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Implementation of STEM Problem Based Learning Model with Quizizz and Spring Media towards Student Learning Outcomes in Stoichiometry Material

Meilani Azizah*, Garvin Simangunsong, Putri Elsa Simamora, Intan Juwita, Santa Maria Manalu, Tasya Putri Haren Simanulang, Jamalum Purba

Departement Chemistry Education, Faculty of Mathematics and Natural Science, Universitas Negeri Medan, Jl. Willem Iskandar, Pasar V, Medan, Indonesia.

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*Correspondinge-mail: meilaniazizah66@gmail.com

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Abstract: Implementation of STEM Problem Based Learning Model with Quizziz and iSpring Media Towards Student Learning Outcomes in Stoichiometry Material. This study aims to determine the significant differences in student learning outcomes using *Quizizz* Media and *i-Spring* Media with the STEM Problem Based Learning model on Stoichiometry material. The population in this study were students of class XI IPA at SMA Swata Sultan Iskandar Muda Meda which were divided into four classes. The research sample was students of class XI IPA selected using random cluster sampling techniques. The instrument used in this study was a test with 20 multiple choice questions. The data collected were in the form of student learning outcome ability test instruments. The results of the study were that there was a significant difference between student learning outcomes taught with the STEM-based Problem Based Learning model using Quizizz media with iSpring media with a Sig. (2-tailed) value of 0.001 ≤ 0.05.

Keywords: *Quizziz, iSpring,* and *Problem Based Learning.*

Abstrak: Penerapan Model Pembelajaran Problem Based Learning STEM dengan Media Quizziz dan iSpring terhadap Hasil Belajar Siswa pada Materi Stoikiometri. *Penelitian ini bertujuan untuk mengetahui perbedaan yang signifikan terhadap hasil belajar siswa menggunakan Media Quizizz dan Media i-Spring dengan model Problem Based Learning STEM pada materi Stoikiometri . Populasi dalam penelitian ini adalah siswa kelas XI IPA SMA Swata Sultan Iskandar Muda Meda yang terbagi dalam empat kelas. Sampel penelitian adalah siswa kelas XI IPA yang dipilih dengan teknik random cluster sampling. Instrumen yang digunakan dalam penelitian ini adalah tes dengan 20 soal pilihan ganda. Data yang dikumpulkan berupa instrumen test kemampuan hasil belajar siswa. Hasil penelitian adalah terdapat perbedaan yang signifikan antara hasil belajar siswa yang diajarkan dengan model pembelajaran Problem Based Learning berbasis STEM menggunakan media Quizizz dengan media iSpring dengan nilai Sig.(2-tailed) sebesar 0,001 ≤ 0,05.*

Kata kunci: *Quizziz, iSpring, dan Problem Based Learning.*

▪ INTRODUCTION

The development of science and technology demands an increase in the quality of education. Education is the key to all progress and quality development, because with education humans can realize all their potential both as individuals and as members of society (Talaohu, 2022). Chemistry is a science that can be challenging to understand since some of its ideas are abstract. Electrolyte solutions are chemistry learning material that requires students to carry out experiments in testing solutions to understand the concept of the material (Kristalia & Yerimadesi, 2021). chemistry learning is currently generally running, but it really needs to be improved further because based on the fact that chemistry scores are still less than optimal (Sahnam, 2021). However, sometimes students do not include new concepts that are taught into the network of concepts that already exist in students' minds. This is due to the low understanding of students' concepts. Understanding concepts is a primary foundation that must be instilled in students, in order to avoid misunderstandings in understanding the actual concept. The low interest of students in learning chemistry lessons is because some students consider that chemistry lesson material is very difficult to understand and is abstract and is considered relatively new material (Fauzannur et al., 2022).

Stoichiometry material is one of the chemistry materials that is considered difficult by students because Stoichiometry has material that is characterized by many calculations, concepts and formulas (Purba et al., 2021). Stoichiometry material is one of the materials that is difficult for students to understand because this material, in addition to understanding the concept, also involves a lot of calculations(Konengian et al., 2023). Students' difficulties in understanding, finding concepts and learning independently will have an impact on the achievement of student learning outcomes. Therefore, efforts are needed to help students learn and understand the stoichiometry material. One effort that can be made is to choose the right learning model(Rahayu & Yerimadesi, 2022).

Learning outcomes are the result of a person's learning process that has gone through several stages (Prastika, 2020). The low learning outcomes experienced by students in stoichiometry material can be caused by students' mathematical learning abilities, such as the role of teachers as learning activity guides, learning strategies applied, facilities and infrastructure, curriculum, and learning environment. To avoid deviations that cause the learning process to be less effective and efficient that occurs in schools, innovative follow-up is needed, namely by implementing new strategies to be able to involve students in active learning (Lider, 2022).

Based on the results of observations and interviews conducted by researchers at SMA Swasta Sultan Iskandar Muda Medan, it was concluded that many students considered stoichiometry material difficult to understand, and teachers tended to convey the material through verbal explanations. This resulted in a lack of student involvement in the learning process, so that many of them had difficulty understanding stoichiometry material. Chemistry teachers at SMA Swasta Sultan Iskandar Muda Medan also showed that many students had difficulty in mathematical calculations when answering stoichiometry questions. Therefore, an appropriate learning model is needed so that students can absorb the information presented optimally. A good learning model must be adapted to the characteristics and conditions of the students(Harefa, 2023).

PBL (Problem Based Learning) is a learning concept that can improve students' critical thinking skills in the era of improve students' critical thinking skills in the current era of globalization. This learning model begins by raising a problem from the

real life of learners, then learners real life, then learners investigate and solve the problem by using a problem solving approach (Hutabarat & Simatupang, 2024). Learning that prioritizes competency mastery should be student-oriented (focus on learners), provide relevant and contextualized subject matter, and develop students' intelligence and mental strength (Widana & Diartiani, 2021). In this context, teachers are expected to design learning activities that can develop students' competencies, both in the cognitive, affective, and psychomotor domains. Learning strategies that focus on students and create a pleasant atmosphere are important to improve student learning outcomes in chemistry subjects. As the right solution, researchers chose a problem-based learning model (PBL), with a Science, Technology, Engineering, and Mathematics (STEM) approach, to increase students' motivation in developing science and mathematics skills, as well as to improve problem-solving skills (Pujiati, 2022). Learning with a STEM approach tends to improve the quality of learning and increase student motivation and interest(Septiani et al., 2020).

The use of a learning model will be better if it is accompanied by media. The media used in learning can speed up and improve the quality of the teaching and learning process(Aryani & Pulungan, 2024). In the teaching and learning process in schools, it is very necessary to have media to support the learning process to be used by students independently and can create enthusiasm for students' learning (Leny et al., 2021). Learning media is one of the important aspects in teaching methodology, functioning as a teaching aid in the hope of improving student learning outcomes. One of the ICT-based learning media is *Quizizz*, a web tool for creating interactive quiz games that can be used as a learning tool. *Quizizz* is considered an optimal alternative choice for use as a learning medium, because it is available in mobile applications such as Android and the App Store, and can be accessed as a website via a browser on a computer (Sodiq et al., 2021).

In addition to *Quizizz*, media that can be used in learning stoichiometry material is iSpring. iSpring is a tool that provides several features in power point which includes additional evaluation assessment features. iSpring is also able to package learning in an interesting way, and can accommodate students' critical thinking skills. This iSpring media will be integrated into Microsoft Power Point (Aritonang & Moondra Zubir, 2022).The results of (Wahyuni, 2020), study showed that the use of iSpring media can improve learning outcomes, and iSpring media provides students with a better understanding which has a positive impact on their learning outcomes. This is because iSpring learning media is more interactive and attracts students' attention. This shows that learning media has a role that can have a positive impact on increasing student learning motivation (Felentina & Agus Kembaren, 2022).

The learning outcomes obtained by students when taking the test can vary, some get high, medium, and low scores. This can happen because students' chemistry learning outcomes are still low. The low learning outcomes of students are because stoichiometry material is one of the materials that is difficult for students to understand because this material, in addition to understanding the concept, also involves a lot of calculations. Therefore, so that students do not feel bored and tired of following the learning, especially when solving questions, a media is needed that can involve students actively and quickly (Konengian et al., 2023). Seeing these problems, researchers will conduct research on the application of the Problem Based Learning STEM model with Quizizz and i-Spring media can improve student learning outcomes.

▪ METHOD

This research was conducted at SMA Swasta Sultan Iskandar Muda Medan located at Jalan Tengku Amir Hamzah Pekan I Gg. Bakul, Sunggal, Kec. Medan Sunggal, Medan City, North Sumatra 20128. This research will be conducted in the odd semester of the 2024/2025 academic year. The population in this study were all students of class XI MIPA in the odd semester of the 2024/2025 academic year totaling 4 classes. The sampling technique used in this study was Random cluster sampling, namely directly selecting several students of class XI IPA into several clusters (groups). The type of research used was true experiment. The data collection techniques used were quantitative and qualitative data which were carried out by means of written tests by making, Pretest and posttest. Data collection was carried out by providing Pretest sheets to students in experimental class I and experimental class II before entering the stoichiometry material, then providing learning in experimental class I using the Problem Based Learning model using Quizziz media and providing learning in experimental class II using the Problem Based Learning model using *iSpring* media. Posttests were given to each experimental class at the end of learning as a final test. The final test (posttest) was adjusted to the HOTS indicators. Data analysis in this study used test validity tests, test reliability, question difficulty levels, question discrimination tests, distractors, normality tests, homogeneity tests, gain tests, hypothesis tests, using SPSS 21 for windows.

Research Design

The type of research used is true experiment. The following is a table of research designs used:

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experiment I	T_1	X	T_2
Experiment II	T_1	Y	T_2

(Maslahah et al., 2021)

Research Instrumen

1. Sebanyak n molekul glukosa ($C_6H_{12}O_6$) dengan massa molekul relatif 180 gram mol^{-1} bergabung membentuk suatu karbohidrat dan menghasilkan 8 molekul air (Mr air = 18 gram mol^{-1}). Maka massa molekul relatif karbohidrat tersebut adalah….. gram mol^{-1}.
   A. 1800
   B. 1944
   C. 1764
   D. 1476
   E. 1620
2. Sebanyak 6 gram logam X direaksikan dengan larutan asam sulfat menurut reaksi. $X_{(s)} + H_2SO_{4\,(aq)} \rightarrow XSO_{4\,(aq)} + H_{2\,(g)}$. Bila gas yang dihasilkan 6,15 L diukur pada suhu 27°C dan tekanan 1 atm, Ar unsur X adalah ….. (R = 0,082)
   A. 12
   B. 24
   C. 27
   D. 48
   E. 56

Picture 1. Stoichiometry Test Instrument

The research instrument is a test of student learning outcomes in chemistry subjects on the subject of Stoichiometry. Before the test of student learning outcomes is given to students, the test is first validated. After the test of learning outcomes is valid, the test of learning outcomes is given to students who are included in the research

sample. The test of learning outcomes is carried out twice, namely pre-test and post-test. The pre-test is given before treatment in both experimental classes with the aim of determining the homogeneity of students' initial knowledge. The test used in this study is a multiple-choice objective test of 20 questions with each question item consisting of five answer choices (A, B, C, D, and E) and there is only one most appropriate answer choice. After that, treatment is given, namely in experimental class I, treatment is carried out with the Problem Based Learning STEM learning model using *Quizizz* Media and in experimental class two, treatment is carried out with the Problem Based Learning STEM learning model using iSpring media. Then a posttest is carried out in both experimental classes.

▪ RESULT AND DISCUSSION

Description of Research Instrumen Data

Before the research was conducted, the researcher prepared a research instrument in the form of an objective test consisting of 30 questions with 5 answer choices. The questions cover every indicator related to hydrocarbon and petroleum materials. The questions will be tested in class XII IPA 2 of SMA Swasta Slutan Iskandar Muda. The purpose of the trial is to determine the validity, reliability, level of difficulty, discrimination power and distractors. The results of the instrument trial are as follows :

1) Test Validity

In this study, to calculate the validity of the questions, the researcher used Microsoft Excel 2010. To determine whether the test items are valid or not, the criteria can be seen in Table 2.

Table 2. Criteria for Validity of Test Items

Correlation Numbers	Meaning
0,80 – 1,00	Very High
0,60 – 0,80	Tall
0,40 – 0,60	Enough
0,20 – 0,40	Low
0,00 – 0,20	Very Low

The validity coefficient obtained (r_{xy}) is compared with the value of the r table of the product moment if the calculated r value obtained is greater than the r table then the question is said to be valid. For the validity of the test instrument with 30 respondents (N), the r table is 0.361. The results of the validity test of the ability test instrument tested on class XII IPA 2 students showed that out of 30 questions, 22 were valid and 8 were invalid. Of the 22 valid questions, 20 questions were selected based on considerations of difficulty level, discriminating power, and distractors.

2) Test Reliability

If you want to get the reliability price of the test instrument, an analysis is carried out to get the reliability value and compared with = 0.05 with the criteria rcount> rtable for the real level, then the test is said to be reliable. The formula used to test reliability is Kuder Richardson (KR-20) with the criteria if $r_{11} > r_{table}$ then a test item is said to be reliable. In this study for the test instrument $r_{11} = 0.878$ While $r_{table} = 0.361$ so it can be concluded that the student learning outcome test instrument is reliable and in the high category.

3) Difficulty Level

level analysis is used to determine whether the question is easy, medium or difficult. In essence, a good test item is one that is not too difficult and not too easy. The level of difficulty of the question is classified into categories of difficult, medium and easy questions. The number that indicates the level of difficulty of a test item is called the item difficulty index (P).

If the value of P is greater then the item is easier, conversely the smaller P then the item is more difficult. The test item is said to meet the requirements if the value of P ranges between: 0.20-0.80 if P < 0.20 means the test item is too difficult, and if P > 0.80 means the test item is too easy.

Table 3. Test Difficulty Level

Price P	Category
P < 0,20	Difficult
0,2 ≤ P ≥ 0,80	Medium
P > 0,80	Easy

The results of the difficulty level test on the test instrument showed that there were 13 questions that were classified as easy. Questions in the medium category were 14 questions. And while questions in the difficult category were 3 questions.

4) Discriminatory Power

Discriminatory power is used to differentiate between high-ability students and low-ability students. The number that shows the magnitude of the discriminatory power of an item is called the Discriminatory Power Index (Discrimination Index) symbolized by "D" where the value of D ranges from -1 to +1.

Table 4. Criteria for the Level of Distinguishing Power

Coefficient Interval	Criteria
0,70-1,00	Very Good
0,40-0,70	Good
0,20-0,40	Enough
0,00-0,20	Not Good

An item is said to meet the requirements if the Discriminatory Power Index (D) ranges from 0.2-1.0. Based on the results of the analysis of 30 questions tested, 25

questions met the discriminatory power criteria, while 5 questions were declared not to meet the criteria.

5) Distractors

Distractors are all alternative answers (Options) outside of the "answer key". The purpose of using a distractor is as a distractor for the correct answer and to distract test participants who are less able and do not know so that they can be distinguished from test participants who are able to answer the question. Among the answer options, only one is correct and the other options are called distractors. A distractor is said to function well if it has great appeal to test participants who do not master the material. A distractor that is not selected at all (empty) means it is not functioning (not good). From the results of the analysis, a decision can be made, namely the distractor is accepted, rejected, revised.

From the results of the analysis carried out on the test instrument used, the distractor or distractor was accepted. Because a good distractor is a distractor that has been selected by at least 5% of all test participants.

Description of Research Data

The research data was obtained from the test of student learning outcomes on the Stoichiometry material. Before the learning began, a pre-test was conducted in experimental class I and experimental class II. After that, both classes were given different treatments during the learning process. Experimental class I was given learning treatment with a STEM-based PBL learning model with Quizziz media and experimental class II was given learning treatment with a STEM-based PBL learning model with iSpring media. At the end of the learning process, a post-test was given to both classes to evaluate student learning outcomes.

1) Learning Outcomes

In this study, learning outcomes were obtained from a test instrument consisting of 20 multiple-choice questions with 5 answer choices. Students were given questions at the end of the learning process. This treatment was carried out in experimental class I and experimental class II with the same number of questions. Data obtained from student learning outcomes can be seen in table 5.

Table 5. Differences in Student Learning Outcomes

Class	Average post-test scores of students
Experiment I	79
Experimen II	72,5

Based on table 5 above, it is known that the average learning outcomes of students who were given learning using the STEM-based Problem Based Learning model with Quizziz media were 79, while the average learning outcomes of students who were given learning using the STEM-based Problem Based Learning model with Ispring media were 72.5.

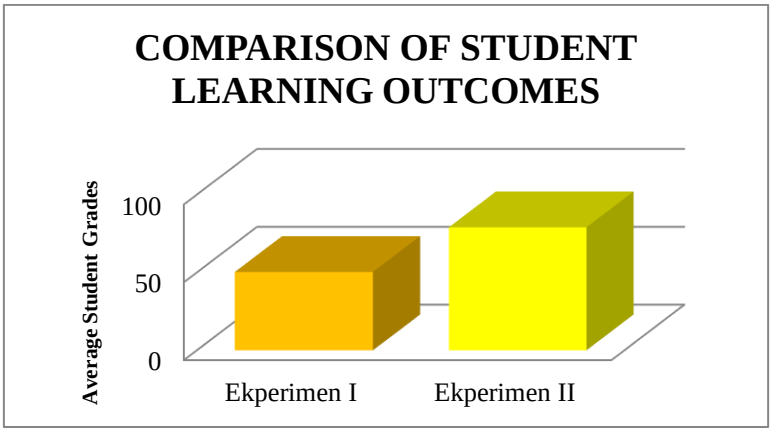

Figure 1. Average Student Learning Outcomes Diagram

2) Media Suitability in Improving Learning Outcomes

In this study to determine whether the Quizziz and iSpring media can improve student learning outcomes seen from the comparison of pretest and posttest scores of experimental class I and experimental class II. Where the questions consist of 20 multiple choice questions with 5 answer choices. The comparison data of pretest and posttest scores of experimental class I and experimental class II can be seen in Figure 2.

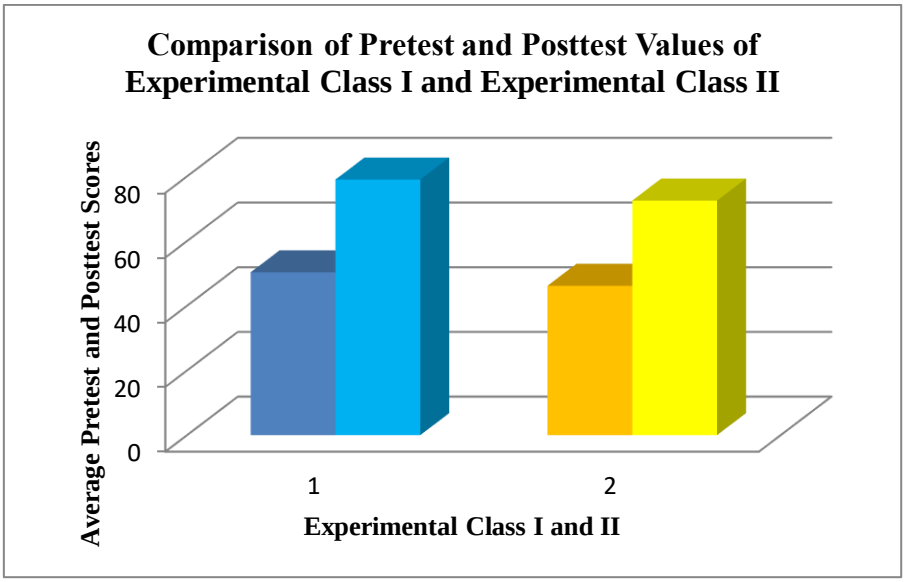

Figure 2. Comparison Diagram of Average Pretest and Posttest Values of Experimental Class I and Experimental Class II

Based on the picture above, it is known that the average pretest and posttest scores of students in experimental class I are 50.33 for the pretest score and 79 for the posttest score, while the average pretest and posttest scores of students in experimental class II are 46.16 for the pretest score and 72.5 for the posttest score. Based on the pretest and posttest scores, it is known that the scores produced increased from students who were previously taught using the STEM-based PBL learning model with *Quizizz* and iSpring media to students who have been taught using the learning model. In other

words, *Quizizz* Media and i-Spring Media based on Problem Based Learning STEM are feasible (valid/effective) to be used in improving student learning outcomes.

Learning Outcome Data Analysis Results

1) Normality Test

The Shapiro Wilk normality test with a significance level (confidence level) of 5% or sig. 0.05 is carried out to determine whether the data is normally distributed or not. Data is said to be normally distributed if the significant value obtained is greater than 0.05 (sig > 0.05) and vice versa if the significant value of the data obtained is less than or equal to 0.05 (sig ≤ 0.05) then the data is not normally distributed. The data from the normality test results for the experimental class and control class can be seen in Table 6.

Table 6. Normality Test Data

			Shapiro-Wilk		
	Teaching Materials	Class	Data Source	Sig.	Information
Learning Outcomes	STEM *Problem Based Learning* Model using *Quizizz* Media	Ekxperimen I	Pre-test	0.247	Normal
			Post-test	0.087	Normal
	STEM Problem Based Learning Model using *iSpring* Media	Experimen II	Pre-test	0.177	Normal
			Post-test	0.141	Normal

The sig values of pre-test and post-test in experimental class I were 0.247 and 0.087. While the sig values of pre-test and post-test in experimental class II were 0.177 and 0.141. Based on Table 6. The sig values of pre-test and post-test in experimental and control classes were both greater than 0.05, indicating that the data were normally distributed.

2) Homogeneity Test

The homogeneity test is conducted to determine whether the data has homogeneous variations or not. In this study, the data homogeneity test was conducted using SPSS 27.0 for windows at a significance level of 5% or (sig.0.05). If the sig value > 0.05, then the data is homogeneous. Conversely, if the sig value <0.05, then the data is not homogeneous. The homogeneity test results in this study can be seen in table 7.

Table 7. Results of the Homogeneity Test of Learning Outcomes

	Levene statistik	df1	df2	Sig.	Information
Learning Outcomes	3.507	1	58	0.066	Homogeneous

Based on these data, it shows that the data on student learning outcomes using the STEM-based PBL learning model using Quizziz and Ispring media are homogeneous, where the data has a significant value of 0.066, which means that student learning outcomes have a confidence level of around 6.6%.

3) Hypothesis Testing

Data analysis was carried out systematically using SPSS 27.0 for windows after ensuring that the data were normally distributed and had homogeneous variations. An independent sample t-test was conducted with a 5% error rate and a 95% confidence level ($\alpha = 0.05$). The test criteria are if the significance value $\leq \alpha$ (0.05), then Ha is accepted and Ho is rejected, conversely, if the significance value $> \alpha$ (0.05), then Ha is rejected and Ho is accepted. Hypothesis testing was conducted using post-test data from experimental class I and experimental class II, because the pre-test data between the two classes showed significant differences, the pre-test value of experimental class I was higher than that of experiment II. The test result data can be seen in Table 8.

Table 8. Results of Hypothesis Test Analysis of Student Learning Outcomes

	Independent Samples T-Test				
	t	df	Sig.(2-tailed)	Mean Disserence	Information
Learning Outcomes	3.369	58	0.001	7.833	Ha accepted

Table 8. shows Sig. (2-tailed) of 0.001. Based on the hypothesis test criteria, if the significance value $\leq \alpha$ (0.05), then Ha is accepted and Ho is rejected. Thus, in the first hypothesis it can be concluded that Ha is accepted, meaning that there is a significant difference between the learning outcomes of students taught using the STEM-based PBL learning model using Quizziz media with classes taught using the STEM-based PBL learning model using Ispring media on the subject of Stoichiometry.

Discussion

This research was conducted at SMA Swasta Sultan Iskandar Muda Medan with a population of all students of class XI IPA consisting of 4 classes in the 2024/2025 academic year. The research sample was selected using a random sampling technique, namely class XI IPA I as the experimental class I which was taught using the STEM-based PBL learning model using Quizziz media and class XI IPA II which was taught using the STEM-based PBL learning model using Ispring media. In experimental class I and experimental class II, assisted by the same learning model and approach, namely the STEAM-based Problem Based Learning model and Stoichiometry learning material. This study was conducted to observe the differences in learning outcomes of experimental class I and experimental class II and to determine whether *Quizizz* Media and i-Spring Media based on Problem Based Learning STEM were feasible (valid/effective) in improving student learning outcomes. Student learning outcomes were measured through post-tests and the feasibility of the Media *Quizizz* and Media i-Spring based on Problem Based Learning STEM was measured using pretest and posttest scores.

The measuring instrument of this research was a test instrument, namely multiple-choice questions with five alternative answer choices (a, b, c, d, e). Before being used in

the pretest and posttest, the test instrument consisting of 30 questions was first validated by an expert validator. After improvements were made based on input from the expert validator, the test instrument was tested on 30 students of class XII IPA 2 SMA Swasta Sultan Iskandar Muda Medan who had studied Stoichiometry material. The next stage was to evaluate the feasibility of the test instrument through item validity tests, reliability tests, difficulty level tests, and discrimination power tests. The results of the validity test showed that 22 questions were declared valid, while 8 questions were invalid. The difficulty level test resulted in a classification of 13 questions that were classified as easy. There were 14 questions in the moderate category. And while there were 3 questions in the difficult category. The discriminatory power test consisted of 25 questions that met the discriminatory power criteria, while 5 questions were declared not to meet the criteria. In addition, the reliability test showed that the test instrument had a KR-20 coefficient value of 0.878 which was included in the high category. Based on the results of the analysis, 22 questions were declared to meet the eligibility criteria, and 20 questions were selected to represent all the material indicators that had been set, so they were used as test instruments in the pretest and posttest.

This study was conducted in 4 meetings, the initial stage of the study began with the administration of an initial test (pretest) to both classes to measure students' initial abilities. The pretest questions used had met the criteria for validity, reliability, discriminatory power, and level of difficulty. The pretest results showed an average value of experimental class I of 50,33 while experimental class II was 46,16. Furthermore, learning was carried out using the STEM-based Problem Based Learning learning model with Quizziz media for experimental class I and using the STEM-based Problem Based Learning model with Ispring media for experimental class II. After the learning process is complete, students are given a final test (posttest) to measure learning outcomes. The average posttest result in experimental class I reached 79 while the control class was 72,5.

Students are given Student Worksheets (LKPD) during learning to discuss and collaborate actively in small groups according to the stages of the STEM-based Problem Based Learning (PBL) model. This model is designed to direct students to explore concepts through a problem-solving process that involves stages of exploration, data or information analysis, to drawing conclusions. In group discussions, each student has a specific role such as leader, recorder, and reporter to ensure that all members are actively involved in group discussions.

Prerequisite tests consisting of normality and homogeneity tests are carried out before hypothesis testing to ensure that the data meets the basic assumptions of parametric statistics, where the normality test is used to ensure that the data is normally distributed, while the homogeneity test ensures that the variance between data groups is homogeneous. Based on the normality test of student learning outcome data using Shapiro Wilk 27 with a significance level of 0.05, the sig value of the pre-test and post-test in experimental class I and experimental class II were both greater than 0.05, indicating that the data were normally distributed. The homogeneity test was carried out through the Levene statistical test with a significance level of 0.05, the significance value of the pre-test and post-test of experimental class I and experimental class II was 0.066> 0.05, which means that the data is homogeneous.

Hypothesis Testing

The results of hypothesis testing using the Independent t-test in both classes showed a Sig (2-tailed) value of 0.001. Based on the hypothesis test criteria, if the significance value ≤ α (0.05), then Ha is accepted and Ho is rejected. Thus, in the first hypothesis it can be concluded that Ha is accepted, meaning that there is a significant difference in student learning outcomes using *Quizizz* Media and i-Spring Media with the STEM Problem Based Learning model on the subject of Stoichiometry. Students who are taught using the STEM-based Problem Based Learning model with *Quizizz* media show a higher increase in learning outcomes compared to students who are taught using the STEM-based Problem Based Learning model with Isprin media. This is due to the use of the STEM-based Problem Based Learning model with *Quizizz* media which can attract students' interest in the learning process and encourage increased learning outcomes compared to before. This is in line with research conducted by Wahyuni (2021) which shows that the use of *Quizizz* media can improve learning outcomes, and *Quizizz* media provides students with more understanding which has a positive impact on their learning outcomes. This is because Quizziz learning media is more interactive and attracts students' attention.

▪ CONCLUSION

The study explains the application of the Problem Based Learning model with digital media such as *Quizizz* and iSpring to improve student learning outcomes. The conclusions in the study are as follows: 1) There is a significant difference between the learning outcomes of students taught with the STEM-based Problem Based Learning (PBL) learning model with *Quizizz* media and the learning outcomes of students taught with the STEM-based Problem Based Learning model with iSpring media on the subject of Stoichiometry with a Sig. (2-tailed) value of 0.001 ≤ α (0.05). 2). Quizziz media and iSpring media are suitable for use to improve student learning outcomes on the subject of Stoichiometry. This can be seen from the average pretest and posttest scores of each experimental class, which are 50.33 and 79 for experimental class I. While for experimental class II the pretest and posttest scores are 46.16 and 72.5.

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