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Utilization of Interactive Media Articulate Storyline in Chemical Bonding Learning for Grade X High School

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***Abstract*:** *Educational media can enhance student outcomes and interest in learning about chemical bonds. This study utilized an interactive learning media, Articulate Storyline. This research attempts to: 1) Determine the learning outcomes of students taught using Articulate Storyline and 2) their interest in learning compared to conventional educational media, namely PowerPoint; and 3) identify the correlation between learning outcomes and the interest of students taught with Articulate Storyline. 50 students from classes X-3 and X-9 were selected based on their homogeneity status as the sample. A two-tailed t-test and a correlation coefficient test data analysis. Results: 1) The learning outcomes of students using Articulate Storyline were higher than those using PowerPoint, with scores obtained by students using Articulate Storyline (86.4 ± 4.90) and PowerPoint (81.4 ± 6.54), and a t_{count} (3.059) > t_{table} (1.677). 2) The learning interest of students using Articulate Storyline was higher than that of students using PowerPoint, with scores obtained by students using Articulate Storyline (82.65 ± 2.22) and PowerPoint (79.70 ± 2.85), and a t_{count} (3.94) > t_{table} (1.677). 3) There was a positive correlation between the learning outcomes and interest of students taught with Articulate Storyline, where the calculated r_{count} (0.931) > r_{table} (0.396).*

***Keywords*:** *Interactive Learning Media; Articulate Storyline; Learning Outcomes; Interest in Learning; Chemical Bonds*

INTRODUCTION

The role of education is essential in molding proficient human resources (Mardhiyah *et al*., 2021). One vital component of education is Chemistry learning, which requires a profound understanding of the composition, structure, and energy involved in substance changes. The topic of chemical bonding, especially in the high school curriculum for the tenth grade, is often deemed challenging due to its abstract nature, the need for high-level comprehension, and the lack of direct visualization.

The learning of chemistry involves a combination of theories and calculations that require proficient mathematical skills to solve problems. Chemistry education extensively employs calculations that are inherently intertwined with mathematics, which serves as the fundamental discipline for computations (Silitonga *et al*., 2022).

These challenges are reflected in the low interest in learning, students' lack of engagement, and their difficulties in

understanding the concept of chemical bonding (Mutaqqin *et al*., 2018). Field observations indicate that students often struggle to comprehend the material, as evidenced by low assignment scores and a lack of enthusiasm for learning. In this context, teachers are confronted with the demand to innovate in teaching to enhance both students' outcomes and interest in learning.

An suggested advancement involves incorporating interactive educational tools, such as Articulate Storyline (Mandasari *et al*., 2021). In the digital age, the adoption of Information and Communication Technology (ICT) in education is on the rise, aiming to improve the overall quality of the educational experience (Shalikhah, 2016). Articulate Storyline, as an interactive learning medium, offers significant potential to increase students' interest, comprehension, and learning outcomes (Utomo & Yulianti, 2017).

Articulate Storyline boasts a user-friendly interface akin to PowerPoint, yet it is capable of creating interactive multimedia accessible across various devices. Previous research indicates that the use of Articulate Storyline can enhance students' learning outcomes in chemical bonding topics (Sapitri & Bentri, 2020; Sundari & Silitonga, 2022). Nevertheless, this research concentrates on the utilization of such media within the framework of remote learning, assessing its influence on student outcomes and learning interest at SMA Negeri 2 Medan.

Aligned with prior research discoveries, the objective of this study is to investigate the potential of employing the interactive media Articulate Storyline to improve both learning outcomes and students' interest in the subject of chemical bonding. By adapting this media for application in both face-to-face and distance learning, it is anticipated that this research will provide a valuable contribution to the development of effective and flexible teaching methods.

LITERATURE REVIEW

Learning Media

The integration of technology in education (Rohmah & Bukhori, 2020), empowers teachers to employ instructional media effectively, facilitating the seamless delivery of educational content. This becomes particularly crucial in the context of the ongoing pandemic, where educators are compelled to rely on technology as a medium to ensure the continuity of learning. Strategic selection of appropriate instructional media, (Lubis & Ikhsan, 2015), is identified as a key approach for educators to achieve their learning objectives.

Educational materials, encompassing both tangible and technological components, play a crucial role in the instructional process, as emphasized by several scholars (Adam & Syastra, 2015; Rahma, 2019; Tafonao, 2018). This broad definition includes tools that stimulate learners' minds, feelings, attention, abilities, and interests, contributing to a more effective and meaningful learning experience (Syafrina *et al*., 2016). The multifaceted functions of instructional media, as described by Wina Sanjaya (Aghni, 2018), further underline its significance, serving as a communicative aid, motivator, enhancer of meaningful learning, perceptual aligner, and a tool for individualized learning. Overall, instructional media is pivotal in not only overcoming challenges posed by the pandemic but also in enhancing the quality and efficacy of the teaching and learning process (Octavia *et al*., 2021).

Interactive Learning Media

Interactive learning media is one of several types of media utilized in education. Interactive media is a communication method where the output of the media originates from user input. Interactive media operates through user participation, maintaining the same educational objectives, but user input enhances interaction and introduces engaging features to the system and media display for a more enjoyable experience. Interactive media typically refers to digital products and

services on computer-based systems (Kurniawan & Adistana, 2019). Utilizing multimedia for learning is anticipated to empower students to actively participate in the learning process and autonomously construct their knowledge (Qosyim & Priyonggo, 2017).

Articulate Storyline

The Articulate Storyline application is an interactive multimedia application that can be utilized by teachers or students. Creating content with this application is relatively straightforward as its interface closely resembles PowerPoint. The application allows for customizable publishing according to user needs and is accessible through the internet, supported in HTML5 format, android, flv, and links (Putra & Kurniawan, 2021).

Articulate Storyline boasts several advantages that manifest in more comprehensive and creative presentations. This software offers user-friendly features such as timelines, movies, pictures, characters, and more (Sapitri & Bentri, 2020). The utilization of Articulate Storyline for interactive learning media has been shown to enhance students' learning motivation (Rafmana *et al*., 2018), as well as their understanding of the material and interest in learning (Sari & Harjono, 2021).

Learning Interest

According to Nurhasanah & Sobandi (2016), learning interest is the attitude of dedication to learning activities, encompassing both the planning of study schedules and the initiative to undertake these efforts earnestly. Interest is one of the factors that can influence an individual's efforts. Strong interest will lead to persistent, serious, and resilient efforts in the face of challenges. If a student has a desire to learn, they will quickly comprehend and remember the material. Therefore, interest has a significant impact on learning because if the subject matter does not align with the student's interest, they will not learn as effectively, as there is no attraction for them (Supardi *et al*., 2015).

METHODS

The population under focus in this study includes all students in grade X at SMA Negeri 2 Medan during the first semester of the academic year 2023/2024. Two classes, namely X-3 and X-9, are involved, comprising a total of 72 students. The sampling process was conducted in two stages. In the initial stage, two classes were randomly selected using a random sampling technique. Subsequently, purposive sampling was employed to select approximately 25 students from each class who shared relatively homogeneous status.

This study employs a Pretest-Posttest Control Group Design, categorized as a quasi-experimental or Quasi Experimental Design. The research design involves two groups or classes, namely Experimental Group 1 and Experimental Group 2. The research paradigm structure, as depicted in **Table 1**, follows the Pretest-Posttest Control Group Design model.

Table 1. Research Design

Group	Initial State	Treatment	Final State
Experiment 1	T_1	X	T_3
Experiment 2	T_2	Y	T_4

Explanation:
X : Teaching method utilizing Articulate Storyline media
Y: Teaching method utilizing PowerPoint media
T1: Scores/observations of Experimental Group 1 at the initial stage of the study (pretest)
T2: Scores/observations of Experimental Group 2 at the initial stage of the study (pretest)
T3: Scores/observations of Experimental Group 1 at the final stage of the study (posttest)
T4: Scores/observations of Experimental Group 2 at the final stage of the study (posttest)

(Silitonga, 2011)

The data collection instruments in this study encompass cognitive tests conducted at the beginning and end of the learning process, as well as affective tests administered at the final stage of the learning period. Following the completion of the learning process in each experimental class, data analysis was carried out by calculating the changes in students' learning outcomes (the difference between

post-test and pre-test scores) and determining the average learning interest obtained in each experimental class. Subsequent steps involved conducting prerequisite tests for statistical analysis, particularly tests for normality and homogeneity of data, as well as conducting a comparison test for the mean outcomes and learning interests of students in experimental class 1 and experimental class 2 using the t-test. Additionally, a correlation search between students' learning outcomes and interests was performed (Silitonga, 2014).

RESULT AND DISCUSSION

Learning Outcomes Data

Based on the research findings, learning outcome data were obtained. Prior to the implementation of the treatment, each class first underwent a pretest with the aim of evaluating the students' initial abilities. Subsequently, the learning process was conducted using the respective prepared media. Following that, a posttest was administered at the end of the learning process to assess the students' learning outcomes. Data analysis included the calculation of the average pretest and posttest scores for each experimental class, as presented in **Table 2.**

Table 2 Pretest and Posttest Student Score Data

Data		Group Experiment 1	Experiment 2
Pretest	Minimum Score	10	5
	Maximum Score	45	40
	Average	29.4	24.6
Posttest	Minimum Score	75	65
	Maximum Score	95	95
	Average	86,4	81,4

Through a comparison test of the average pretest scores between the two sample groups, a thit value of 1.891 was found, while the t-table value was 2.011. The analysis results indicate that t-count < t-table, thus accepting the null hypothesis (Ho). This means that there is no significant difference in pretest scores between the two experimental classes. This conclusion suggests that before receiving the treatment, the initial abilities of students in both sample groups were considered comparable.

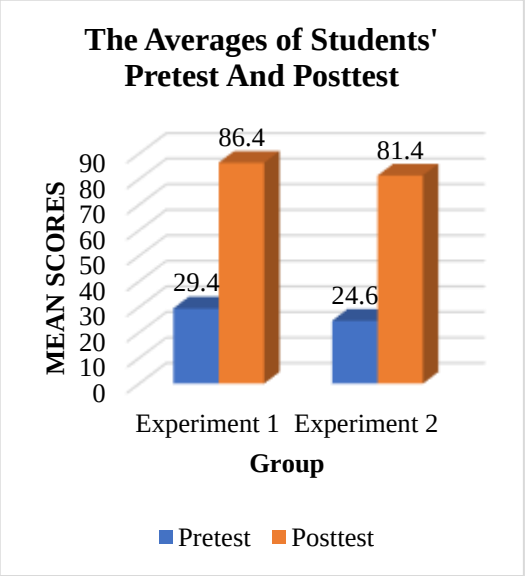

Figure 1. Pretest and Posttest Student Score Data

The improvement in learning outcomes can be observed from the average gain scores of all students for each experimental class based on the pretest and posttest data obtained. The increase in learning outcomes for experimental class 1 is 0.81 or 81%, and for experimental class 2, it is 0.76 or 76%, as summarized in **Table 3** below:

Table 3 Learning Outcome Improvement Calculation Data

Data	Group Experiment 1	Experiment 2
Minimum Gain Score	0.69	0.63
Maximum Gain Score	0.93	0.92
Average Gain Score	0.81	0.76
Percentage Gain	81%	76%
Description	High	High

Based on the data in **Table 3**, it can be seen that the improvement in learning outcomes is categorized as high in both experimental classes. Observing the average gain scores, it is evident that the improvement in learning outcomes in experimental class 1 is higher compared to experimental class 2. The data on the improvement in learning

outcomes in both experimental classes are also presented graphically in **Figure 2** below.

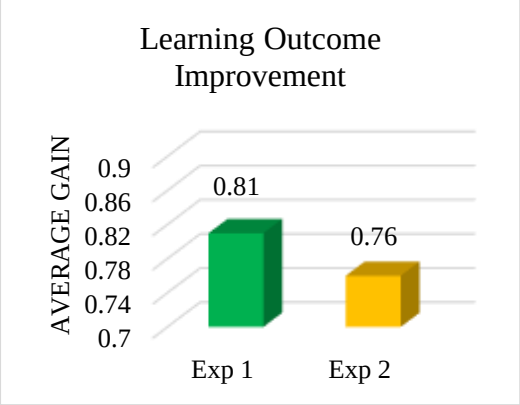

Figure 2 Student Learning Outcome Improvement Graph

Learning Interest Data

Based on the obtained data, the average interest scores were calculated for both experimental classes, as summarized in **Table 4** and presented in **Figure 3** below.

Table 4 Student Interest Data

Data		Group Experiment 1	Experiment 2
Learning Interest	Minimum Score	77.17	73.91
	Maximum Scroe	89.13	85.87
	Average	82.65	79.70

Based on the research data in **Table 4**, the minimum interest scores were found to be 77.17 for experimental class 1 and 73.91 for experimental class 2. The maximum interest scores were 89.13 for experimental class 1 and 79.70 for experimental class 2.

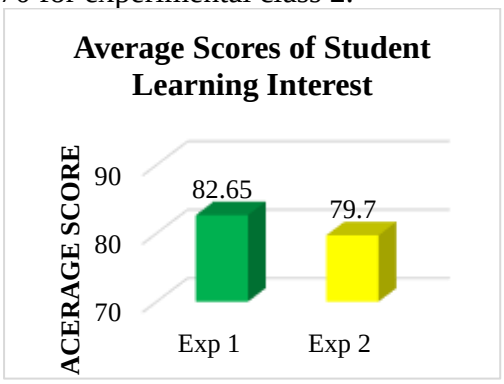

Figure 3 Student Interest Average Score Graph

Data Normality Test

To test the normality of data in this study, the chi-square test (χ^2) was employed. In this testing, conclusions about the normality of the data can be drawn by comparing the calculated chi-square value (χ^2) with the critical chi-square value at the significance level α = 0.05. If the calculated chi-square (χ^2) is less than the critical chi-square value, then the data is considered to be normally distributed. A summary of the normality test calculations for the learning outcomes and students' interest data in each experimental class is presented in **Table 5** below.

Table 5 Normality Test Calculation for Learning Outcome and Student Interest Data

Group	χ^2 count Learning Outcome	Learning Interest	χ^2 table	Description
Experiment 1	7.50	4.44	11.07	Normal Distribution of Data
Experiment 2	5.04	4.63	11.07	Normal Distribution of Data

Based on the normality test calculations, the obtained values for the chi-square (χ^2) test for learning outcomes and interest in experimental class 1 are 7.50 and 4.44, respectively. For experimental class 2, the values are 5.04 and 4.63, with a critical chi-square value of 11.07. Thus, comparing the calculated χ^2 values with the critical χ^2 value, it can be concluded that the data for learning outcomes and interest in both classes meet the prerequisite for statistical analysis, indicating a normal distribution.

Data Homogeneity Test

Homogeneity calculations were conducted on the data of learning outcomes and students' interest in both classes, namely experimental class 1 and experimental class 2, using the F-test. The decision-making process in the homogeneity test involves comparing the calculated F-count with the critical F-

table, where the data is considered homogenous if F-count < F-table at the significance level α = 0.05 and degrees of freedom (df) = (24)(24). A summary of the homogeneity test calculations for the data in each experimental class is presented in **Table 6** below.

Table 6 Homogeneity Test Calculation for Learning Outcome and Student Interest Data

Data	Kelas	Varians	F_{count}	F_{table}	Description
Learning Outcome	Experiment 1	24	1.78	1.98	Homogenous Data
	Experiment 2	42.75			
Learning Interest	Experiment 1	5.86	1.39		Homogenous Data
	Experiment 2	8.14			

Based on the homogeneity test calculations, the obtained F-values for learning outcomes and students' interest are 1.78 and 1.39, respectively. Comparing the variances of each class, the learning outcomes data for experimental class 1 is 34.33 and for experimental class 2. The interest data for experimental class 1 is 8.14, and for experimental class 2, it is 5.86. Therefore, since F-count < F-table, it can be concluded that the learning outcomes and interest data in both experimental classes meet the prerequisite for statistical analysis, indicating homogeneity in both sample groups.

Hypothesis Testing

In the calculation of the first and second hypotheses in this study, a right-tailed t-test was conducted on two sample groups. The decision-making for the hypotheses can be based on the obtained t-value; if the calculated t-count is greater than the critical t-table, then the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted. The results of the right-tailed t-test calculation can be observed in **Table 7** below.

Table 7 Results of Hypothesis Test 1 and Hypothesis 2 Calculation

Test	Data Value		t_{count}	t_{table}	Description
Hypothesis 1	Experiment 1	$\bar{X}$ = 86.4 s = 4.90	3.059	1.677	Acceptance of Ha, Rejection of Ho
	Experiment 2	$\bar{X}$ = 81.4 s = 6.54			
Hypothesis 2	Experiment 1	$\bar{X}$ = 82.6 s = 2.42	3,94		Acceptance of Ha, Rejection of Ho
	Experiment 2	$\bar{X}$ = 79.7 s = 2.85			

Based on the calculations performed for the first hypothesis test, the critical t-table at a significance level of α = 0.05 (degrees of freedom = 48) from the t-distribution table is found to be 1.677. However, the calculated t-count from the t-test is determined to be 3.059. Since the t-value falls into the rejection region of the null hypothesis (Ho) with t-count > critical t-value (3.059 > 1.677), it can be concluded that the null hypothesis is rejected, and the alternative hypothesis (Ha) is accepted. This implies that the learning outcomes of students taught using the interactive media Articulate Storyline are higher than the learning outcomes of students taught using PowerPoint.

Furthermore, based on the calculations conducted for the second hypothesis test, the critical t-table at a significance level of α = 0.05 (degrees of freedom = 48) from the t-distribution table is found to be 1.677. On the other hand, the calculated t-count from the t-test is determined to be 3.94. Since the t-table falls into the rejection region of the null hypothesis (Ho) with t-count > critical t-table (3.94 > 1.677), it can be concluded that the null hypothesis is rejected, and the alternative hypothesis (Ha) is accepted. This indicates that the learning interest of students taught using the interactive media Articulate Storyline is higher than the learning interest of students taught using PowerPoint.

Next, in the third hypothesis of this study, we investigate whether there is a positive correlation between students' learning outcomes and learning interests after

being taught using Articulate Storyline. The correlation between students' learning outcomes and learning interests is calculated using the product-moment formula. To determine the magnitude of the contribution or impact of learning outcomes on students' learning interests and vice versa, the Coefficient of Determination (CD) is calculated, representing the percentage of the squared correlation coefficient (r) count.

The decision-making for the hypothesis can be based on the obtained correlation coefficient (r-count); if the calculated r-count is greater than the critical r-value (r-table), then the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted. The results of the correlation test calculation can be observed in **Table 8** below.

Table 8 Results of Hypothesis Test 3 Calculation

Data	Total Value(∑) X = Learning Interest Y = Learning Outcome	r_{count}	r_{table}	CD
X	2066.3			
Y	2160			
X^2	170925.09	0.931	0.396	87%
Y^2	187200			
XY	178793.48			
N	25			

Based on the calculations conducted, it is found that the calculated correlation coefficient (r-count) is 0.931, while the critical r-table is 0.396 at a significance level of $\alpha = 0.05$ (N=25). The value of r, 0.931, indicates a very high level of correlation (0.81-1.00). Since the calculated r-count is greater than the critical r-table, the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted. This implies that there is a positive correlation between the learning interest and learning outcomes of students taught using the interactive media Articulate Storyline. The contribution of learning interest to student learning outcomes and vice versa is 87%, while the remaining 13% is attributed to other contributing factors.

The use of Articulate Storyline as a media tool has a significant impact on students' learning outcomes, as evidenced by the results of the first hypothesis testing in this study, revealing an improvement in learning outcomes in experimental class 1 using Articulate Storyline. This finding aligns with the research by Sundari & Silitonga (2022), who reported that post-learning with Articulate instructional media resulted in an average student learning outcome of 85.2, which was higher than the class not using Articulate Storyline, where the average learning outcome was 81.6.

In addition to learning outcomes, the implementation of Articulate Storyline also influences students' learning interest, as demonstrated by the second hypothesis testing, where the learning interest of students is higher in the class taught using PowerPoint. This is in line with the findings of Dani & Arief (2022), who stated that the use of this media can enhance students' learning interest by providing a more engaging and interactive learning experience. Another study by Sari & Harjono (2021) suggested that the use of Articulate Storyline can stimulate students' interest and engagement in classroom learning.

In evaluating the benefits of using Articulate Storyline in a learning context, several positive aspects can be identified. Firstly, Articulate Storyline's interactive nature supports active learning, allowing students to directly engage in the learning process. This interactivity not only enhances student engagement but also creates a more dynamic learning experience. Additionally, Articulate Storyline can present material in a dynamic way, offering variety in teaching methods. The reasons behind the improvement in student learning outcomes with the use of Articulate Storyline include the motivation boost provided by interactive elements and the comprehensive material presentation, laying a strong foundation for concept understanding. Moreover, the diversity in teaching methods accommodated by Articulate Storyline caters to various learning styles, creating an inclusive and responsive learning environment. Therefore,

these advantages are key factors in supporting enhanced student learning outcomes through the use of Articulate Storyline.

Analyzing the reasons behind increased student learning interest with Articulate Storyline usage involves considering several key factors. First, the interactive features provided by Articulate Storyline significantly enhance student engagement. These interactive elements not only offer deeper understanding but also stimulate active student participation in the learning process. Furthermore, the ability for students to participate directly in learning activities plays a crucial role in increasing their interest in the taught material. Additionally, the variety of learning approaches enabled by Articulate Storyline acts as a determining factor. By accommodating different preferences and learning styles, Articulate Storyline creates a more dynamic and engaging learning environment. This variety not only enriches the student learning experience but also prevents boredom. Lastly, the diversity of learning materials that can be presented through simulations, videos, and interactive elements offers flexibility in conveying information. The appeal generated from this diversity can stimulate student interest, creating a more engaging and effective learning experience.

CONCLUSION

Based on the findings of the conducted research, which involved data analysis and hypothesis testing, it can be concluded that students who participated in learning using Articulate Storyline media demonstrated significantly higher learning outcomes compared to those who learned using PowerPoint media. The average learning outcomes for students in classes using Articulate Storyline reached (86.4 ± 4.90), whereas in classes using PowerPoint, it only reached (81.4 ± 6.54). Furthermore, students' learning interest was also proven to be higher when taught with Articulate Storyline media, with an average learning interest of (82.65 ± 2.22), compared to (79.70 ± 2.85) in classes using PowerPoint. Additionally, the research indicates a positive correlation between students' learning interest and learning outcomes when Articulate Storyline is employed as the instructional media. With a contribution of 87%, Articulate Storyline media has been proven to have a positive impact on increasing students' interest and learning outcomes. The findings from this study underscore the significant impact of employing more engaging and interactive instructional media, such as Articulate Storyline, over traditional methods like PowerPoint in enhancing student learning outcomes and interest. These insights pave the way for innovation in educational tools, advocating for the development of new technologies that cater to diverse learning styles and preferences. Moreover, the demonstrated success of interactive media in education could inspire curriculum designers to integrate dynamic tools into teaching, thereby transforming traditional educational models. This research also has the potential to influence educational policy and investment, encouraging the integration of advanced technological tools in educational institutions worldwide. Additionally, the positive correlation between students' learning interest and learning outcomes highlights the importance of further research in educational psychology to develop more effective teaching strategies. Overall, this study not only contributes to the advancement of educational science and technology but also has broader implications for improving global access to quality education and fostering innovation across various sectors.

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