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The Effectiveness of Game-Based Learning in Improving Javanese Language Understanding: A Comparative Study of Visual Semantic Memory and Verbal Recognition Memory Methods

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KEY WORDS

Game-Based Learning, Visual Semantic Memory, Verbal Recognition Memory, Javanese Language

ABSTRACT

This study aims to explores the effectiveness of Game-Based Learning (GBL) in improving Javanese language understanding among students. Using the Visual Semantic Memory (VSM) and Verbal Recognition Memory (VRM) methods, this study analyzed the comparison of students' comprehension before and after the GBL intervention. The results showed that there was a significant difference in Javanese language understanding after the intervention in the Visual Semantic Memory (VSM) method, with a prob>z value of 0.0170, which showed that the Game-Based Learning Visual Semantic Memory method can be an effective alternative to traditional learning methods. However, there was no significant difference in Javanese language understanding after the intervention in the Verbal Recognition Memory (VRM) method, with a prob>z value of 0.6260 which indicates that the Verbal Recognition Memory method, which focuses on verbal recognition, is considered less effective in improving Javanese language comprehension. This study recommends the use of a Game-Based Learning approach that integrates visual elements (Visual Semantic Memory) to increase motivation and effectiveness in learning regional languages, as well as provide insights for educators and curriculum developers in designing a more immersive learning experience.

1. Introduction

Education is one of the important aspects in human resource development. Understanding language is one of the keys to communicating and understanding culture. As one of Indonesia's regional languages, Javanese has a rich culture and history that needs to be preserved and learned by the younger generation. However, learning Javanese often faces challenges, such as a lack of student interest and less interesting teaching methods. In today's digital era, technology has opened up new opportunities in the world of education, one of which is through the Game-Based Learning (GBL) approach. GBL integrates game elements into the learning process, so that it can create a more interactive and enjoyable learning experience. This approach not only increases student motivation, but can also help them understand the material better. According to Köse & Güner-Yildiz (2021) various supporting factors are needed in

developing educational materials. With the advancement of technology and easy internet access, the distribution of educational-themed applications or games has become more focused. In addition, smartphones, which are now one of the main needs, can also function as a medium that facilitates the distribution of educational materials. This not only makes education more affordable, but also provides a more interactive and interesting way for users, especially the younger generation. With the support of these factors, technology-based education can be spread more quickly and accessed by anyone, anytime.

In recent years, there has been a worrying phenomenon related to the decline in understanding of Javanese among the younger generation. This can be seen from the decreasing number of students who are able to speak, read, and write Javanese well. According to Bram (2023) and Pramesti and Wiranti (2023) with increasing access to global media and foreign cultures, many young people are more interested in foreign languages and cultures, such as English and western pop culture. This has led to neglect of regional languages, including Javanese. In addition, the Javanese language teaching method which is still conventional and less interactive makes students feel bored and unmotivated to learn. The lack of use of technology in learning is also one of the causes. Rossano et al. (2020) explained that the burden in learning can affect student comfort during the learning process. Various forms of fun learning, such as educational games through outbound activities, visits to museums, or other activities, can help create a more interesting learning atmosphere. In addition, the application of Game-Based Learning (GBL) is also an effective approach. In GBL, students can learn through games that contain subject matter, making them more involved and motivated. According to (Gee, 2003) games are not only fun, but they can also improve students' understanding and skills in a more interactive and entertaining way. This approach shows that fun learning can encourage students to be more active and interested in following lessons.

This study aims to explore the effectiveness of GBL in improving Javanese language comprehension among students. Using the Visual Semantic Memory (VSM) and Verbal Recognition Memory (VRM) methods, this study will analyze the comparison of students' comprehension before and after GBL intervention. Through this approach, it is expected that students can learn Javanese in a more in-depth and meaningful way, and can associate the meaning of words or phrases with concrete visual representations. Thus, this study is expected to contribute to the development of more effective and interesting language learning methods, as well as provide new insights into the application of technology in regional language education.

2. Literature Review

Game Based Learning (GBL)

Game-based learning (GBL) has become an increasingly popular approach in education, especially in the context of technology-based learning. According to Cheng and Su (2012) GBL combines game elements with educational content to create an interactive and engaging learning environment. Previous research has shown that GBL can increase student motivation and engagement, which in turn can improve learning outcomes (Gee, 2003). Research result Cheng and Su (2012) showed that students who used GBL had better learning outcomes compared to those who followed traditional learning. This provides important insights for educators and curriculum developers. With the increasing accessibility of technology and the need to attract the attention of the younger generation, GBL can be an effective alternative to traditional learning methods. This is in line with the findings de Felix and Johnson (1993) which states that video games can be an effective tool for learning, as well as research by Huang et al. (2010) which shows the effectiveness of mobile-based learning systems in education.

Visual Semantic Memory (VSM)

Visual Semantic Memory (VSM), or visual semantic memory, plays a vital role in building the

conceptual knowledge base needed to understand and communicate in a language. This approach focuses on how certain objects are represented and associated with other images or visuals, creating deep semantic relationships. According to Varela-Aldás et al. (2022), various factors can affect the effectiveness of visual semantic recognition, such as age, gender, health conditions, user experience, and the type of media used. These findings suggest that each individual has a unique experience in processing and recognizing semantic relationships based on their various contexts and personal attributes.

The development of VSM to improve cognitive abilities in understanding patterns, relationships, and meanings of language, especially through a visual-based approach is very relevant for technology-based learning such as game-based learning. In game-based learning, visuals are used as the main media to convey information (Lu et al., 2022). Visual factors in a game can be an element that attracts players' attention. Although visual influences in action games do not affect short-term visual memory capacity, when players play action games, they experience an increase in the speed of processing visual information. This suggests that visual influences in games can affect users' memory behavior Wilms et al. (2013) to strengthen the semantic relationship between visuals and language, students can be asked to connect images with appropriate words or phrases in language learning applications. In addition, the age and experience of the user are very influential because the ability to understand semantic relationships tends to develop with time and experience, but may be lower for certain groups, such as the elderly or people with cognitive impairments (Kumar, 2021).

Verbal Recognition Memory (VRM)

Verbal Recognition Memory (VRM) is a concept that focuses on semantic memory related to words and spoken language. In this context, participants are given verbal stimuli, such as questions, definitions, or lists of words, to test their ability to recognize previously presented information. According to Yee et al. (2018) this method involves testing memory by asking respondents to identify whether they have seen or heard certain information before. VRM plays an important role in measuring a person's ability to store and access verbal information, which is very relevant in language-based learning. In its application, VRM is often used in tasks such as vocabulary recognition exercises, word repetition tests, or evaluating understanding of concepts explained verbally. This test not only assesses how well a person remembers verbal information, but also how they relate that information to previous experiences or contexts (Baruzzo et al., 2023). VRM can be used in education to create better learning strategies, such as quizzes, repetition of important words, and interactive Q&A sessions. The age, concentration level, and learning experience of the participants are some other factors that affect VRM. Educators can improve students' verbal memory retention and recognition by providing reinforcement through relevant and challenging verbal stimuli by knowing how VRM works.

Augmented Reality (AR)

Augmented Reality (AR) is a new technology that can combine digitally generated three-dimensional representations with real environmental stimuli. Inits use, AR can leverage smartphones, tablets, or other devices to create highly engaging learning environments and provide immersive learning experiences in real time (Dhar et al., 2021). In the context of language, AR can be used to present practical language learning by displaying virtual objects related to vocabulary, thereby enriching students' understanding and communication skills.

Based on the background and theoretical studies described, the following hypothesis can be formulated:

H1 : There is a difference in understanding Javanese before and after game-based learning with the Visual Semantic Memory method.

H2 : There is a difference in understanding Javanese before and after game-based learning with the Verbal Recognition Memory method.

3. Methods

The focus of this study is to analyze the comparative results of the application of game-based learning using the Visual Semantic Memory approach to measure Javanese language memory by concentrating on visual elements, as well as Verbal Recognition Memory to direct users in remembering vocabulary and choosing relationships or associations with other words. The main objective of the study is to measure the effectiveness of both methods by assessing the comparison of user answer results between before and after the game-based learning intervention. The design of this research model applies Game-Based Learning as a method of learning Javanese. Unity as a game engine is the main choice for incorporating game elements into learning. The main features in Game-Based Learning include AR Knowledge, VSM Test, and VRM Test. There are three levels of difficulty that will be designed in the game-based learning application, namely Javanese at Ngoko, Krama Madya, and Krama Inggil levels.

After the proposed VSM and VRM approach methods are successfully implemented in the Game-Based Learning application, an experiment will be conducted on users. The experiment with users begins with a pre-test activity to measure the level of understanding of Javanese language possessed by users before the game-based learning intervention. After the game-based learning intervention is carried out, a post-test activity is given to re-measure the level of understanding of Javanese language possessed by users. Experimental analysis of users will be carried out as the final step in order to determine the level of success of understanding Javanese language using the game-based learning application based on the Visual Semantic Memory (VSM) and Verbal Recognition Memory (VRM) methods.

The data analysis technique used includes a normality test using the Shapiro-Wilk test with the data testing criteria stated as normally distributed if sig. (p-value) > 0.05 (Kadir, 2018). After the normality test is carried out, if the data is normally distributed, a comparative analysis (difference test) will be carried out before and after the intervention using the Paired Sample T-test, while if the data is not normally distributed, a comparative analysis (difference test) will be carried out using the Wilcoxon Signed Test as an alternative to the Paired Sample T-test. If the sig. (p-value) > 0.05 then H0 is accepted or Ha is rejected (there is no significant difference), while if the sig. (p-value) < 0.05 then H0 is rejected or Ha is accepted (there is a significant difference) (Ghozali, 2018).

4. Discussion and Analysis

The respondents in this study were 40 students of Madrasah Ibtidaiyah Muhammadiyah Kota Madiun. The data collection process was carried out for 30 to 45 minutes, which included technical explanations and briefings before the test began. The data collection process in this study consisted of four testing sessions, namely two sessions for the Visual Semantic Memory (VSM) method and two sessions for Verbal Recognition Memory (VRM). The selection of Madrasah Ibtidaiyah Muhammadiyah Kota Madiun as the research location was based on the uniqueness of the school's curriculum, which requires students to learn three main languages in daily learning, namely Indonesian, English, and Arabic. The researcher wanted to explore the comparison of students' understanding in learning Javanese before and after the game-based learning intervention through the visual and verbal approaches applied in the VSM and VRM tests. Before the comparative analysis was carried out, a normality test was carried out to determine the normality of the research data.

Normality Test Results

The normality test is used to test whether the residuals in the regression model are normally distributed. In this study, the normality test was carried out using the Shapiro-Wilk test.

```
. swilk Pre_test_Visual Post_test_Visual Pre_test_Verbal Post_test_Verbal

                Shapiro-Wilk W test for normal data

    Variable |        Obs        W         V         z       Prob>z
-------------+-------------------------------------------------------
Pre_test~ual |         22    0.91953     2.038     1.444     0.07435
Post_tes~ual |         22    0.96907     0.783    -0.495     0.68961
Pre_test~bal |         18    0.94848     1.132     0.249     0.40171
Post_tes~bal |         18    0.98355     0.362    -2.036     0.97915
```

Figure 1 Normality Test

Based on the results of the normality test using the Shapiro-Wilk test, the prob>z values for all variables were 0.074, 0.689, 0.401 and 0.979. These results mean that the prob>z values for all variables are more than 0.05. Thus, the research data are normally distributed. Because the data are normally distributed, the comparative analysis was carried out using the Paired Sample T-test.

Paired Sample T-Test Difference Test Results

The difference test is conducted to analyze the comparison (difference test) on related samples (before and after intervention). In this study, the difference test was conducted using the Paired Sample T-test.

```
. ttest Pre_test_Visual =  Post_test_Visual

Paired t test

Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
Pre_~ual |      22    .5795455    .042374    .1987515    .491424    .6676669
Post~ual |      22    .6704545    .0363603   .1705447    .5948393   .7460698
---------+--------------------------------------------------------------------
    diff |      22   -.0909091    .0350689   .1644879   -.163839   -.0179792

    mean(diff) = mean(Pre_test_Visual - Post_test_Visual)        t =  -2.5923
Ho: mean(diff) = 0                                     degrees of freedom =       21

 Ha: mean(diff) < 0           Ha: mean(diff) != 0           Ha: mean(diff) > 0
 Pr(T < t) = 0.0085         Pr(|T| > |t|) = 0.0170          Pr(T > t) = 0.9915
```

Figure 2 Paired Sample T-test
(Visual Semantic Memory)

Based on the results of the paired sample T-test on the results of understanding through the Visual Semantic Memory method, the prob>z value was obtained at 0.0170, less than 0.05. These results mean that there is a significant difference between understanding Javanese before and after the game-based learning intervention.

```
. ttest Pre_test_Verbal = Post_test_Verbal

Paired t test

Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
Pre_~bal |      18    .6805556    .03231     .1370797    .6123874   .7487237
Post~bal |      18    .6597222    .0493064   .2091894    .5556948   .7637497
---------+--------------------------------------------------------------------
    diff |      18    .0208333    .0419719   .1780718   -.0677197   .1093863

    mean(diff) = mean(Pre_test_Verbal - Post_test_Verbal)        t =   0.4964
Ho: mean(diff) = 0                                     degrees of freedom =       17

 Ha: mean(diff) < 0           Ha: mean(diff) != 0           Ha: mean(diff) > 0
 Pr(T < t) = 0.6870         Pr(|T| > |t|) = 0.6260          Pr(T > t) = 0.3130
```

Figure 3 Paired Sample T-test
(Verbal Recognition Memory)

Based on the results of the paired sample T-test on the results of understanding through the Verbal Recognition Memory method, the prob>z value was obtained at 0.6260 more than 0.05. These results mean that there is no significant difference between understanding of Javanese before and after the game-based learning intervention.

Discussion

Understanding of Javanese Language Before and After Game-Based Learning Intervention Based on Visual Semantic Memory

Understanding Javanese through game-based learning using the Visual Semantic Memory approach provides uniqueness in the way students process information. This method integrates visual elements with semantic memory, where relevant images, symbols, or illustrations are used to strengthen understanding of words or concepts in Javanese. In this way, participants can associate the meaning of words or phrases with concrete visual representations, making it easier to remember and understand. Game-based learning designed with Visual Semantic Memory also provides a more interesting and immersive learning experience, because participants not only learn the language verbally, but also through visual and contextual interactions.

The results of this study indicate that there is a significant difference in understanding Javanese before and after the implementation of game-based learning with the Visual Semantic Memory method. This indicates that the Visual Semantic Memory

method has significant effectiveness in improving understanding of Javanese. The results of this study support the research of Keighrey et al. (2021) which shows that there are differences in each research media with the visual semantic method. Visual Semantic Memory approach that combines visual elements and semantic relationships for memory has succeeded in helping students learn in a more in-depth and meaningful way. The use of the Game-based Learning learning model has proven to be more effective in improving material understanding and learning outcomes (Maharani et al., 2024).

Understanding of Javanese Language Before and After Game-Based Learning Intervention Based on Verbal Recognition Memory

The potential for developing game-based learning with Verbal Recognition Memory in Javanese language learning is very large. With the advancement of technology, games can be designed to be more interactive and interesting. In addition, learning data obtained from the game can be used to analyze the strengths and weaknesses of participants, so that learning can be tailored to individual needs. Verbal stimulus, such as questions, definitions, or words, are given to a person while working on an assignment or exam that requires the recognition of verbal memory (Yee et al., 2018).

The results of this study indicate that there is no significant difference in Javanese language understanding before and after the implementation of game-based learning with the Verbal Recognition Memory method. This indicates that the Verbal Recognition Memory method which focuses on verbal recognition, is considered less effective in improving Javanese language understanding. Learning that uses the verbal presentation method is less successful to be able to increase the retention of learning outcomes. Learning using the verbal presentation method receives very little student attention and participation in learning is low so that students will turn their attention to other objects (Noya, 2020). In the context of this study, there is no difference in understanding before and after the Game-Based Learning intervention based on Verbal Recognition Memory can occur because the approach does not support the learning needs of students in understanding Javanese material in depth.

4. Conclusion

This study shows that the implementation of Game-Based Learning (GBL) with the Visual Semantic Memory (VSM) approach has significant effectiveness in improving Javanese language comprehension among students. The results of the analysis showed a significant difference in Javanese language comprehension before and after the GBL intervention using the VSM method. In contrast, the Verbal Recognition Memory (VRM) method did not show a significant difference, indicating that this approach is less effective in improving Javanese language comprehension through Game-Based Learning. This highlights the importance of the relevance of the methods used in supporting students' learning needs through Game-Based Learning.

Based on the research findings, it is suggested that educators and curriculum developers can consider using the Game Based Learning approach that integrates visual elements for language learning. The development of more interactive and interesting games, as well as adjusting the material to the needs of students, can increase the effectiveness of learning. In addition, further research can be conducted to explore other combinations of methods that can support Javanese language learning more optimally.

The implications of the results of this study indicate that Game Based Learning can be an effective alternative to traditional learning methods, especially in the context of regional language learning. With the increasing accessibility of technology, Game Based Learning can attract the attention of the younger generation and increase their motivation to learn. In addition, the Visual Semantic Memory approach that emphasizes visualization can help students understand and remember vocabulary and language concepts better. This study also provides insights for educators and curriculum developers to design more

immersive, contextual learning experiences that can contribute to the preservation of regional languages and cultures.

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