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Implementation of an Integrated Problem Based Learning Model in Generic Science Skills in Acid-Base Material

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Abstract: *This research was carried out on the basis of the dominance of the use of lecture methods and the lack of use of learning tools in learning especially on Acid-Base material at SMAN 1 Purba. This research aims to (1) know significant influence between prior knowledge and LKPD on learning outcomes. (2) knowing the difference in learning outcomes between high initial knowledge and low initial knowledge. The population of this study were all class XI SMAN 1 Purba consisting of 3 classes by determining 1 class as the research sample, namely class XI-1 using purposive sampling techniques. This research uses multiple linear regression test and Independent Sample t-Test. Based on data analysis, values are obtained the average EPA is 78.24; 86.00; 72.62, average LKPD value is 78.82; 87.06; 74.12 and the average EHB value is 79.26; 88.97; 82.47. Observation data from the observation sheet the average value obtained was 82.06; 87.57; 82.50. Based on the multiple linear regression test, there is a significant influence between initial knowledge and LKPD on learning outcomes. Results Independent Sample t-Test There is a significant difference in learning outcome scores between students with initially high ability and students with low initial ability.*

Keywords: *Generic Science; Learning Models; Problem Based Learning; Acid and Base*

INTRODUCTION

Education is a learning process as a conscious and systematic effort for students to be able to understand, comprehend, and make people more critical in thinking and every experience that has a formative effect on people's ways. The current era of global competition demands quality learning to provide facilities for students to develop skills, skills and abilities as capital to face challenges in global life (Sofyan, 2019).

Based on the results of direct interviews with chemistry teachers at SMAN 1 Purba and several class XI students there, data was obtained that the difficulties experienced by students were saying that chemistry was fun but difficult to understand the basic concepts. Students do not have the initial knowledge to understand the material and cannot work on HOTS questions. There are low student chemistry scores, especially in acid-base material, namely around 85% of students have not obtained satisfactory scores.

Education is always related to the curriculum. The curriculum is a tool used to achieve educational goals, so it can be said that the curriculum is a reference for the

process of implementing education in Indonesia. This certainly describes the educational goals that will be achieved in education. The curriculum was created with the aim of simplifying the educational process. The implementation of the independent curriculum refers to the Pancasila student profile, where graduates who are competent and uphold character values are produced. The implementation of the independent curriculum in driving schools is optimal and ongoing, although in the implementation of the independent curriculum there are still many obstacles and (Andari, 2022). In the independent curriculum, there are several learning models applied in learning, namely, Problem Based Learning (PBL), Project Based Learning (PJBL), Inquiry Learning and Discovery Learning.

The problem-based learning model is a model that invites students to reconstruct their own knowledge and develop the skills they have. PBL can increase students' activities in learning such as expressing, asking, answering questions, participating in discussions and many more which of course will influence the students' learning outcomes (Pratiwi & Setyaningtyas, 2020).

In applying the problem-based learning model to learning, skills are needed that can link the learning model to the generic science skills (KGS) possessed by students. During the learning process, students must be actively involved to improve Generic Science Skills (KGS). KGS is a basic skill that can be developed through studying chemistry. This skill is needed by students as a preparation for learning the concepts contained in chemistry learning at a higher level. KGS is needed to train students' scientific work, so that students are able to understand concepts, solve problems scientifically, and are able to learn on their own effectively and efficiently (Rosidah et al., 2017). The application of the problem-based learning model can be maximized by using learning tools, namely Initial Knowledge Evaluation (EPA), Teaching Materials (BA), Student Worksheets (LKPD) and Learning Outcome Evaluation (EHB). Evaluation of students' initial knowledge is the starting point to see students' readiness to participate in the learning process.

This research implementation the learning tools that have been developed, the learning tools include Initial Knowledge Evaluation Test Instruments, Teaching Materials, Student Worksheets, and Student Learning Outcome Evaluation Question Instruments. Based on the description stated above, the researcher is interested in conducting research entitled “Implementation of an Integrated Problem Based Learning Model with Generic Science Skills in Acid-Base Material”.

LITERATURE REVIEW

Initial Capabilities

Students' initial abilities are a prerequisite for participating in learning so that they can carry out the learning process well. A person's abilities are obtained from training throughout his life, and what is brought to face a new experience (Astuti, 2015). These differences can influence students to manage the information obtained and then interpret it. Students' differences in processing and integrating new information can influence students in thinking, remembering, applying and creating new knowledge. Initial abilities are abilities that are seen as input that students must have before learning. Students who have initial abilities will find it easier to understand and learn new subject matter. If students already know the learning material, it will be easier for students to develop the initial abilities they already have into new, broader abilities. Students who understand the concept of learning will be able to convey the material again using their own language without changing the true meaning of the material itself. This is what makes initial abilities and understanding of concepts interrelated with each other and will of course influence students' learning outcomes (Rahmadani et al., 2022).

Learning Model

A model is a projection, presentation, representation or summary description that illustrates an object, system or principle that is often imagined or realized. A learning model is a particular learning approach that includes teaching materials such as films, books, programs and curricula that are systematically designed based on learning theories or research on the ways in which students achieve their goals and have access to a learning environment, the interaction process is used to help learning produces better results (Dakhi et al., 2020).

A learning model is a conceptual framework that describes systematic procedures for organizing learning experiences to achieve certain learning goals and functions as a guide for learning designers and teachers in planning and implementing learning activities (Kristina et al., 2020).

Problem Based Learning (PBL)

Problem Based Learning (PBL) is a learning model in which students are faced with real problems that students have experienced (Ardianti et al., 2022). Kurniawan & Wuryandani (2017), stated that the problem-based learning model is a form of learning that is based on the constructivist paradigm which prioritizes students in learning and is oriented towards the process of learning activities.

Problem-based learning is a type of teaching that engages students in active, collaborative, student-centered learning, and also maximizes their capacity for problem solving and independent learning. Problem-based learning shows student involvement in experiential learning through authentic experiences that are reflected in a student-centered chemistry curriculum (Dibyantini et al., 2021).

Generic Science Skills

Generic Science Ability is an intellectual ability resulting from a combination or complex interaction between scientific knowledge and skills. Generic skills are cognitive strategies that can be related to cognitive, affective and psychomotor aspects that can be learned and left behind by students (Ulia et al., 2017). Generic science skills are students' ability to think and act based on students' scientific knowledge, which is obtained from the results of learning science. Generic science skills are also abilities and attributes for life and work. Generic science skills can be used for all types of work, including basic competencies or key abilities that include cognitive, personal and interpersonal abilities related to various career levels.

To improve students' generic science skills and student learning outcomes, an appropriate learning model is needed, because generic science abilities rely on understanding concepts and problem solving. The application of the problem-based learning model is able to improve students' generic science skills with indicators of direct observation, indirect observation, cause and effect laws, logical inference, and a logical framework that adheres to principles. So a learning model is needed that invites students to solve problems in real life (Dibyantini & Azaria, 2020).

Teaching materials

Teaching materials are those that are designed systematically based on a certain curriculum and are packaged in the form of the smallest learning units and allow them to be studied independently in a certain amount of time so that students are able to master the competencies being taught. Teaching materials in chemistry learning are used as supplemental learning resources for students in studying the material. Apart from that, by using teaching materials students can learn independently. Teaching materials can support the teacher's role in the learning process because the teacher's role in learning using modules can be minimized, so that learning is more student-centered and the teacher acts as a facilitator in the chemistry learning process no longer dominating learning (Andriani et al., 2019).

LKPD (Student Worksheets)

Student Worksheets, also known as LKPD, are student activities that are applied in the classroom to apply or implement lesson material that has been studied previously. It is very important to understand students' job responsibilities to apply and understand new information provided using Student Worksheets (Widodo, 2017). LKPD is a learning aid consisting of sheets of paper containing student guidance materials and tips for carrying out learning tasks that must be carried out by capable students, both experts in theory and practice. In addition, LKPD uses certain directions to collect information, create products, and other similar tasks (Ainun et al., 2021).

Evaluation of Learning Outcomes

Evaluation is very much needed in various activities of daily human life, because whether we realize it or not, evaluations are actually often carried out, both for ourselves and other social activities (Mahirah, 2017).

Evaluation of learning outcomes is a systematic process carried out to see or monitor students' learning progress with predetermined standards and goals. Evaluation of learning outcomes is not just about giving grades spontaneously, but is also supported by accurate information (Rusandi, 2017).

Acid Base

Since ancient times, acids and bases have been understood. Acid comes from the Latin word acetum, which means vinegar. The word base (alkali) comes from Arabic which means ash, which is another name for hydroxide. Chemical substances known as bases and acids are often found in life. When consumed, various types of food have different tastes. This is because the chemical properties of food ingredients contain basic and acidic compounds.

METHOD

The population of this study was class XI SMA Negeri 1 Purba who studies chemistry using the Merdeka curriculum which consists of 3 classes, namely classes XI-1, XI-2, XI-3 with a total of around 100 students. The sample in this study used one class is class XI-1 and the sampling technique from the population is purposive sampling.

The research design used is a dual paradigm with two independent variables and one dependent variable.

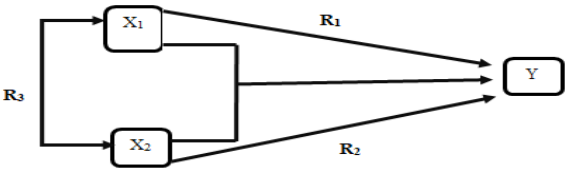

Figure 1. Dual paradigm shows the relationship between two independent variables and one dependent variable

Information:
X_1 = EPA
X_2 = LKPD
Y = EHB
R_1 = The relationship between EPA and student learning outcomes
R_2 = The relationship between LKPD and student learning outcomes
R_3 = The relationship between EPA, LKPD and learning outcomes

The research instrument used by researchers is a test instrument using an initial knowledge instrument consisting of two types of instruments, namely scholastic tests and evaluation tests of chemistry learning outcomes. This instrument is in the form of a multiple-choice test with 5 answer options. Where the scholastic test and the instrument of the chemistry learning outcome evaluation test amount to 20 questions each, the student worksheet questions are 15 questions and the learning outcome evaluation instrument is 20 questions that will be given at the end of learning and the Non-Test Instrument used is the Student Observation Sheet. The observation sheet aims to determine the involvement of teachers and students during the learning process. Non-test instruments used as many as 10 Observation Descriptors with Likert scales 1 – 4.

RESULTS AND DISCUSSION

The research was conducted three times at SMA Negeri 1 Purba in January of the 2023/2024 academic year. The data obtained

in this study are the value of Initial Knowledge Evaluation, Student Worksheets, and Learning Outcomes Evaluation on Acid-Base material. The number of students involved in this study was 34 students from class XI-1 who were treated with the Problem Based Learning Integrated Generic Science Skills learning model.

Student Learning Outcomes

This research uses multiple linear regression tests and Independent Sample t-Test.

1. EPA, LKPD and EHB Result Data

The EPA, LKPD, and EHB data obtained during the research can be seen in Table 1 below:

Table 1. EPA, LKPD, and EHB result data

Data Type		Meeting I (N = 34)	Meeting II (N = 34)	Meeting III (N = 34)
EPA	Minimum Value	60	66	50
	Maximum Value	100	100	92
	Average	78.24	86.00	72.62
LKPD	Minimum Value	60	60	60
	Maximum Value	100	100	80
	Average	78.82	87.06	74.12
EHB	Minimum Value	44	50	43
	Maximum Value	89	100	100
	Average	79.26	88.97	82.47

Based on the results of the average score of Initial Knowledge Evaluation (EPA), Student Worksheets (LKPD) and Learning Outcomes Evaluation (EHB) from meeting one to meeting three there was an increase, in meeting three there was a decrease in the average score because there were still students whose preparation for learning was still lacking which can be seen from the low Initial Knowledge Evaluation (EPA) score, low LKPD scores and low learning outcomes. This happens because there are other influencing factors such as internal and external factors such as motivation, interests and family or classmate environment. From the data calculation table, the EPA, LKPD, and EHB results are depicted in the following figure 1.

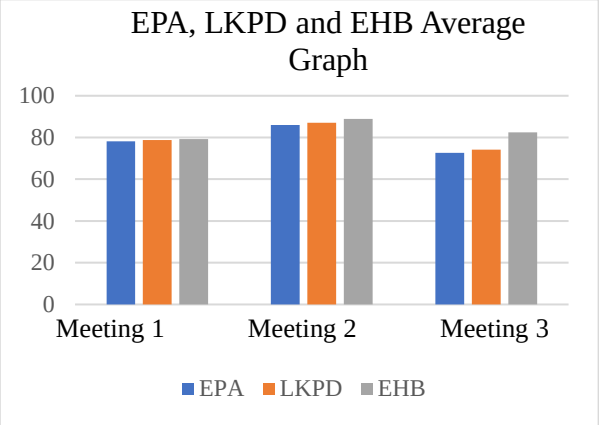

Figure 2. Graph of average EPA, LKPD, and EHB

2. Data from Observation Results Observation Sheet

The observation sheet aims to determine the involvement of teachers and students during the learning process. Data from the student learning observation sheet can be seen in Table 2.

Table 2. Results of student learning observation sheets

Observation Sheet Data	Meeting I	Meeting II	Meeting III
N	34	34	34
Minimum Value	50	55	52.5
Maximum Value	100	100	100
Average value	82.06	87.57	82.50

Based on table 2 above, it is obtained the average value of the student learning observation sheet at the first meeting to the third meeting in a row was 82.06; 87.57; 82.50. At the meeting the three average scores of student activity decreased experiencing problems where there were still many students who were afraid to ask questions so that participants were less active in learning.

Normality Test

The EPA, LKPD, and EHB data obtained were first tested for data normality to find out whether the data was normally distributed or not. By using the Shapiro-Wilk test at the significance level α (0.05). EPA, LKPD and EHB normality test results data can be seen in Table 3.

Table 3. Data normality test

Data	*Shapiro-Wilk* Sig	Sig level	Information
EPA	0.095	0.05	Normally Distributed Data
LKPD	0.060	0.05	Normally Distributed Data
EHB	0.138	0.05	Normally Distributed Data

Based on the data in table 3, the data results show that the EPA, LKPD and EHB of students who use the Problem Based Learning (PBL) model integrated with Generic Science Skills (KGS) have a sig value > α (0.05), so it can be concluded that the EPA, LKPD and EHB data are normally distributed.

Homogeneity Test

By using Levene's test at the significance level α (0.05). Data from the EPA, LKPD and EHB Homogeneity test results can be seen in Table 4:

Table 4. Homogeneity test results

Data	*Levene Sig*	Sig level	Information
EPA	0.208	0.05	Homogeneous Data
LKPD	0.751	0.05	Homogeneous Data
EHB	0.565	0.05	Homogeneous Data

Based on the data in table 4, the data results show that EPA, LKPD and EHB which use the Problem Based Learning (PBL) model integrated with Generic Science Skills (KGS) have a significance value is > α (0.05), which means that the EPA, LKPD and learning outcomes data are homogeneous.

Hypothesis testing

The hypothesis tests carried out were multiple linear regression tests and Independent Sample T-Test.

1) Multiple Linear Regression Test

1. Significant Influence between EPA on Learning Outcomes

a. Partial t test

Data from the partial t test can be seen in Table 5.

Table 5. EPA Partial t test of EHB

Coefficients a

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	6.409	4.747		1.350	.186
	EPA	.966	.062	.940	15.645	.001

a. Dependent Variable: EHB

Based on the data in table 5 showing a constant value of 6.409, it can be interpreted that the consistent value of the participation variable is 6.409. The regression coefficient X_1 of 0.966 states that for every 1% increase in the EPA value, the participation value increases by 0.966. The regression coefficient is positive, so it can be said that the direction of influence of variable X_1 on Y is positive. Based on the significance value of the EPA partial t test on EHB, it was obtained at 0.001 < 0.05, so it can be concluded that the EPA variable (X1) has an effect on the EHB variable (Y).

b. F test

The F test was carried out to determine the effect of EPA on EHB together using the SPSS 29.0 program at a significance level of 5% or 0.05, which can be seen in Table 6:

Table 6. EPA Partial F Test of EHB

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.674.611	1	2674.611	244.778	.001b
	Residual	349.654	32	10.927		
	Total	3.024.265	33			

a. Dependent Variable: EHB
b. Predictors: (Constant), EPA

Based on the data in table 6, it shows that the calculated F value is 244.778 with the significance level of the EPA F test on EHB being < 0.001. The results obtained show that the significance value is smaller than 0.05 (sig value < α (0.05)). Thus, it can be concluded that EPA has a significant effect on EHB

c. Test R^2

The R^2 test was carried out to determine how much influence EPA has on

EHB at a significance level of 5% or 0.05. Data from the R^2 test can be seen in Table 7:

Table 7. EPA R^2 test for EHB

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.940a	.884	.881	330.555

a. Predictors: (Constant), EPA

The table shows the correlation value (R) which is 0.940 while the coefficient of determination (R square) value is 0.884. This means that the influence of the independent variable (EPA) on the dependent variable (EHB) is 88.4%. Meanwhile, 11.6% was influenced by other variables.

2. Significant influence between LKPD on learning outcomes

a. Partial t test

Data from the partial t test can be seen in Table 8:

Table 8. LKPD Partial t test on EHB

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	6.735	5.261		1.280	.210
	LKPD	.947	.067	.928	14.053	.001

a. Dependent Variable: EHB

Based on the data in table 8, it shows a constant value of 6.735. So, it can be interpreted that the consistent value of the participation variable is 6.735. The regression coefficient is positive, so it can be said that the direction of influence of variable X on Y is positive. Based on the significance value of the LKPD partial t test on EHB, it was obtained at 0.001 < 0.05, so it can be concluded that the LKPD variable (X_2) has an effect on the EHB variable (Y).

b. F test

The F test was carried out to determine the effect of LKPD on EHB together using the SPSS 29.0 program at a significance level of 5% or 0.05, which can be seen in Table 9:

Table 9. LKPD Partial F Test on EHB

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2602.571	1	2.602.571	197.495	.001b
	Residual	421.694	32	13.178		
	Total	3.024.265	33			

a. Dependent Variable: EHB

b. Predictors: (Constant), LKPD

Table 9 shows the calculated F value of 197.495 with the significance level of the LKPD F test on EHB being < 0.001. The results obtained show that the significance value is smaller than 0.05 (sig value <α(0.05)). Thus, it can be concluded that LKPD has a significant effect on EHB

c. Test R^2

The R^2 test was carried out to find out how much influence LKPD has on EHB at a significance level of 5% or 0.05. Data from the R^2 test can be seen in Table 10.

Table 10. R^2 LKPD test against EHB

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.928a	.861	.856	363.014

a. Predictors: (Constant), LKPD

The table shows the correlation/ relationship value (R) which is 0.928 while the coefficient of determination (R square) value is 0.861. This means that the influence of the independent variable LKPD on the dependent variable (EHB) is 86.1%. Meanwhile, 13.9% was influenced by other variables.

3. Significant Influence between EPA and LKPD on Learning Outcomes

a. Partial t test

Data from the partial t test can be seen in Table 11.

Table 11. EPA and LKPD Partial t test on EHB

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3.776	4.420		.854	.399
	EPA	.586	.148	570	3.959	.001
	LKPD	.408	.147	400	2.774	.009

a. Dependent Variable: EHB

Based on the data in table 4.11, it can be seen that the significance value of the partial t test EPA and LKPD against EHB is <0.001 and 0.009 respectively. The constant value obtained is 3.776 then it can be interpreted if the independent variable is 0 (constant) then the value of the dependent variable is 3.776. Furthermore, the value of the regression coefficient of the variable X1 evaluation of initial knowledge is positive, which is 0.586. This means that if variable X1 increases by one unit in variable X1 (EPA), then the value of variable Y (learning outcomes) will increase by 0.586 units assuming other independent variables remain and the value of the regression coefficient of variable X2 (LKPD) is positive at 0.408. This means that if variable X2 increases by one unit in variable X2 (LKPD), then the value of variable Y (learning outcomes) will increase by 0.408 units assuming other independent variables remain. The results obtained show that the significant value of < α (0.05). Thus, it can be concluded that H_a is accepted and H_0 is rejected meaning that EPA and LKPD partially have a significant effect on EHB.

The results of research conducted by Hikmah (2018), show that students' initial knowledge has a positive and significant influence on student learning outcomes. Likewise, the results of research by Silitonga et al. (2022), stated that initial knowledge is very influential on learning outcomes. The greatest contribution is initial ability, this is understandable because initial ability is the basis for understanding concepts in starting a new concept that describes students' readiness to enter a new material. Likewise, the results of research conducted by Nofriyanti & Hardeli (2023), regarding the influence of LKPD on learning outcomes said that 95% of students are interested in using LKPD based on the PBL model.

The use of LKPD provides opportunities for students to be active in the learning process so that when the LKPD score obtained is high, it will obtain high learning outcomes and vice versa when the LKPD score obtained is low, the learning outcomes are low. Likewise, the results of research by Hastuti et al. (2023) stated that LKPD also has a positive and significant effect on EHB which states that the use of LKPD in the learning process can improve student learning outcomes. The use of LKPD can make students active in learning and students collaborate with their friends so that learning is not only monotonous. In LKPD there are errors and questions that will be done by students that are made according to learning objectives and interesting that can make student learning outcomes increase, it can be concluded that LKPD affects learning outcomes although not as big as the influence of Initial Knowledge, but LKPD contributes to improving student learning outcomes.

b. F test

The F test was carried out to determine the effect of EPA on EHB together using the SPSS 29.0 program at a significance level of 5% or 0.05 which can be seen in Table 12 below.

Table 12. EPA and LKPD F test for EHB

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2.744.160	2	1372.080	151.852	.001b
	Residual	280.105	31	9.036		
	Total	3.024.265	33			

a. Dependent Variable: EHB
b. Predictors: (Constant), LKPD, EPA

It can be seen that the significance value of the F EPA and LKPD tests on EHB is < 0.001. The results obtained show that the significance value is smaller than 0.05 (sig value < α (0.05)). Thus, it can be concluded that EPA and LKPD simultaneously have a significant effect on EHB.

c. Test R^2

The R^2 test was carried out to determine how much influence EPA and LKPD have on EHB at a significance level of 5% or 0.05. Data from the R^2 test can be seen in Table 13.

Table 13. EPA and LKPD R^2 test for EHB

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.953a	.907	.901	3.00593

a. Predictors: (Constant), LKPD, EPA

Table 13 shows the correlation/ relationship value (R) which is 0.953 while the determination coefficient (R square) value is 0.907. This means that the influence of EPA and LKPD on EHB simultaneously (together) is 90.7%. Meanwhile, 9.3% is influenced by other variables.

2) Independent Sample t-Test

In this study, the Independent Sample T-Test was carried out to determine whether there was a difference in EHB between students with high EPA and students with low EPA using the SPSS 29.0 program at a significance level of 5% or 0.05. Data results from the Independent Sample t-Test can be seen in Table 14.

Table 14. Independent Sample T-Test

Independent Samples Test

		F	Sig	t	df	Sig
EHB	Equal Variances assumed	3.027	.092	7.214	32	.001
	Equal Variances not assumed			9.390		.001

Based on Table 14, it shows that the significance value of the Independent Sample t-Test is smaller than 0.001. These results show a significance value smaller than 0.05 (sig α value (0.05)). Thus, it can be concluded that there is a difference in EHB between students with high EPA and students with low EPA. So, H_a is accepted and H_0 is rejected. This is in line with the results of research conducted by Hikmah (2018), which states that students who have high initial abilities will get high learning outcomes, and students who have low initial abilities are likely to have low learning outcomes because students have not been able to master basic concepts as a guide to learn the material to be taught.

Likewise, the results of research conducted by Situmorang et al. (2023), explained that the higher the level of initial knowledge a student has, the higher the learning outcomes obtained by the student. This is due to the high ability of these students to find and investigate concepts. The success of students in learning depends on the readiness of these students. One such readiness is his initial ability or knowledge. Students must have initial knowledge because initial knowledge is about the material that is a prerequisite for learning the next material that is continuous. Many students in understanding lessons depend on initial skills that provide memory for students in finding the information they need and when they need it. Initial ability is considered as the accumulation of intelligence possessed at the beginning of learning material that can be used where and when quickly (Panggabean et al., 2022).

CONCLUSION

From the overall data analysis that has been carried out, the following conclusions can be drawn: There is a significant effect between EPA and LKPD on EHB, both partially and simultaneously with a sig of $0.001 < \alpha$ (0.05). The influence of EPA and LKPD on EHB is 90.7%, while 9.3% is influenced by other variables that can come from internal and external factors. The contribution of influence from EPA and LKPD on learning outcomes was 58.6% and 40.8%. When compared with the contribution of mathematical ability with initial ability to chemistry learning outcomes, the greatest contribution is initial ability. This is understandable because initial ability is the basis for understanding concepts in starting a new concept that describes students' readiness to enter a new material. There are differences in the learning outcomes of students who have low

EPA and high EPA with a significant value of 0.001 < α (0.05) and a calculated T value of 7,214 > T table 2,037. Where students who have high EPA then the learning outcomes obtained are high, while students who have low EPA learning outcomes obtained are also low.

When compared with this research with previous journals researched by Silitonga et al. (2022),based on the results of their research stated that the influence of early knowledge contributed greatly to learning outcomes by 33.64%, while the results of research by Mursalim & Rumbarak (2021), stated that the influence of LKPD contributed greatly to improving student learning outcomes by 74%. From the results of these two studies, the biggest contribution is LKPD, while in this study, the largest contribution is initial knowledge.

By utilizing the PBL learning model and integrating it with science skills, especially in chemistry subjects, it has been proven in this research that it can improve student learning outcomes in acid-base material, and this can also be an alternative for use in other materials and can be developed more variedly with models. other learning models and using learning tools so that learning is more effective in the future.

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