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The Effect of FSLC Model with Crossword Media on Interest and Learning Outcomes

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Abstract: *The FSLC (Formulate Share Listen Create) model is a cooperative learning approach. This study compares the FSLC model with crossword media to a conventional PowerPoint-based model and examines the correlation between students' learning outcomes and interest. The sample included 25 purposively selected students per class for experimental and control groups with similar backgrounds. Using a pretest-posttest control group design, the experimental class learned electrolyte and nonelectrolyte solutions via FSLC with crossword puzzles, while the control class used PowerPoint. Results showed higher average interest (86.60 vs. 80.40) and outcomes (83.30 vs. 79.70) in the experimental group, with F_calculated > F_table. A strong correlation was found between interest and outcomes in the experimental class (r = 0.931 > r_table = 0.396), with a determination index of 11%, indicating a positive relationship.*

Keywords: *FSLC (Formulate Share Listen Create); crossword puzzle; interest and learning outcomes*

INTRODUCTION

One of the main components in developing superior human resources is education (Mardhiyah et al., 2021). Another learning process that can help us reach our full potential is education. Humans need education to be able to face the changing times (Puspaningtyas & Dewi, 2020).

Education is a conscious and planned effort to create an atmosphere and learning process so that students actively develop their potential as a quality generation of the nation, in accordance with Law of the Republic of Indonesia Number 20 of 2003 Article 1 concerning the National Education System (Tambun et al., 2020)

One of the learning that is closely related to the interaction of students with their environment is the subject of chemistry. Chemistry is a branch of science that focuses on studying matter, its properties, changes in compounds and energy (Hidayati, 2022).

Based on observations and interviews with the chemistry teacher at SMAN 4 Medan, it was found that the learning process still predominantly utilizes conventional methods with minimal emphasis on the application of innovative learning models. Instruction is often teacher-centered, relying heavily on

lectures with limited student engagement. As a result, students tend to be passive, with few opportunities to ask questions, express ideas, or develop critical thinking skills. This lack of active participation contributes to a decline in students' learning interest and hinders the development of independent learning habits. To address the low levels of learning outcomes and student interest in chemistry, an appropriate learning model is required.

The FSLC learning model is considered effective in addressing low student interest and achievement, as it fosters critical thinking, creativity, collaboration, and communication in understanding concepts and solving problems (Gultom & Muchtar, 2020).

FSLC trains students' thinking skills. Through these thinking skills, teachers expect improvements in student learning outcomes. If students are trained through these situations, their character and learning outcomes will grow and become more qualitative (Alfiantara et al., 2016).

To address these issues, implementing a student-centered learning model supported by interactive media is recommended. This approach aligns with the findings of, which show that the use of problem-based learning combined with media significantly improves student learning outcomes.

Considering the issues identified in the background, this study aims to examine the effectiveness of an instructional approach through the research titled: "The Effect of the Formulate Share Listen Create (FSLC) Learning Model with Crossword Puzzle Media on Improving Students Interest and Learning Outcomes in Electrolyte and Nonelectrolyte Solution Topics."

LITERATURE REVIEW

Learning is a process that occurs over a period of time, characterized by changes in behavior as a result of the interaction of individuals with their environment (Pulungan & Simamora, 2024). Learning is a Continuous change in knowledge, skills, and attitudes through experience and active interpretation of that experience (Martin, 2024).

Self-directed learning is a cooperative and differentiated strategy that encourages interaction, group work, and teacher adjustment to student differences (Dalimunthe & Ginting, 2022).

The learning model is an evidence-based approach in the form of a framework of eight scientific principles that guide how teaching and learning are designed for maximum effectiveness.

The FSLC cooperative learning model is a learning process where students actively construct their own knowledge by solving the problems given (Nisa & Selly, 2022).

Learning media is essentially a means for communicators (teachers) to convey information to communicants (students) as recipients. The learning environment can achieve learning objectives well if it is created methodically (Saleh et al., 2023).

One medium that can be used in chemistry learning is crossword puzzles. In this study, the crossword puzzles contained questions related to the nomenclature of compounds. In practice, crossword puzzles involve active student participation from the beginning of the learning activity. Crossword puzzles are useful for reviewing previously presented material (Waruwu & Susanti, 2019).

One of the internal elements that supports student learning outcomes is interest in learning. interest in learning can be interpreted as the level of student interest in learning (Sutiswo et al., 2024). Students who are not interested in the subject will show an attitude of not understanding, being lethargic, and not enthusiastic in following the teaching and learning process. The tendency of students to be involved or interested in learning and applying it for constructive purposes is a sign of their interest in learning (Komariyah et al., 2018). Learning outcomes refer to relatively permanent changes in knowledge, attitudes, and skills resulting from

a multi-stage learning process (Prastika, 2020).

METHODS

This research was conducted in the even semester of the 2024–2025 academic year at SMA Negeri 4 Medan, located at Jl. Gelas No. 12, Sei Putih Tengah, Medan Petisah District, Medan City, North Sumatra. The population in this study included all Grade XI students, while the sample was selected using purposive sampling, involving two intact classes assumed to have similar characteristics and academic backgrounds. A total of 50 students participated, consisting of 25 students from class XI-8 (control group) and 25 students from class XI-9 (experimental group). The research employed a quasi-experimental design, specifically the post-test-only control group design. The treatment was conducted over seven meetings, with four meetings in the experimental class and three meetings in the control class. Both classes were first given a pretest to measure prior knowledge. In the experimental class, students were taught using the Formulate Share Listen Create (FSLC) learning model integrated with crossword puzzle media, involving a series of learning activities including watching a video related to the topic, engaging in group discussions using student worksheets (LKPD), and conducting group presentations. At the end of the treatment, a post-test was administered. Meanwhile, in the control class, students received direct instruction through PowerPoint-based lectures, followed by the same post-test in the next session.

The instruments used in this study included both test and non-test instruments. The test consisted of 40 multiple-choice items with five options each, designed to assess students' learning outcomes. The non-test instrument was a learning interest questionnaire consisting of 30 items adapted from previous undergraduate studies on similar topics. Both instruments underwent content validation by an expert from the Chemistry Education Department at FMIPA UNIMED and were also empirically tested with Grade XII students who had previously studied the same material.

The difficulty level of each valid test item was analyzing using the formula:

$$P = \frac{B}{N}$$

where B is the number of students answering correctly and N is the total number of students. The discriminating power was calculated using the formula

$$D = \frac{P_A}{P_B}$$

comparing the upper and lower groups' performance. To ensure the appropriateness of further statistical testing, a normality test was performed using the Lilliefors test. The results indicated that the data for both learning outcomes and learning interest in both groups were normally distributed, as the calculated L values were less than the critical value.

The statistical analysis technique to determine the results of the research uses the T check (Hypothesis Check) with the prerequisites of normal check and homogeneity check. Hypothesis testing is a test conducted when the data analysis requirements have been met and the data results are normally distributed (Rilanty & Juwitaningsih, 2020).

To check the hypothesis whether the truth is acceptable or not, the one used in this study is a one-sided t-check, namely the right-hand t-check. With a real level of α = 0.05.

The t-check formula is as following:

$$t_{count} = \frac{(\bar{X}1 - \bar{X}2)}{\sqrt{\left(\frac{S1^2}{n1} + \frac{S_2^2}{n2}\right)}}$$

(Rukminingsih et al., 2020)

To test the hypotheses, a one-tailed t-test was conducted with α = 0.05 and degrees of freedom (df) = 48. The results of the hypothesis tests were as follows:

1. Learning Outcomes: $t_{count} = 3.043 > t_{table} = 1.677$, indicating a significant difference in

favor of the experimental class. Can be counted :

$$t_{count} = \frac{(\bar{X}1 - \bar{X}2)}{\sqrt{\left(\frac{S1^2}{n1} + \frac{S_2{}^2}{n2}\right)}}$$

Based on the collected data:

- Experimental group: X_1=86.6, n_1=25, $s_1^2 = 24.41$
- Control group: X_2=80.4, n_2=25, $S_2^2 = 26.92$

Substituting these values into the formula:

$$t_{count} = \frac{(86.6 - 80.4)}{\sqrt{\frac{24.41}{25} + \frac{26.92}{25}}}$$

$$t_{count} = 3.043$$

With t_{count} = 3.043 and t_{table} = 1.677 (α = 0.05, df = 48), the result shows that $t_{count} > t_{table}$ > $t_{count} > t_{table}$. Thus, the null hypothesis is rejected, indicating a statistically significant difference in learning outcomes between the two groups. This supports the conclusion that the FSLC learning model with crossword puzzle media was more effective than conventional PowerPoint-based teaching in improving student performance.

2. Learning Interest: t_{count} = 6.21 > t_{table} = 1.677, also favoring the experimental class. To evaluate whether there was a significant difference in students' learning interest between the experimental and control classes, a one-tailed independent sample t-test was applied using the formula below:

$$t_{count} = \frac{(\bar{X}1 - \bar{X}2)}{\sqrt{\left(\frac{S1^2}{n1} + \frac{S_2{}^2}{n2}\right)}}$$

Where:

- X_1 = 83.30, the mean learning interest score of the experimental class
- X_2 = 79.70, the mean learning interest score of the control class
- $n_1 = n_2$ = 25 (number of students per group)
- S_2^1 = 6.58, variance of the experimental class
- S_2^2 = 8.14, variance of the control class

Substituting the values:

$$t_{count} = \frac{(83.3 - 79.7)}{\sqrt{\frac{6.58}{25} + \frac{8.14}{25}}}$$

$$t_{count} = 6.21$$

With t_{count} = 6.21 and t_{table} = 1.677(α = 0.05, df = 48), the null hypothesis is rejected. This result indicates a statistically significant difference in students' learning interest, favoring the group taught using the Formulate Share Listen Create (FSLC) learning model supported by crossword puzzle media.

3. To further analyze the relationship between learning interest and outcomes, a correlation test was applied using the Pearson product-moment formula, yielding r_{count} = 0.94 > r_{table} = 0.396, indicating a strong positive correlation. The coefficient of determination showed that 89% of the variance in learning outcomes could be attributed to students' learning interest.

In addition, an N-Gain analysis was conducted to measure the increase in students' understanding before and after treatment using the formula:

$$N - Gain = \frac{\text{Posttest} - \text{Pretest}}{\text{Maximum Score} - \text{Pretest}} \times 100\,\%$$

The N-Gain Test is a calculation carried out to understand the percentage increase in student learning outcomes (Dalimunthe & Ginting, 2022).

This analysis supported the overall effectiveness of the FSLC model in improving both student learning outcomes and interest.

RESULT AND DISCUSSION

This study was conducted through face-to-face instruction in both experimental and control classes. A pretest consisting of 20 validated multiple-choice questions was administered to assess students' initial

understanding of electrolyte and nonelectrolyte solutions. The instrument has undergone validity, reliability, difficulty level, and discriminating power tests. Prior to treatment, both groups completed the pretest to measure baseline skills. All developed media were implemented during the learning process. A posttest was given at the end to evaluate learning outcomes. The average pretest and posttest scores of both groups are summarized in Figure.

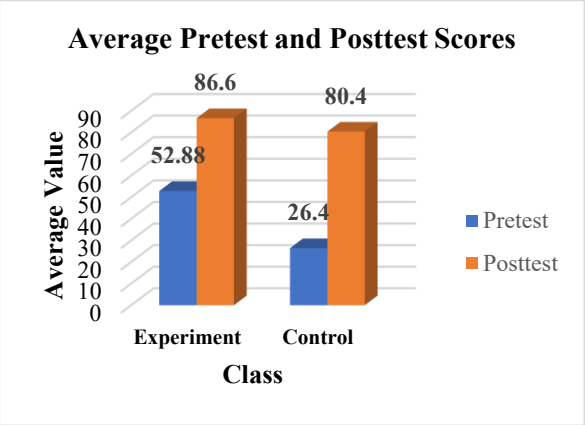

Figure 1. Average Pretest and Posttest Scores

After being given learning using the FSLC learning model assisted by crossword puzzle media in the experimental class, the average value of students experienced a significant increase, namely 86.60 and this value is an average value with a high category. Meanwhile, the average pretest value of the control class taught with a conventional model assisted by powerpoint media was 80.40 with a moderate category obtained from the results of statistical processing of normal checks, homogeneity checks, n-gain checks as seen in the table below.

Table 1. Statistic Normality Check

Room	F_{val}	F_{Tab}	A	Information
Eksperimen	7.74	11.07	0.05	Normal
Control	8.16	11.07	0.05	

Based at table 1 Normality test results showed χ^2 values of 7.74 for the experimental class and 8.16 for the control class, both below the χ^2 table value of 11.07, indicating that the learning outcome data were normally distributed and met the assumptions for statistical analysis.

Table 2. Statistic Homogeneity Check

Room	Varians	F_{val}	F_{Tab}	α	Information
Eksperimen	24,41	1.10	1.98	0.05	Homogen
Control	26,91				

Homogeneity test results showed an F_{hit} value of 1.10, comparing variances of 24.41 (experimental class) and 26.91 (control class), which is lower than the F_{table} value. This indicates that the learning outcome data from both groups were homogeneous and met the requirements for further statistical analysis. Following the analysis of pretest and posttest data, students' learning interest was examined using a validated questionnaire consisting of 23 items. After the posttest, both experimental and control groups completed the questionnaire to measure their interest after being taught using the FSLC model with crossword puzzle media (experimental) and the PBL model with PowerPoint (control). The average scores of learning interest for both groups are summarized in Figure:

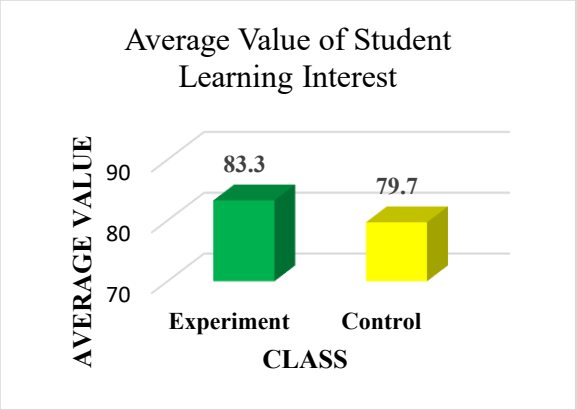

Figure 2. Average Value of Student Learning Interest

After knowing the data of the students' learning interest results, then the normality and homogeneity were tested. The results showed that χ^2 for the experimental class was 8.42 and for the control class was 4.63, both lower than the χ^2 table value of 11.07, indicating that the data was normally distributed.

Following the normality and homogeneity tests, the data were found to be normally distributed and homogeneous.

Table 3. Results of Hypothesis Calculation 1

Value Data		t_{count}	t_{table}	Information
Experiment	$\bar{X} = 86,4$ $s = 4,94$	3,043	1,677	Ha accepted Ho rejected
Control	$\bar{X} = 81,4$ $s = 5,19$			

This indicates that students taught using the Formulate Share Listen Create (FSLC) learning model achieved significantly higher learning outcomes than those taught with conventional learning models.

Table 4. Results of Hypothesis Calculation 2

Value Data		t_{count}	t_{table}	Information
Experiment	$\bar{X} = 83,3$ $s = 2,42$	6,21	1,677	Ha accepted Ho rejected
Control	$\bar{X} = 79,7$ $s = 2,85$			

Based on the results of the second hypothesis test, the t count value = 6.21 with t table = 1.677 at a significance level of 0.05. Because t count > t table, Ho is rejected and Ha is accepted. This shows that students who are taught using the Formulate Share Listen Create (FSLC) learning model have a higher interest in learning compared to students who are taught using the conventional model.

The third hypothesis in this study tested the existence of a positive correlation between learning outcomes and students' learning interests after learning with the Formulate Share Listen Create (FSLC) model. A positive correlation indicates that an increase in one variable is followed by an increase in the other variable. The strength of the relationship is measured using a correlation coefficient with a value range of -1 to +1. The closer to +1, the stronger the positive relationship between the two variables. The correlation table between learning outcomes and learning interests in the experimental class is presented as follows.

Table 5. Results of Hypothesis Calculation 3

Data	Total Value (∑) X = Interest in Learning Y = Learning Outcomes	r_{count}	r_{table}	CD
X	2082,61	0,94	0,39	89%
Y	2165			
X^2	173648,39			
Y^2	188075			
XY	180641,30			
N	25			

Based on the calculation results, the values of $r_{hitung} = 0.94$ and $r_{tabel} = 0.396$ were obtained at a significance level of $\alpha = 0.05$ ($N = 25$). Because $r_{count} > r_{table}$ Ho is rejected and Ha is accepted, which means that there is a very high positive correlation between learning interest and student learning outcomes after using the Formulate Share Listen Create (FSLC) learning model. The FSLC model contributed 89% to increasing student interest and learning outcomes, while the remaining 11% was influenced by other factors.

This study has several limitations that should be acknowledged. First, the sample was limited to two intact classes from a single school, which may not represent the broader student population. Second, although both test and questionnaire instruments were validated, student responses could still be influenced by individual interpretation or mood at the time of assessment. Furthermore, external variables such as classroom environment, peer influence, and students' prior motivation were not fully controlled and could have affected the results. Lastly, the researcher's direct involvement in the implementation of the FSLC model may have introduced unintentional bias in instruction delivery. These factors should be considered when generalizing the findings.

CONCLUSION

Based on the results of the study, data analysis, and hypothesis testing, it was concluded that: The Formulate Share Listen Create (FSLC) learning model significantly improved student learning outcomes compared to the conventional model, with an average achievement of 86.4 ± 4.94 in the experimental class and 81.4 ± 5.19 in the control class. Student learning interest in the FSLC class was higher (83.30 ± 2.42) xcompared to the conventional class (79.70 ± 2.85). There was a positive correlation between student interest and learning outcomes with the contribution of the FSLC model to both of them being 89%.

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