These differences are allegedly influenced by the variation in students' learning styles and different levels of e-learning utilization. Therefore, this study was conducted to analyze the influence of learning styles and the use of e-learning on the understanding of concepts of grade XI students of SMKN 8 Makassar.

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METHODS

This study uses a quantitative approach with a correlational design. The quantitative approach was chosen because the research aims to measure and analyze the relationship and influence between learning style variables and the use of e-learning on students' understanding of concepts through numerical data processing and statistical analysis. The correlational design was used to determine the level of relationship between variables without giving special treatment to respondents.

This study examines two independent variables, namely learning style (X_1) and the use of e-learning (X_2), as well as one bound variable, namely concept understanding (Y). The relationships between variables were analyzed using Pearson correlation and multiple linear regression to determine the contribution of each independent variable to the bound variable.

The research was carried out at SMKN 8 Makassar which is located on Jalan Monginsidi No. 17, Maricaya Baru, Makassar District, Makassar City, South Sulawesi. Data collection will be carried out in October 2025.

The selection of the research location is based on the consideration that SMKN 8 Makassar has implemented technology-based learning through the use of e-learning platforms in learning activities so that it is relevant to the research objectives.

The population is a whole of research subjects that have certain characteristics in accordance with the research objectives. The population in this study is all students of grade XI of the Hospitality Expertise Program (PHT) of SMKN 8 Makassar which is 42 students.

Sample determination was carried out using the purposive sampling technique, which is a sampling technique based on certain considerations and criteria set by the researcher. This technique is used because not all members of the population have characteristics that are in accordance with the needs of the research.

The sample criteria used are:

1. Active students in grade XI of the Hospitality Expertise Program of SMKN 8 Makassar.
2. Have participated in learning using the e-learning platform implemented by the school.
3. Willing to be a research respondent.
4. Fill out the questionnaire completely and can be used in the data analysis process.

Based on these criteria, 31 students were obtained who met the requirements and were designated as research samples.

Data collection was carried out using questionnaires or questionnaires that were compiled based on the indicators of each research variable.

The research instrument uses a five-level Likert scale with always, often, sometimes, rare, and never-answer alternatives. The questionnaire was given directly to respondents to obtain data on learning styles, the use of e-learning, and students' understanding of concepts.

Data analysis was carried out using the help of Statistical Package for Social Sciences (SPSS) software. Descriptive statistical analysis is used to describe the characteristics of research data through mean values, median, mode, frequency, and percentage. Before the regression analysis is carried out, classical assumptions are first tested which include:

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1. Normality Test
   The normality test aims to find out whether the research data is normally distributed. The test was carried out using the Kolmogorov-Smirnov method. Decision-making criteria:
   Sig. > 0.05 = normally distributed data.
   Sig. < 0.05 = data not normally distributed.
2. Linearity Test
   The linearity test aims to find out whether the relationship between the free variable and the bound variable is linear. Decision-making criteria:
   Sig. Deviation from Linearity > 0.05 = linear relationship.
   Sig. Deviation from Linearity < 0.05 = nonlinear relationship.
3. Multicollinearity Test
   The multicollinearity test aims to find out whether or not there is a very strong relationship between independent variables.
   Decision-making criteria:
   VIF value < 10 = no multicollinearity occurs.
   VIF value > 10 = multicollinearity occurs.

Pearson's correlation analysis is used to determine the level of relationship between learning style and e-learning use and students' understanding of concepts. Multiple linear regression analysis was used to determine the influence of learning style and the use of e-learning on students' concept understanding. Hypothesis testing was carried out through the F test to determine the simultaneous influence of the free variable on the bound variable with a significance level of 5%. The instrument is declared significant if the significance value is less than 0.05.

RESULT AND DISCUSSION

Descriptive Statistical Analysis

Descriptive statistical analysis was used to provide an overview of the condition of each research variable.

Table 1: Frequency Distribution of Learning Styles

Score Interval	Category	Frequency	Percentage (%)
10–18	Very Low	0	0,0
19–26	Low	1	3,2
27–34	Currently	7	22,6
35–42	High	18	58,1
43–50	Very High	5	16,1
Total		**31**	**100,0**

Based on Table 1, the majority of respondents (18 students) fell into the high category, followed by 7 students (22.6%) in the moderate category, and 5 students (16.1%) in the very high category. Only 1 student (3.2%) fell into the low category. These findings indicate that the majority of students possess learning style characteristics that support the learning process.

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Table 2. Frequency Distribution of E-Learning Use

Score Interval	Category	Frequency	Percentage (%)
10–18	Very Low	0	0,0
19–26	Low	2	6,5
27–34	Currently	10	32,3
35–42	High	15	48,4
43–50	Very High	4	12,8
Total		**31**	**100,0**

Based on Table 2, the majority of respondents (15 students) fell into the high category. Furthermore, 10 students (32.3%) fell into the moderate category, and 4 students (12.8%) fell into the very high category. These findings indicate that the majority of students have optimally utilized e-learning to support their learning activities.

Table 3. Frequency Distribution of Concept Understanding

Score Interval	Category	Frequency	Percentage (%)
10–18	Very Low	0	0,0
19–26	Low	1	3,2
27–34	Currently	8	25,8
35–42	High	17	54,8
43–50	Very High	5	16,2
Total		**31**	**100,0**

Based on Table 3, the majority of students are in the high category (17 students (54.8%), while the very high category is 5 students (16.2%). Eight students (25.8%) are in the moderate category, and only one student (3.2%) is in the low category. These results indicate that the level of conceptual understanding of class XI students at SMKN 8 Makassar is in the high category.

Classical Assumption Test

1. Linearity Test

The linearity test is conducted to determine whether the relationship between the independent and dependent variables is linear.

Table 4. Linearity Test Results

Variable Relationships	Sig. Deviation from Linearity	Information
X_1 -> Y	0,183	Linear
X_2 -> Y	0,666	Linear

The significance value for the relationship between learning styles and conceptual understanding is 0.183. This value is greater than 0.05, indicating a linear relationship between the two variables.

The significance value for the relationship between e-learning use and conceptual understanding is 0.666. This value is also greater than 0.05, indicating a linear relationship between the two variables.

Therefore, all variables meet the linearity assumption and can be further analyzed in regression analysis.

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2. Normality Test

Normality tests were conducted using the Kolmogorov-Smirnov method.

Table 4. Normality Test Results

Variabel	Asymp. Sig.
X_1 with Y	0,200
X_2 with Y	0,200

The test results yielded a significance value of 0.200. This value is greater than 0.05, indicating that the research data is normally distributed. This result indicates that the data meets one of the important assumptions in multiple linear regression analysis.

3. Multicollinearity Test

A multicollinearity test was conducted to determine if there was an excessively strong relationship between the independent variables.

Table 5. Multicollinearity Test Results

Variables	VIF
Learning Style (X_1)	1,473
Use of E-Learning (X_2)	1,473

The Variance Inflation Factor (VIF) value of 1.473 indicates that the value is far below the maximum limit of 10. Therefore, it can be concluded that there are no symptoms of multicollinearity in the research model..

4. Correlation Analysis

Pearson correlation analysis was conducted to determine the strength of the relationship between the research variables.

Table 6. Correlation Test Results

Variable Corralation	Correlation Coefficient (r)	Interpretation
X_1 with Y	0,605	Strong
X_2 with Y	0,622	Strong
X_1 with X_2	0,567	Medium

The analysis results show that learning styles have a strong positive relationship with conceptual understanding, at 0.605. This means that the better a student's learning style, the stronger their conceptual understanding.

E-learning use has a strong positive relationship with conceptual understanding, at 0.622. This indicates that increased e-learning utilization is followed by increased student conceptual understanding.

The relationship between learning styles and e-learning use, at 0.567, indicates a positive relationship with a moderate level of strength..

5. Multiple Linear Regression Analysis

Multiple linear regression analysis was conducted to determine the simultaneous effect of learning styles and e-learning usage on students' conceptual understanding.

Table 7. Regression Analysis Results

Indicator	Value
R	0,693
R Square	0,481
Sig. F	<0,001

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The analysis yielded a multiple correlation coefficient (R) of 0.693. This value indicates a strong relationship between learning styles and e-learning usage and conceptual understanding.

A significance value of <0.001 indicates that the regression model used is significant at the 95% confidence level. Therefore, the research hypothesis is accepted, namely that there is a significant influence between learning styles and e-learning usage on students' conceptual understanding.

The coefficient of determination (R^2) of 0.481 indicates that 48.1% of the variation in students' conceptual understanding can be explained by learning styles and e-learning usage. Meanwhile, 51.9% is influenced by other factors not examined in this study, such as learning motivation, learning interest, family environment, learning facilities, and teacher competence.

The results indicate that learning styles have a strong relationship with students' conceptual understanding. This finding indicates that students' learning characteristics play a crucial role in determining their success in understanding learning materials. Students who learn according to their learning style tendencies will more easily receive, process, and connect new information with prior knowledge.

The research findings also indicate that the use of e-learning has a strong relationship with students' conceptual understanding. These results demonstrate that the use of digital technology for learning can support improved learning quality. Through e-learning, students can access learning materials anytime and anywhere, making the learning process more flexible.

The availability of learning videos, digital teaching materials, discussion forums, and online quizzes allows students to have a more diverse learning experience. This helps them understand the material more deeply than relying solely on conventional classroom learning.

Regression analysis shows that learning style and the use of e-learning simultaneously contributed 48.1% to students' conceptual understanding. These results indicate that both variables are important factors in improving learning quality. These findings also demonstrate that the success of digital learning is determined not only by technological sophistication but also by students' ability to utilize technology according to their learning characteristics.

However, 51.9% of the variation in conceptual understanding is still explained by factors other than the research model. These factors can include learning motivation, learning discipline, family environment, school support, teacher competence, and students' digital literacy levels. Therefore, improving conceptual understanding requires a more comprehensive approach that incorporates various learning factors.

The results of this study imply that teachers need to develop learning strategies that consider students' learning style characteristics while optimally utilizing learning technology. Integrating appropriate pedagogical approaches with effective e-learning utilization can improve the quality of learning and strengthen students' conceptual understanding on an ongoing basis.

CONCLUSION

Based on the research findings on the influence of learning styles and e-learning usage on the conceptual understanding of eleventh-grade students at SMKN 8 Makassar, it can be concluded that students' learning styles are in the high category. Descriptive analysis results indicate that most respondents exhibit positive learning style characteristics that

support the learning process. This indicates that students are able to utilize learning methods appropriate to their characteristics and learning needs.

E-learning utilization is in the high category. Most students have optimally utilized the e-learning platform as a learning tool. The use of e-learning makes it easier for students to access learning materials, complete assignments, and interact during the learning process.

Students' conceptual understanding is in the high category. The majority of students demonstrate good abilities in understanding, explaining, and connecting the concepts they learn. This indicates that the learning process has supported the achievement of good conceptual understanding.

Learning styles have a positive and significant relationship with students' conceptual understanding. The correlation analysis results show a correlation coefficient of 0.605, which is considered strong. This finding indicates that the better a student's learning style, the higher their level of conceptual understanding.

The use of e-learning has a positive and significant relationship with students' conceptual understanding. The correlation analysis showed a correlation coefficient of 0.622, which is considered strong. This indicates that the more optimal the use of e-learning, the better the students' conceptual understanding.

Learning style and e-learning use simultaneously had a significant effect on students' conceptual understanding. The results of the multiple linear regression analysis showed a multiple correlation coefficient (R) of 0.693, with a coefficient of determination (R^2) of 0.481. These findings indicate that 48.1% of the variation in students' conceptual understanding can be explained by learning style and e-learning use, while the remaining 51.9% is influenced by other factors not examined in this study.

Overall, this study indicates that learning style and e-learning use are important factors contributing to improved student conceptual understanding. Therefore, teachers need to develop learning strategies that take into account students' learning style characteristics and optimize the use of e-learning to create a more effective and meaningful learning process.

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