THE CONSTRUCTION OF STUDENTS' LEARNING MOTIVATION THROUGH AUGMENTED REALITY: A CONSTRUCTIVIST PERSPECTIVE OF JEAN PIAGET IN FIFTH GRADE AT SDN SIDOKERTO 1

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ABSTRACT

This study investigates the construction of students' learning motivation through the use of Augmented Reality (AR) within the framework of Jean Piaget's constructivist theory in a fifth-grade classroom at SDN Sidokerto 1. The research addresses the limited student engagement and low motivation commonly found in teacher-centered instructional practices, particularly in science learning involving abstract concepts such as food chains. A mixed methods approach with a sequential explanatory design was employed, combining quantitative analysis of pre-test and post-test motivation scores with qualitative interpretation of students' learning behaviors. The quantitative data were obtained from 20 students using a validated Likert-scale questionnaire, and analyzed using descriptive statistics, Shapiro–Wilk normality test, and paired sample t-test. The results revealed a significant increase in the mean motivation score from 61.68 (pre-test) to 80.15 (post-test), with a gain of 18.47 points. The t-test indicated a statistically significant difference ($p < 0.05$), and the effect size analysis showed that AR contributed 29% to the improvement of learning motivation, categorized as a moderate effect. Qualitative findings supported these results, indicating increased student engagement, curiosity, and participation during AR-based learning. From a constructivist perspective, the improvement in motivation is explained through the processes of assimilation and accommodation, facilitated by interactive and concrete learning experiences provided by AR. The findings suggest that AR is not merely a technological tool, but a pedagogical medium that supports cognitive construction and enhances intrinsic motivation. Therefore, the integration of AR, aligned with students' cognitive development, can create meaningful and engaging learning experiences that significantly improve students' learning motivation.

Keywords: *Augmented Reality, learning motivation, constructivism, Piaget, primary education*.

A. Pendahuluan

Students' learning motivation remains a central issue in primary education, particularly in the context of science-related subjects that require both conceptual understanding and active engagement. Motivation is not merely a supporting variable but functions as a driving force that determines students' persistence, attention, and willingness to engage in learning activities (Schunk et al., 2014). Empirical studies have consistently shown that students with higher motivation demonstrate better academic performance, stronger engagement, and greater conceptual retention compared to those with lower motivation (Pintrich, 2003; Ryan & Deci, 2020).

However, classroom practices in many primary schools still rely heavily on teacher-centered instruction, where students passively receive information. Such instructional patterns often limit opportunities for active knowledge construction, leading to decreased motivation and superficial understanding of concepts (Slavin, 2018). This condition is particularly evident in science learning, where abstract concepts—such as food chains—require visualization and concrete representation to be meaningfully understood by learners at the elementary level (Mayer, 2014).

From a theoretical standpoint, the issue of low motivation can be examined through the lens of constructivist learning theory. Jean Piaget posits that knowledge is actively constructed by learners through interactions with their environment, rather than transmitted directly from teacher to student (Piaget, 1972). Learning occurs through processes of assimilation and accommodation, which are triggered when learners encounter cognitive conflict or new experiences. Therefore, instructional strategies that provide rich, interactive, and meaningful experiences are essential to stimulate both cognitive development and learning motivation.

In line with this perspective, the integration of digital technology in education has been increasingly explored as a means to enhance student engagement and motivation. One emerging technology is Augmented Reality (AR), which overlays virtual objects onto the real world in real time, allowing users to interact with three-dimensional representations (Azuma, 1997). AR has been recognized for its potential to create immersive and interactive learning environments that bridge the gap between abstract concepts and concrete experiences (Billinghurst & Duenser, 2012).

Recent studies indicate that AR can significantly improve students' motivation and learning outcomes. For instance, research by Ibáñez and Delgado-Kloos (2018) found that AR-based learning environments enhance students' engagement and conceptual understanding in science education. Similarly, Garzón et al. (2020) reported that AR applications contribute positively to students' motivation, particularly through increased attention and curiosity. These findings suggest that AR is not merely a technological novelty but a pedagogical tool that supports active learning processes.

Despite its potential, the application of AR in primary education, especially within the Indonesian context, remains limited. Moreover, previous studies tend to focus on learning outcomes rather than examining how AR contributes to the construction of learning motivation from a theoretical perspective. There is still a lack of research that explicitly connects AR implementation with Piagetian constructivist theory, particularly in explaining how motivation is formed through cognitive processes such as assimilation and accommodation.

This study addresses this gap by investigating the construction of students' learning motivation through the use of Augmented Reality, analyzed from a Piagetian constructivist perspective. Unlike purely descriptive or experimental studies, this research not only examines the effect of AR on motivation quantitatively but also interprets how such effects reflect underlying cognitive processes in learners.

The research is conducted in a fifth-grade classroom at SDN Sidokerto 1, where students are at the concrete operational stage of cognitive development. At this stage, learners benefit significantly from visual and interactive learning media that allow them to manipulate and explore objects directly (Piaget, 1972; Slavin, 2018). Therefore, AR is expected to provide an appropriate learning environment that aligns with students' developmental characteristics.

Based on the background described above, the research question of this study is: How does Augmented Reality contribute to the construction of students' learning motivation from a Piagetian constructivist perspective in fifth-grade primary education?

B. Metode Penelitian

This study employed a mixed methods approach, specifically a sequential explanatory design, in which quantitative data analysis was followed by qualitative interpretation. This approach was selected to provide a more comprehensive understanding of the effect of Augmented Reality (AR) on students' learning motivation, as well as to interpret the findings through a constructivist perspective. Mixed methods research enables the integration of numerical data and contextual interpretation, thereby producing a more complete analysis of educational phenomena (Creswell & Plano Clark, 2018).

In the first phase, the study utilized a quantitative approach to examine changes in students' learning motivation before and after the implementation of AR-based learning. The data analyzed in this phase were secondary data, obtained from documented results of classroom-based learning activities. Secondary data analysis allows researchers to re-examine existing datasets to generate new insights or theoretical interpretations without collecting new primary data (Johnston, 2017). The dataset consisted of pre-test and post-test motivation scores from 20 fifth-grade students at SDN Sidokerto 1 Jombang.

The instrument used in the original data collection was a Likert-scale questionnaire designed to measure students' learning motivation. The instrument initially consisted of 18 items, of which 15 items were declared valid based on Pearson product-moment correlation testing. The reliability test using Cronbach's Alpha yielded a value of 0.770, indicating that the instrument had acceptable internal consistency and could be used to produce stable measurements (Taber, 2018).

Quantitative data were analyzed using descriptive and inferential statistics. Descriptive analysis was conducted to determine the mean scores of students' motivation in both pre-test and post-test conditions. To ensure the appropriateness of parametric testing, a normality test using the Shapiro–Wilk method was performed. The results indicated that the data were normally distributed ($p > 0.05$), thus meeting the assumptions required for further statistical analysis (Ghasemi & Zahediasl, 2012). Subsequently, a paired sample t-test was employed to examine whether there was a statistically significant difference between the two sets of scores. This test is commonly used to compare means from the same group under different conditions (Field, 2013). In addition, an effect size analysis was conducted to determine the magnitude of the influence of AR on students' learning motivation.

Following the quantitative phase, the study proceeded to the qualitative phase, which aimed to interpret the statistical findings. The qualitative data were derived from observational descriptions of students' learning behaviors during the implementation of AR-based instruction. Observation is considered an essential technique in educational research to capture behavioral changes and learning engagement in natural settings (Merriam & Tisdell, 2016). The analysis of qualitative data involved data reduction, data display, and conclusion drawing, following the framework proposed by Miles, Huberman, and Saldaña (2014).

The integration of quantitative and qualitative findings was conducted at the interpretation stage. The statistically significant increase in motivation scores was explained through qualitative evidence, such as increased student participation, curiosity, and engagement during AR-based learning. This integrative analysis is a key characteristic of sequential explanatory design, where qualitative findings are used to explain and deepen the understanding of quantitative results (Creswell & Plano Clark, 2018).

Furthermore, the findings were interpreted using Piaget's constructivist theory, particularly the concepts of assimilation and accommodation. According to Piaget, learning occurs when individuals actively construct knowledge through interaction with their environment, leading to cognitive restructuring (Piaget, 1972). In this study, the use of AR provided interactive and concrete learning experiences that facilitated these cognitive processes, thereby contributing to the construction of students' learning motivation.

C. Hasil Penelitian dan Pembahasan

1. Research Findings

Based on the analysis of questionnaire data on students' learning motivation before and after the implementation of Augmented Reality (AR) media, a statistically significant improvement was identified, both descriptively and inferentially.

From a descriptive perspective, the mean score of students' learning motivation in the pre-test was 61.68, which increased to 80.15 in the post-test. This indicates a gain of 18.47 points. Such an increase reflects a substantial enhancement in students' learning motivation following the instructional intervention utilizing AR media in teaching the food chain topic within the IPAS subject.

In terms of data distribution, the pre-test scores ranged from 50 to 71, whereas the post-test scores ranged from 70 to 90. This shift in score distribution suggests not only an increase in the mean score but also a more uniform improvement in motivation levels across the majority of students.

The normality test, conducted using the Shapiro–Wilk method, revealed that the data were normally distributed, with significance values of 0.352 for the pre-test and 0.458 for the post-test ($p > 0.05$). These results indicate that the data met the assumptions required for parametric statistical testing.

Furthermore, the results of the paired sample t-test showed a significance value (2-tailed) of 0.000 ($p < 0.05$), indicating a statistically significant difference between students' learning motivation before and after the use of AR media. Therefore, the alternative hypothesis (Ha) is accepted.

In addition, the effect size analysis revealed that the use of AR media contributed 29% to the improvement of students' learning motivation, which falls into the moderate effect category. This finding suggests that AR has a meaningful impact on enhancing learning motivation, although other contributing factors remain influential.

2. Discussion

The observed increase in students' learning motivation should not be interpreted merely as a consequence of technological integration; rather, it requires examination through a relevant theoretical framework, particularly Jean Piaget's constructivist theory. From a constructivist perspective, learning is understood as an active process in which individuals construct knowledge through interaction with their environment (Piaget, 1972). In this regard, Augmented Reality (AR) functions as a learning environment that provides concrete and interactive experiences, thereby facilitating the knowledge construction process.

The relatively low mean score of students' learning motivation in the pre-test (61.68) indicates that prior instructional practices had not fully supported active student engagement. This finding aligns with the view that teacher-centered approaches tend to limit student participation and, consequently, reduce learning motivation (Slavin, 2018). In contrast, the implementation of AR resulted in a substantial increase in the post-test mean score (80.15), suggesting that interactive, technology-enhanced learning environments are more effective in fostering student engagement.

This improvement can be explained through the mechanisms of assimilation and accommodation as proposed by Piaget. Assimilation occurs when learners integrate new information into their existing cognitive structures, whereas accommodation takes place when these structures are modified in response to new information that does not align with prior understanding (Piaget, 1972). Within AR-based learning, the visualization of three-dimensional objects, such as food chains, enables students to connect abstract concepts with concrete representations, thereby facilitating the assimilation process.

Conversely, when students encounter information that contradicts their prior knowledge, a state of cognitive disequilibrium arises, prompting the need for accommodation. This process is essential for deeper learning, as it drives cognitive restructuring. Thus, AR serves not only as a visual medium but also as a cognitive stimulus that supports students' intellectual development.

Beyond the cognitive dimension, the enhancement of learning motivation can also be examined through the lens of intrinsic motivation. According to Ryan and Deci (2020), intrinsic motivation emerges when individuals engage in activities perceived as interesting and enjoyable. The interactive, immersive, and visually rich characteristics of AR have been shown to stimulate students' curiosity and attention—key indicators of intrinsic motivation. This is consistent with previous findings indicating that AR-based technologies significantly enhance student engagement and interest in learning (Garzón et al., 2020).

Furthermore, the integration of AR in instructional practices aligns with the principles of multimedia learning, where the combination of text, images, and animations contributes to improved conceptual understanding (Mayer, 2014). Considering that elementary school students are generally in the concrete operational stage, the use of visual media is particularly effective in facilitating the comprehension of abstract concepts. Therefore, the observed increase in learning motivation is also influenced by the alignment between the characteristics of AR media and students' cognitive developmental stage.

The findings also indicate that AR accounts for 29% of the variance in students' learning motivation, which falls within the moderate effect category. This suggests that, while AR makes a meaningful contribution, other factors also play a role, including teacher facilitation, the learning environment, and individual student characteristics. In this context, the teacher functions as a facilitator who ensures that the use of technology remains aligned with instructional objectives (Schunk et al., 2014).

These results corroborate prior studies highlighting the potential of AR to enhance both motivation and learning outcomes (Ibáñez & Delgado-Kloos, 2018). However, the present study contributes a more nuanced explanation by demonstrating that the increase in motivation is mediated by cognitive construction processes, rather than being solely a byproduct of technological use.

In summary, the effectiveness of Augmented Reality in enhancing students' learning motivation lies in its capacity to create meaningful, interactive, and developmentally appropriate learning experiences. The synergy between technological tools, pedagogical approaches, and learning theories constitutes a critical factor in producing instructional practices that are not only engaging but also significantly impactful in fostering students' learning motivation.

D. Kesimpulan

This study demonstrates that the implementation of Augmented Reality (AR) significantly enhances students' learning motivation in primary education. The findings indicate a substantial increase in motivation scores, as reflected in both descriptive and inferential analyses, with a mean improvement of 18.47 points and statistically significant differences between pre-test and post-test results. This confirms that AR is an effective instructional medium for fostering higher levels of student engagement and motivation.

From a theoretical perspective, the improvement in learning motivation can be explained through Piaget's constructivist framework, particularly the processes of assimilation and accommodation. AR facilitates the construction of knowledge by providing concrete, interactive, and meaningful learning experiences that align with students' cognitive development at the concrete operational stage. Consequently, motivation is not merely increased due to the presence of technology, but as a result of active cognitive engagement and meaningful learning experiences.

Furthermore, the findings reveal that AR contributes 29% to the variance in students' learning motivation, indicating a moderate effect. This suggests that while AR plays a significant role, other factors such as teacher facilitation, learning environment, and individual student characteristics also influence motivation. Therefore, the effective integration of AR requires not only technological readiness but also pedagogical alignment and teacher competence.

In conclusion, the effectiveness of Augmented Reality in enhancing learning motivation lies in its ability to integrate technology with constructivist learning principles, creating an engaging, interactive, and developmentally appropriate learning environment. Future research is recommended to explore the long-term impact of AR on other learning outcomes, as well as to examine its implementation across different subjects and educational contexts.

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