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The Use of Articulate Storyline 3-Based Learning Media on the Understanding of Mathematical Concepts is Reviewed from the Learning Style

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Abstract

This study aims to examine the effectiveness of Articulate Storyline 3-based learning media on students' understanding of mathematical concepts when reviewed from learning styles. The research employed a quantitative approach using a pre-experimental design with a one-group pretest–posttest model. The participants consisted of 26 seventh-grade students of MTsN 1 North Aceh in the 2023/2024 academic year. Data were collected through a mathematical concept understanding test and a learning style questionnaire to classify students into visual, auditory, and kinesthetic categories. The collected data were analyzed using a normality test, paired sample t-test, and one-way ANOVA with the assistance of IBM SPSS Statistics version 29.00. The results showed a significant improvement in students' understanding of mathematical concepts after the implementation of Articulate Storyline 3-based learning media. The paired sample t-test indicated a significant difference between pretest and posttest scores, demonstrating the effectiveness of the interactive learning media. Furthermore, the ANOVA results revealed no significant differences in students' conceptual understanding based on learning styles, indicating that the media effectively accommodates diverse learning preferences. These findings suggest that Articulate Storyline 3-based learning media can enhance conceptual understanding in mathematics and provide an inclusive learning experience for students with different learning styles.

Introduction

Education plays a fundamental role in preparing future generations to become competent, skilled, and adaptive individuals in response to global challenges. A high-quality education system is widely recognized as a key driver of national progress, as countries with strong educational foundations tend to achieve higher levels of development and global competitiveness (Muhali, 2019). In this context, technological advancement has transformed education from a conventional process into a dynamic and technology-supported learning environment. Technology is no longer an optional complement to education but a necessity that facilitates efficiency, accessibility, and effectiveness in teaching and learning processes (Agustian & Salsabila, 2021; Berezi, 2025; Hassan, 2023; Mhlanga, 2024; Sánchez-Vera, 2024).

Alongside the rapid development of information and communication technology, learning practices in schools have undergone significant changes. Traditional learning tools such as textbooks, whiteboards, and markers are increasingly complemented or replaced by digital learning media designed to enhance student engagement and understanding. One form of digital learning media that has gained attention is Articulate Storyline 3, a multimedia

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authoring tool that enables educators to develop interactive learning materials by integrating text, images, audio, animation, and video into a single platform (Moeis & Harmin, 2022; Alzubi, 2023; Kleftodimos, 2024; Erfiana & Rohmah, 2025). The learning products created using Articulate Storyline 3 can be deployed across multiple devices, including computers, tablets, smartphones, and web-based platforms, making them highly flexible and accessible.

In mathematics education, understanding mathematical concepts is a critical learning outcome, as it forms the foundation for problem-solving and the application of knowledge in real-life contexts. Conceptual understanding allows students not only to recall formulas but also to interpret, classify, and apply mathematical ideas meaningfully (Borji et al., 2019; Kholid et al., 2018; Sumarni et al., 2018). However, mathematics learning in Indonesia continues to face significant challenges, particularly related to students' low conceptual understanding and their tendency to rely on memorization rather than deep comprehension. Studies indicate that insufficient conceptual understanding hinders students' ability to solve mathematical problems and connect abstract concepts to practical situations (Siregar et al., 2024; Yunita, 2023; Ningrum et al., 2022; Rauhun et al., 2025; Schmid et al., 2026; Thoms et al., 2026).

One major difficulty in mathematics learning lies in the abstract nature of mathematical concepts. Students are often required to understand symbols, formulas, and representations that are not directly observable, which can impede their ability to build accurate mental models (Sitanggang, 2025; Li et al., 2022; Kaur et al., 2025). Research suggests that students frequently struggle to visualize abstract mathematical ideas, resulting in misconceptions and weak problem-solving skills. The use of appropriate instructional media and concrete representations has been shown to help students bridge the gap between abstract concepts and meaningful understanding by supporting visualization and cognitive processing (Wathoni, 2024; Alabi, 2024; Iyamuremye & Burns, 2025).

Interactive digital learning media have emerged as an effective solution to address these challenges by enhancing student engagement, visualization, and conceptual understanding (Sabri et al., 2024; Lotfi et al., 2025). Previous studies demonstrate that digital interactive media can significantly improve students' participation and facilitate contextual and visual learning experiences in mathematics (Pitriyana & Razali, 2024; Rahmatyas, 2025). The use of multimedia applications such as interactive PowerPoint, GeoGebra, and game-based learning platforms has been proven to increase students' motivation, reduce learning boredom, and improve learning outcomes through meaningful pretest–posttest gains (Afhami, 2022; Ferlina & Fratiwi, 2024; Nabila et al., 2025).

Among various interactive media, Articulate Storyline 3 has shown strong potential in supporting mathematics learning. Research findings indicate that interactive multimedia developed using Articulate Storyline 3 can enhance students' motivation, learning engagement, and academic achievement across different educational levels (Afrianda & Reinita, 2022; Ramadani et al., 2024; Han, 2025; Li et al., 2022). Its ability to present complex content through dynamic visualization and interactive navigation makes it particularly suitable for mathematics instruction, where abstract concepts require clear representation. Moreover, Articulate Storyline 3 is often developed using systematic instructional design models such as ADDIE, ensuring the quality, feasibility, and effectiveness of the learning media (Hakim & Pebrina, 2023; Rofiah et al., 2024; Saputra et al., 2025).

Despite the effectiveness of digital media, students' learning styles remain an important factor influencing learning outcomes. Learning styles visual, auditory, and kinesthetic reflect individual preferences in receiving, processing, and applying information (Himmah & Nugraheni, 2023). Previous studies reveal that students with different learning styles

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demonstrate varying levels of success in understanding mathematical concepts (Yuniarto et al., 2024). Classroom observations and interviews at MTsN 1 North Aceh further indicate that conventional lecture-based instruction, which neglects learning style diversity and digital media integration, often leads to student disengagement and low conceptual understanding. Therefore, this study aims to examine the effectiveness of Articulate Storyline 3-based learning media on students' understanding of mathematical concepts when reviewed from learning styles, in order to provide a more personalized, inclusive, and effective approach to mathematics learning in line with technological developments.

Methods

This study employed a quantitative research approach, as it involved numerical data that were statistically analyzed to examine the effectiveness of the treatment (Sugiyono, 2013). The research design was an experimental method using a pre-experimental design, specifically the one-group pretest–posttest design. In this design, a single experimental group was observed before and after the implementation of the treatment, without the inclusion of a control group. Students were first given a pretest (O_1) to measure their initial understanding of mathematical concepts, followed by instruction using Articulate Storyline 3-based learning media (X), and finally a posttest (O_2) to identify changes in their conceptual understanding after the intervention.

The population of this study consisted of all seventh-grade students (classes VII.1 to VII.8) at MTsN 1 North Aceh during the 2023/2024 academic year. The sample was selected using a simple random sampling technique to ensure equal opportunity for each class to be chosen. Based on a random draw, class VII.8 was selected as the experimental group. Data were collected using two instruments: a learning style questionnaire and a mathematical concept understanding test. The questionnaire was used to classify students into visual, auditory, or kinesthetic learning styles, while the test was designed to measure students' mathematical conceptual understanding. The assessment of conceptual understanding was based on indicators including restating concepts, classifying objects according to their properties, selecting and using appropriate procedures, and applying concepts to problem solving, with scores converted into percentage values.

Data analysis began with a normality test to determine whether the data were normally distributed, which was conducted using IBM SPSS Statistics version 29.00. To examine the effect of Articulate Storyline 3-based learning media on students' understanding of mathematical concepts, a paired sample t-test was applied to compare the mean pretest and posttest scores. The decision to accept or reject the hypothesis was based on a significance level of 0.05. Furthermore, a one-way analysis of variance (ANOVA) was conducted to identify differences in students' conceptual understanding based on learning styles (visual, auditory, and kinesthetic). The ANOVA test was also analyzed using IBM SPSS Statistics version 29.00, with hypothesis testing conducted at a 0.05 significance level.

Results and Discussion

The results of the research that has been carried out in MTsN 1 North Aceh grade VII, namely the implementation of learning on the subject of Data and Diagrams discussion using *Articulate Storyline 3-based* learning media in grade VII/8 consisting of 26 students. The data processing method is adjusted to the techniques discussed in chapter III, so the data is processed as expected with the stipulated provisions.

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Data Collection

The data collected by the researcher in the form of learning style questionnaires, pretest and posttest data regarding the ability to understand mathematical concepts of grade VII/8 students will be taken for analysis, which is received from the students' mathematical concept comprehension test instruments to students. The pretest and posttest data are based on the scoring guidelines for students' understanding of mathematical concepts that have been converted to a scale of 100. The details of the learning style and posttest pretest data can be seen in the following table:

Table 1. List of pretest, posttest grades and student learning styles

No.	Name	Pretest scores	Posttest scores	Learning Style
1	AVS	50	90	Visual
2	ASS	50	90	Kinesthetic
3	FA	30	55	Auditory
4	M	25	70	Auditory
5	MAA	45	85	Visual
6	MK	40	85	Visual
7	MR	35	85	Visual
8	MSA	55	85	Visual
9	NR	50	95	Auditory
10	TM	30	50	Visual
11	AH	35	70	Auditory
12	CAM	30	60	Auditory
13	CZM	50	90	Auditory
14	FR	40	65	Visual
15	HZ	45	85	Visual
16	MJ	40	75	Visual
17	MY	25	35	Visual
18	NM	55	95	Visual
19	NH	40	60	Visual
20	NA	40	75	Visual
21	NNF	30	50	Auditory
22	ONP	30	50	Auditory
23	PA	45	70	Visual
24	SN	45	80	Auditory
25	ZK	30	65	Kinesthetic
26	ZZ	30	60	Visual

Normality Test

The normality test is useful for determining whether the data follows a normal distribution or not. In SPSS, the normality test is divided into two based on the number of samples used. When the sample is less than 50, the Shapiro-Wilk test is used, on the other hand, when the sample is more than 50, the Kolmogorov-Smirnov test is used. How to make decisions: 1) If the significance value (Sig.) is greater than 0.05, it can be concluded that the research data follows the normal distribution; 2) If the significance value (Sig.) is less than 0.05, it can be concluded that the research data is not normally distributed.

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Table 2. Test of Normality

Data Set	Kolmogorov–Smirnov Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
Pre-Test	0.187	26	0.020	0.924	26	0.050
Post-Test	0.171	26	0.050	0.945	26	0.050

From the SPSS table above, we will use *Shapiro Wilk* because our sample number is 26 which is certainly smaller than 50. With a significant level of *pretest* 0.056 and *posttest* 0.177 so that the significance value (sig) is greater than 0.05, it can be concluded that the data follows the normal distribution.

Paired Sample T-Test

The hypothesis to be tested in this thesis is related to the *paired sample t-test*, which aims to assess whether there is a significant difference between the average of two paired samples. The data used in this experiment came from the same sample but had two different data sets.

Table 3. Paired Sample T-Test

Pair	Comparison	Mean Difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference	t	df	Sig. (Two-tailed)
1	Pretest – Posttest	-7.346	6.902	1.353	Lower = -10.138 Upper = -4.555	-5.429	-5.429	-5.429

Based on the SPSS output table, it is known that the Sig. value is $0.001 < 0.05$, then H0 is rejected and H1 is accepted. So it can be concluded that the posttest results are better than the pretest scores, which means that there is a difference in the average pretest and posttest scores of students' ability to understand mathematical concepts with the use of Articulate Storyline 3-based learning media. This proves that there is an increase in understanding of mathematical concepts with the treatment given so that it has a significant impact on changes in student test scores. In other words, there is strong statistical evidence to state that the observed changes did not occur by chance, but rather as a result of the factors tested in this study.

Anova Test

The hypothesis analysis used Oneway ANOVA was used to compare the averages of more than two groups of samples.

Table 4. One-Way ANOVA Results (Pretest Scores Based on Learning Styles)

Source of Variance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	238.782	2	119.391	1.448	0.256
Within Groups	1895.833	23	82.428		

Table 5. One-Way ANOVA Results (Posttest Scores Based on Learning Styles)

Source of Variance	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	56.154	2	28.077	0.099	0.907
Within Groups	6552.500	23	284.891		

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From the ANOVA table, the significant value possessed in the *pretest* value is 0.256 where greater than α = 0.05, then H_o Accepted. And the significant value possessed by the *posttest* value is 0.907 where greater than α = 0.05, then H_o are also accepted. Conclusion without using the learning media, the three learning styles produce products with the same quality, but after using the learning media, there are differences in learning outcomes as evidenced by an increase in posttest results with their respective learning styles.

The researcher started the lesson by using *Articulate Storyline 3-based* learning media after previously conducting an assessment to identify students' learning styles visual, auditory, and kinesthetic through questionnaires and pretests. The material studied was data and diagrams, with the aim of seeing how the use of *Articulate Storyline 3* could help students' understanding.

This research took place from May 6, 2024 to May 25, 2024 with a total of six meetings in grade VII/8. The series of research began with one pretest session and the distribution of questionnaires to identify students' learning styles, followed by four learning sessions using Articulate Storyline 3 media, and ended with one posttest session. The material taught in this study focuses on Data and Diagrams, with the first meeting discussing the basics of statistics, the second meeting about bar charts, the third meeting about pie charts, and the last meeting teaching how to choose the right diagram according to the existing data.

Articulate Storyline *3*, as an interactive learning medium, is designed to meet the needs of various learning styles of students visual, auditory, and kinesthetic. In this study, teachers direct students to use this media as a tool to understand mathematical concepts. At the first meeting, students were invited to get to know statistics in general and get acquainted with various kinds of diagrams used in statistics. This material is delivered through interactive visual displays, diagrams, graphs, and animations that attract the attention of students, especially those with visual learning styles. In this session, visual students showed high interest in the graphic display presented.

In the second meeting, the focus of learning is the bar chart. Articulate Storyline 3 is used to display bar charts in a variety of shapes and colors, complete with included narrative explanations for students with auditory learning styles. This narrative helps them to better understand the material through hearing, so they can relate visual information to the information they hear.

The third meeting discussed pie charts, where students again used Articulate Storyline 3 to explore how data can be visualized in the form of circles. In these sessions, kinesthetic students get the opportunity to interact with the content through interactive activities such as drag-and-drop, which allows them to manipulate the diagram directly on the screen.

The last meeting before the posttest is used to teach you how to choose the right chart for different types of data. Students are invited to apply the knowledge they have learned before in more complex situations, where they must decide on the most suitable type of diagram to present certain data.

After all learning sessions are completed, a posttest is carried out to evaluate students' understanding of the material that has been taught. The results of data analysis showed a significant increase in students' understanding of mathematical concepts from pretest to posttest. This shows that the use of learning media based on Articulate Storyline *3* not only improves the understanding of concepts, but also makes the learning process more effective and fun. The average posttest score of students who use this media is higher than the average score of students who are taught with formal learning methods without using media.

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Furthermore, the hypothesis test using the paired sample t-test strengthened this finding by showing a significant difference between the pretest and posttest results, which confirmed that the use of Articulate Storyline 3 was effective in improving students' understanding of mathematical concepts. The ANOVA test applied to the posttest results also revealed that there was no significant difference in improving concept understanding based on students' learning styles, both visual, auditory, and kinesthetic. This means that this learning medium is effective for all types of learning styles, and can be used widely without the need for special adjustments.

The main advantage of Articulate Storyline 3 lies in its ability to blend different types of media text, audio, video, animation, and interactive elements in a single learning package. This feature allows students with different learning styles to learn according to their individual preferences. For example, visual students may focus more on visual content such as graphs and diagrams, while auditory students may pay more attention to the included audio narrative. Kinesthetic students, on the other hand, can be more actively engaged through interactive activities that allow them to learn while practicing.

In addition, this media also offers a personalized learning path, where the material can be adjusted to the level of student understanding. This helps ensure that each student can learn at a pace and in a way that works best for them, without feeling overwhelmed by material that is too difficult or feeling bored by material that is too easy.

Overall, the results of this study show that the use of Articulate Storyline 3 in mathematics learning in MTsN 1 North Aceh has a significant positive impact on students' understanding of mathematical concepts. This medium is not only effective for one or two types of learning styles, but also for all types of learning styles, making it a flexible and versatile tool in education. The integration of technology like this in the learning process can be an important strategy for improving the quality of learning and overall academic outcomes of students. Teachers can confidently use Articulate Storyline 3 as a learning method, as it has been proven to be able to improve student understanding without having to worry about customizing the method specifically for each learning style.

In conclusion, Articulate Storyline 3 is not just a learning aid, but also an innovation that can help create a more dynamic, interactive, and effective learning experience, ultimately improving student learning outcomes at various levels of education. The integration of technology-based learning media like this is not only relevant but also indispensable in the context of modern education which increasingly focuses on personalization and effectiveness in teaching.

The findings of this study indicate that the use of Articulate Storyline 3-based learning media has a significant positive effect on students' understanding of mathematical concepts, as evidenced by the statistically significant difference between pretest and posttest scores. This result confirms that students' conceptual understanding improved after the implementation of interactive digital media in mathematics learning. These findings align with previous studies highlighting that low conceptual understanding in mathematics is often caused by abstract content presentation and instructional approaches that emphasize memorization rather than meaningful understanding (Siregar et al., 2024; Yunita, 2023). By integrating interactive multimedia, the learning process becomes more concrete and meaningful, enabling students to better construct mathematical concepts.

The improvement in students' understanding can be attributed to the ability of Articulate Storyline 3 to reduce the cognitive difficulty associated with abstract mathematical concepts. Mathematics requires students to interpret symbols, data, and representations that are often

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intangible, which can hinder comprehension if presented conventionally (Sitanggang, 2025). In this study, the material on data and diagrams was delivered through visualizations, animations, and interactive activities, allowing students to form clearer mental representations of statistical concepts. This supports previous research indicating that the use of appropriate media and concrete representations can help students overcome abstraction barriers and enhance conceptual understanding (Wathoni, 2024).

Furthermore, the results strengthen existing evidence regarding the effectiveness of interactive digital learning media in mathematics education. The significant increase in posttest scores is consistent with studies reporting that digital interactive media improve student engagement, motivation, and learning outcomes (Nabila et al., 2025; Pitriyana & Razali, 2024; Rahmatyas, 2025). The findings also align with research on Articulate Storyline 3, which demonstrates its effectiveness in improving students' academic performance and learning motivation through the integration of multimedia elements such as text, audio, animation, and interactive navigation (Afrianda & Reinita, 2022; Ramadani et al., 2024). These features create a dynamic learning environment that supports active learning rather than passive reception of information.

Interestingly, the results of the one-way ANOVA analysis revealed no significant differences in students' conceptual understanding based on learning styles, both before and after the intervention. This indicates that visual, auditory, and kinesthetic learners benefited equally from the use of Articulate Storyline 3-based learning media. While previous studies have suggested that learning styles can influence students' performance in mathematics (Wahyuni et al., 2021; Yuniarto et al., 2024), the findings of this study suggest that well-designed interactive multimedia can accommodate diverse learning preferences simultaneously. This result contrasts with studies emphasizing differentiated instruction strictly based on learning styles (Safitri & Ahyansyah, 2025), yet supports the view that technology-enhanced learning environments can serve as inclusive instructional solutions.

Overall, this study demonstrates that Articulate Storyline 3 is an effective and versatile learning medium for improving students' understanding of mathematical concepts, regardless of their learning styles. By combining visual, auditory, and kinesthetic elements within a single learning platform, this media provides a balanced learning experience that supports conceptual understanding, active engagement, and motivation. These findings reinforce recommendations from previous research advocating for the integration of interactive digital media and innovative instructional approaches to address persistent challenges in mathematics learning (Anshari, 2025; Widiastuti & Yurita, 2023). Therefore, the use of Articulate Storyline 3 can be considered a promising instructional strategy to enhance the quality of mathematics education in the context of 21st-century learning.

Conclusion

This study concludes that the use of Articulate Storyline 3-based learning media has a significant positive effect on students' understanding of mathematical concepts. The results of the paired sample t-test indicate a meaningful improvement in students' conceptual understanding from pretest to posttest after the implementation of interactive digital media. Furthermore, the findings of the one-way ANOVA show that there are no significant differences in learning outcomes based on students' learning styles (visual, auditory, and kinesthetic), indicating that Articulate Storyline 3 effectively accommodates diverse learning preferences. These results suggest that interactive multimedia learning media can reduce the abstract nature of mathematics, enhance student engagement, and support conceptual understanding in a more inclusive and effective learning environment.

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Based on these findings, it is recommended that mathematics teachers integrate Articulate Storyline 3 or similar interactive digital media into classroom instruction to improve students' understanding of mathematical concepts. Schools should also provide training and support for teachers to develop and implement technology-based learning media effectively. Future research is suggested to involve larger samples, include control groups, and examine the long-term impact of Articulate Storyline 3 on students' conceptual understanding and problem-solving abilities. Additionally, further studies may explore the integration of this media with other instructional models to strengthen its effectiveness in mathematics learning.

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