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The Influence of Science Comics Learning Media and Problem-Based Learning Methods on the Effectiveness of Support Solution Learning for Students of SMAN 1 Toraja Utara

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ABSTRACT
Education is one of the spearheads of a country's success. In the world of education, the teacher is the spearhead; for this reason, the teacher must continue to improve himself to innovate and be creative in presenting the material being taught so that learning objectives can be adequately achieved. One is in chemistry learning, which must motivate students to continue developing critical thinking skills. For this reason, through this thesis, the writer will examine "The Influence of Science Comic Learning Media with Methods*Problem Based Learning* on the Effectiveness of Buffer Solution Learning for SMAN 1 Toraja Utara students. This type of research is correlational and aims to determine the effect of Science Comics and Method media *Learning* as the independent variable on the effectiveness of learning as the dependent variable. The population of this study were students in class XI of the Mathematics and Natural Sciences Department of SMAN 1 Toraja Utara for the academic year 2022/2023, which consisted of 3 classes with a total of 96 students. The sample was taken randomly with 77 students using the Solvin formula $N = n/N\ (d)^2 + 1$. The effect of comic and media methods problem-based learning on the effectiveness of learning using a questionnaire from student observations on teacher teaching activities. The data obtained were analyzed based on descriptive analysis.

1. INTRODUCTION

Education is one of the keys to a country's success; it can reflect the quality of human beings. What about Indonesia, which is far behind other countries? As on the katara.id page (2021) states that according to a survey from PERC (*Politik and Economic Risk Consultancy*), the quality of education in Indonesia ranks 12th out of 48 countries in Asia.

Thus the low quality of education in a country will significantly affect and hurt the life of that country. The poor quality of education will also impact every student and alum who will find it challenging to adapt to world developments with the quality of education they receive. One of the causes of the low quality of education is ineffective learning.

Yusuf B. (2017.14) also says, "The effectiveness of a learning process when it is carried out communicatively, the goals and objectives are well achieved." A communicative teaching and learning process can be achieved when the activities, responses,

management, and understanding of learning are going well. Learning that makes students active is supported by the teacher's effort or way of presenting the material.

One of the ineffectiveness in the teaching and learning process is that there is no proper planning from the teacher; teachers often teach without preparing lesson plans and ironically, teachers sometimes download lesson plans that are on the internet but also don't use them but only prepare them in case there is a supervisor or school principal. The teachers never think about the changes they have to make to continue to be creative and innovative in presenting material even though the learning outcomes that have been carried out are not effective.

Teachers must prepare learning materials in the Industrial 4.0 era through technology-based learning media. For this reason, teachers must be able to use technology in presenting the learning process properly; they must be able to provide learning media that are appropriate to the present. What supports the success of the learning process is innovative teaching media to motivate children to learn. Shodiq.a (2022), "A teacher uses interesting and diverse learning media/methods and provides a variety of learning experiences through interaction with teaching material." An interesting learning model will make students understand the material being taught so that goals can be achieved optimally.

Also, in the industrial era 4.0, it is said that to support success in the learning process to the fullest, teachers must prepare carefully. The teacher must design a good learning process for the material to be taught. To see the success of the learning process taking place by the objectives, the researcher uses PBL-based comic media where, in the learning process, students are continuously equipped to think critically, in the sense that students can analyze everything in the form of problems or the form of statements properly so that a person can think critically and do not easily believe the information that is there. They first analyze, interpret, evaluate, summarize, and conclude all the information.

Based on Kurnia Y.P (2020), one of the learning methods that can make students think critically is the PBL method. Where is the problem-based method in which students are directed to find or solve the problem themselves. According to Nurgiantoro in the same journal, comic media is a medium that is used to tell stories that become a problem of the learning topic to be studied. Pictures of templates and characters, as well as stories in comics, stimulate students to have the desire or motivation to explore information and think critically to find solutions to existing problems.

In line with Brigss in M.abi Hamid (2020), "Learning Media is a device used to convey items in teaching materials that can refresh students following the educational experience." "Media teaching is a tool that is used (whether in the form of humans, objects, or the environment) that can be used to convey messages in learning so that it can give a sense of concern, willingness, action, and feelings of students in teaching and learning activities to

achieve the goals to be achieved. False One media that is interesting and can make students more active is comic.

Pertiwi O.D (2018) said that one of the learning methods that play a role in making students active in the learning process is PBL. Also, according to Nugraha (2013) in the same journal, comics are media in the form of art with templates, characters/figures, and interesting stories to make students experience fun learning.

In line with Muchurifiani (2021), the PBL method can make students skilled and think critically to analyze, test, and summarize to make logical and ethical decisions; he said that the use of comic media in the learning process will also provide a reference for teachers to design learning innovative and motivating students to learn or explore information, process critical thinking and be able to produce works to answer existing problems or challenges.

Yonanda, D. A. et al. (2019), the learning process using PBL-based comics can integrate conceptual material regarding problems that occur in everyday life so that students try to dig up information to build their knowledge in finding solutions to the issues in the comic story.

In line with Thobroni's opinion inDita, P. P. S., Utomo, (2021) that the PBL method used in the learning process encourages students to find solutions in contextual circumstances and can also increase their knowledge by digging up information by thinking critically, besides that students can focus on the material being studied so that actively seeking references from various sources both individually and in groups.

Funa, A. A., & Prudente, M. S. (2021), humans are created uniquely and have different life experiences and different potentials but the PBL method used in the learning process is an innovative method because it helps students develop analytical skills and prepares them for problems real.

It is also said that the Science Comics media occurs through two-way communication and images (visuals) that tell the content to be studied so that students understand it more quickly. Based on the research of State Literature (2014) in the Nur Mazidah Nafala Journal (20220), "The use of comic media can encourage students to be more active in learning that is fun. In line withCandrayani, N. M. W., & Sujana, I. W. (2023), Comic media can increase students' learning interest, and this media is considered attractive because the description of the story is a true story that can motivate students to have high curiosity about the problems presented.

One of the subjects that is feared and considered difficult at the high school level is Chemistry. Why? Dede Salim (2018) states that one of the leading causes is a lack of understanding of mathematics because, according to them, mathematics is a prerequisite for answering chemistry questions. Also, based on the students' comments, they find it difficult to distinguish between existing chemical reactions, and they even want to memorize the symbols of existing elements and compounds. From this point of view, students who study

chemistry comment more that studying chemistry is very difficult. But it is not uncommon to find that of all the students who say that learning chemistry is complex, some students who, when asked about learning chemistry, say that learning chemistry is not tricky depending on the teaching method used by the teacher, which can involve students actively.

Previous researchers obtained data through interviews with several students regarding their active role in learning. They said that students rarely or never play an active role in learning activities when the teacher teaches because the method used is very monotonous or using lectures. They argue that learning takes place only dominated by the teacher (teacher-centered) so that students are often sleepy, bored/saturated, and do not understand what the teacher is teaching.

From these interviews, the writer can conclude that some of the teachers at SMAN 1 Toraja Utara have not been effective in carrying out the learning process. One of the chemical materials in class XI is Buffer Solution, where in this material, we will study the role of chemicals in maintaining pH in instant food (canned food), medicines, and human blood. Based on the evaluation value analysis on the Buffer Solution material for Class XI Students of SMA Negeri 1 Toraja Utara in regular face-to-face learning for four consecutive years starting from the academic year 2015/2016, 2016/2017, 2017/2018, 2018/2019 shows that from the standard The KKM that has been determined is 75, there are still many students who have not reached the KKM. Based on existing data in the 2015/2016 school year, students who completed reached 28%, the 2016/2017 school year students who completed reached 38%, the 2017/2018 school year students who completed around 30%, the 2018/2019 school year students who finished about 35%. This illustrates that many students still do not understand the buffer solution. After the author traced that, it turned out that the teacher taught this material using the Lecture Method, where learning activities were centered on the teacher. Students are silent while listening to the teacher's directions; the teacher has not prepared a good learning activity plan, has not designed a student-centered lesson plan, and has not designed how students actively experience the learning process themselves so that they can find solutions to problems that arise in the learning process.

Based on the phenomenon above, the authors are interested in research related to "The Influence of Science Comic Learning Media and Problem-Based Learning Methods on the Learning Effectiveness of Buffer Solution Students of SMAN 1 Toraja Utara" with the hypothesis whether Comic media based on the PBL model in the learning process has an effective influence on Buffer Solution learning.

2. METHOD

This research was conducted at SMAN 1 Toraja, students of class XI majoring in Science for the 2022/2023 academic year.

Information:

X_1 = Science Comics Learning Media

X_2 = Problem-Based Learning Learning Method

Y = Learning effectiveness (Learning Results)

The sampling methods in this study are:

2.1. Population

The population taken in this study were students of class XI SMA Negeri 1 Toraja Utara for the 2022/2023 Academic Year, consisting of 3 classes with a total of 96 students.

2.2. Samples

The research sample was randomly sampled using *Slovin's formula N = n/N (d)^2 + 1.*

Information :

n = sample.

N = Population

d = 95% precision value or Sig. = 0.05

The population is 96, and the desired error rate is 5%, then the number of samples used is N = 96/96 (0.05)^2 + 1 = 77.4, rounded up to 77

Research Instruments

The instrument in this study is a guideline questionnaire and student learning outcomes through evaluation.

a. Questionnaire Guidelines.

Questionnaires were given to respondents using a Likert scale, and several questions were provided based on indicators that could measure the effectiveness of learning through comic media with the PBL method.

b. Evaluation result

A multiple choice learning outcomes test of 20 numbers is given after the learning process is complete to measure the effectiveness/success of students using science comic media and the PBL method.

Data Analysis Techniques

The data obtained were analyzed through *SPSS 25 for Windows* with Validity Test, Reliability, Normality, Multicollinearity, Heteroscedasticity, Multiple Regression Analysis, and Hypothesis Test.

3. RESULTS AND DISCUSSION

RESULTS

a. Test the Validity Test the Validity of Science Comic Media 02. Test the Validity of Science Comic Media Variables

The data above was obtained using SPSS 25, indicating that each item has a significance value of <0.05 and a Pearson Correlation value > 0.361. From these data, it can be concluded that all items are valid, meaning that the instrument used can be said or considered capable of measuring what is to be measured or desired.

b. Test the Variable Validity of the Problem-Based Learning Method

Table 03. Test the Validity of Problem-Based Learning Variables

	X1_TOTAL	R TABLE	VALID
X1_ITEM_1	,652**	0,361	VALID
X1_ITEM_2	,490**	0,361	VALID
X1_ITEM_3	,602**	0,361	VALID
X1_ITEM_4	,806**	0,361	VALID
X1_ITEM_5	,600**	0,361	VALID
X1_ITEM_6	,681**	0,361	VALID
X1_ITEM_7	,605**	0,361	VALID
X1_ITEM_8	,579**	0,361	VALID
X1_ITEM_9	,693**	0,361	VALID
X1_ITEM_10	,702**	0,361	VALID
X1_ITEM_11	,822**	0,361	VALID
X1_ITEM_12	,591**	0,361	VALID
X1_ITEM_13	,539**	0,361	VALID
X1_ITEM_14	,446**	0,361	VALID
X1_ITEM_15	,625**	0,361	VALID
X1_ITEM_16	,651**	0,361	VALID
X1_ITEM_17	,502**	0,361	VALID
X1_ITEM_18	,792**	0,361	VALID
X1_ITEM_19	,744**	0,361	VALID
X1_ITEM_20	,726**	0,361	VALID
X1_ITEM_21	,726**	0,361	VALID
X1_ITEM_22	,668**	0,361	VALID
X1_ITEM_23	,695**	0,361	VALID
X1_ITEM_24	,762**	0,361	VALID
X1_ITEM_25	,836**	0,361	VALID
X1_ITEM_26	,723**	0,361	VALID
X1_ITEM_27	,586**	0,361	VALID
X1_ITEM_28	,788**	0,361	VALID
X1_ITEM_29	,552**	0,361	VALID
X1_ITEM_30	,538**	0,361	VALID
X1_ITEM_31	,384**	0,361	VALID
X1_ITEM_32	,476**	0,361	VALID
X1_ITEM_33	,701**	0,361	VALID
X1_ITEM_34	,787**	0,361	VALID
X1_ITEM_35	,646**	0,361	VALID
X1_ITEM_36	,717**	0,361	VALID
X1_ITEM_37	,678**	0,361	VALID

The results of the validity test above using SPSS 25, show that each item has a significance value of <0.05 and a Pearson Correlation value > 0.361. It can be concluded that all items are valid, meaning that the instrument is considered appropriate/capable of measuring the attribute in question.

a. Reliability Test

1) Science Comic Media Variable Reliability Test

Table 04. Science Comic Media Reliability Test

Reliability Statistics

Cronbach's Alpha	N of Items
,866	17

The reliability test aims to determine whether the survey is consistent when the measurement is carried out in repeat surveys. The results of the reliability test above using SPSS 25 show that 17 items can be reliable in accordance with the basis for decision-making according to Wiratna Sujerweni (2014) whose Cronbach alpha value is> 0.6.

2) Test the Variable Reliability of the Problem-Based Learning Method

Table 05. Test of Variable Reliability of the Problem-Based Learning Method

Reliability Statistics	
Cronbach's Alpha	N of Items
,958	37

The reliability test aims to determine whether the survey is consistent when the measurement is carried out in repeat surveys. The results of the reliability test above using SPSS 25 show that 37 items are reliable as the basis for decision-making. Wiratna Sujerweni (2014) states that the Cronbach alpha value is> 0.6.

b. Normality test

1) Science Comic Media Variable Normality Test

Table 06. Test for normality of Science Comics Media Variables

One-Sample Kolmogorov-Smirnov Test	
Statistics Test	,095
Asymp. Sig. (2-tailed)	,080

From the results of the Normality Test, a significance value of 0.080 was obtained, which was more significant than 0.05. It can be concluded that the residual values are normally distributed.

2) Variable Normality Test Problem-Based Learning Method

Table 07. Variable Normality Test Problem-Based Learning Method

One-Sample Kolmogorov-Smirnov Test	
Statistics Test	,091
Asymp. Sig. (2-tailed)	,188

From the results of the Normality Test, a significance value of 0.188 was obtained, and it was more significant than 0.05. It can be concluded that the residual values are normally distributed.

c. Linearity Test

Linearity Test of Science Comic Media Variables and PBL Methods with Learning Outcomes

Table 08. Linearity Test of Science Comics Media Variables and PBL Methods with Learning Outcomes

ANOVA Table

		Sum of Squares	df	Mean Square	F	Say.
Learning outcomes	Linearity	,000	1	,000	,000	1,000

From Sig. The linearity obtained is 1.000, which is greater than 0.05. It can be concluded that there is a linear relationship between Science Comics Media and Methods of Problem-Based Learning on student learning outcomes.

d. Multicollinearity Test

Table 09. Multicollinearity Test of Science Comics Media Variables and PBL Methods with Learning Outcomes

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	Science Comics Media	,668	1,496
	Method PBL	,668	1,496

a. Dependent Variable: Learning Outcomes

From the data above, it can be seen that the Tolerance value for Variable X1 (Science et al. and X2 Variable (PBL Method) is 0.668, and the VIF value is 1.496, so it can be concluded that the Tolerance value > 0.100 and VIF < 10.00 indicates that there are no symptoms of Multicollinearity.

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Say.
1	(Constant)	10,160	7,804		1,302	,197
	Science Comics Media	-,042	,103	-,059	-,412	,681
	Method PBL	-,001	,105	-,002	-,012	,990

a. Dependent Variable: RES2

e. heteroscedasticity Test

Table 10. Heteroscedasticity Test of Science Comic Media Variables and PBL Methods with Learning Outcomes From the data above, it can be seen that the significance value is > 0.05 both in Variable X1 (Science et al.) and in X2 Variable (PBL Method), so it can be concluded that there is no Heteroscedasticity. Based on Ghozali (2016), for a good research model, there is no heteroscedasticity, meaning that there are similarities in the variance of the residuals for all observations in the regression model, so it can be concluded that there is an effect of the independent variables on the dependent variable.

f. Regression Test

1) Regression Test of Science Comic Media Variables and PBL Methods on Learning Outcomes

- If the sig value < 0.05 or F count > F table, then there is a simultaneous effect of variable X on variable Y

- If the sig value > 0.05 or F count < F table then there is no effect

ANOVA[a]						
1	Model	Sum of Squares	df	Mean Square	F	Say.
	Regression	2954,936	2	1477,468	20,062	,000[b]
	Residual	5449,739	74	73,645		
	Total	8404,675	76			

a. Dependent Variable: Learning Outcomes
b. Predictors: (Constant), PBL Method, Media Science Comics

- Variable X is simultaneous to variable Y

g. Hypothesis test

Based on the output above, it is known that the significance value for the influence of X1 (Comic Media) and X2 (PBL Method) simultaneously on Y (Learning Outcomes) is 0.000 <0.05 and F counts 20.062 > F table 3.119, so it can be concluded that H3 is accepted which means that there is an influence of X1 (Comic Media) and X2 (PBL Method) simultaneously on Y (Learning Outcomes). F tables in Excel can be calculated through formulas

F_{table} = F (k ; n-k)
= F(2;77-2)
= F (2;75)
= 3,119

Description: F = testing the hypothesis based on the F test
k = Number of independent variables
n = Number of samples (respondents)

4. DISCUSSION

Learning success or effectiveness is a yardstick that can be used in the learning process. When learning takes place effectively, the development of student learning can increase and will be a reflection both for the teacher and the students themselves.

For this reason, teachers must continue to be creative and innovative in designing learning, considering the needs of students' interests. In this study, the teacher designed the learning process through Science Comic Media with the PBL method.

Puriasih, K. N., & Trisna, G. A. P. S. (2022) said that the PBL method invites students to find solutions to existing problems and explore their knowledge and skills to further deepen knowledge so that the expected results are maximized.

In line with Musdiani in Dita, P. P. S. (2021), the PBL method allows him to be independent in learning and get to know each other in group study to find solutions that must be taken from a problem. It is also said that interactive learning can be done by simulating problems to stimulate students to be curious in digging up information, analyzing, synthesizing, and applying that information with critical reasoning. Also, Safitri, I. D. (2022), problem-based comic learning can increase the effectiveness of student learning, and maximum learning success can be achieved.

(Maulana, 2020) also argues that learning through PBL-based comic media has a perfect effect on scientific literacy skills; the same is true when learning with the PBL method through learning video media related to phenomena and problems that occur in everyday life (Sekarwangi, 2021) by D. A. et al (2019) that the learning process using PBL-based comics can integrate conceptual material regarding problems that occur in everyday life so that students try to dig up information to build their knowledge in finding solutions to problems that exist in these comic stories.

(Susanto, 2022) his research also concluded that PBL can increase critical thinking in students in line with the opinion (Khoiryah, 2021) in his journal entitled Effectiveness of Comics to Train Students' Critical Thinking Skills in Physics Learning. (Umarella, 2019) said that PBL learning is the same as simulated learning, which adds knowledge to students.

Learning through the student-oriented PBL method begins by confronting a contextual problem presented in the form of Comic Media with easy-to-understand language and images to provide a stimulus for students to continue trying to dig up information so that students can reason critically and find solutions to these problems. After carrying out the learning process, the teacher evaluates the success of the learning. The average score obtained was 79 out of 77 students, and 56 students passed based on the KKM score, which was 75 or around 72.7% of students who passed.

Based on the results of the multiple regression test using SPSS 25 in the Anova table, it is known that the significance value for the simultaneous effects of X1 (Comic Media) and X2 (PBL Method) on Y (Learning Outcomes) is 0.000 <0.05 and F counts 20.062 > F table 3.119. It can be concluded that there is an effect of X1 (Comic Media) and X2 (PBL Method) simultaneously on Y (Learning Outcomes).

5. CONCLUSION

Based on the results of the analysis and discussion concerning the existing hypothesis with a confidence level of a = 0.05 or 95%, it can be concluded that there is a positive influence from Science Comics Media and the PBL Method simultaneously on learning effectiveness, which can be measured from student learning outcomes. This can be proven through the Multiple Regression test using SPSS 25 in the ANOVA table. It is known that the significance value for the influence of Science Comic Media and PBL Methods on Learning Outcomes is 0.000 <0.05, and F counts 20.062 > F table 3.119.

Based on the R Square value of 0.347, this implies that the effect of variables X1 (Comic Media) and X2 (PBL Method) simultaneously on variable Y (Evaluation Results) is 34.7%.

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