Implementation of Discovery Learning Model Integrated with Science Generic Skills to Improve Higher Level Thinking Ability on Thermochemical Material

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Abstract: Implementation of Discovery Learning Model Integrated with Science Generic Skills to Improve Higher Order Thinking Skills on Thermochemistry Material. This study aims to determine the effect of Evaluation of Prior Knowledge (EPA) and Learner Worksheets (LKPD) on students' higher order thinking skills expressed in the form of Evaluation of Learning Outcomes (EHB) by using the Discovery Learning (DL) learning model integrated with Science Generic Skills (KGS) on Thermochemical Material. This research is a descriptive study with a quantitative approach carried out at SMA Swasta Methodist Tanjung Morawa T.A 2023/2024 with all XI PSP classes as the population and XI PSP classes that take Chemistry subjects on Thursdays obtained by purposive sampling technique as research samples. The research design used is a double paradigm with two independent variables namely; EPA and LKPD, and one dependent variable namely; EHB. The test instruments used in this study were EPA, LKPD and EHB as many as 25 items developed by previous researchers and non-test instruments in the form of student observation sheets. The results showed that there was a significant influence between EPA and LKPD on EHB. From the independent t-test that has been done, students with high EPA get higher EHB than students with low EPA.

Keywords: DL integrated KGS, EPA, LKPD, EHB, Thermochemistry.

Abstrak: Implementasi Model Pembelajaran Discovery Learning Terintegrasi Keterampilan Generik Sains Untuk Meningkatkan Kemampuan Berpikir Tingkat Hight Pada Materi Termokimia. Penelitian ini bertujuan untuk mengetahui pengaruh Evaluasi Pengetahuan Awal (EPA) dan Lembar Kerja Peserta Didik (LKPD) terhadap keterampilan berpikir tingkat Hight peserta didik yang dinyatakan dalam bentuk Evaluasi Hasil Belajar (EHB) dengan menggunakan model pembelajaran Discovery Learning (DL) yang diintegrasikan dengan Keterampilan Generik Sains (KGS) pada Materi Termokimia. Penelitian ini merupakan penelitian deskriptif dengan pendekatan kuantitatif yang dilaksanakan di SMA Swasta Methodist Tanjung Morawa T.A 2023/2024 dengan seluruh kelas XI PSP sebagai populasi dan kelas XI PSP yang mengikuti mata pelajaran Kimia pada hari Kamis yang diperoleh dengan teknik purposive sampling sebagai sampel penelitian. Desain penelitian yang digunakan adalah paradigma ganda dengan dua variabel bebas yaitu; EPA dan LKPD, dan satu variabel terikat yaitu; EHB. Instrumen tes yang digunakan dalam penelitian ini adalah EPA, LKPD dan EHB sebanyak 25 butir soal yang dikembangkan oleh peneliti sebelumnya dan instrumen non-tes berupa lembar observasi peserta didik. Hasil penelitian menunjukkan bahwa terdapat pengaruh yang signifikan antara EPA dan LKPD terhadap EHB. Dari uji independent t-test yang telah dilakukan, peserta didik dengan EPA Hight mendapatkan EHB yang lebih Hight daripada peserta didik dengan EPA rendah..

Kata kunci: DL teritegrasi KGS, EPA, LKPD, EHB, Termokimia.

- **INTRODUCTION**

Indonesian education experiences a variety of problems that are the biggest challenge in realizing quality education. These problems are divided into 2 parts. First, problems in the micro scope, namely learning methods that are too monotonous, inadequate facilities and infrastructure, and low achievement of students. Second, problems in the macro scope, namely the curriculum used is confusing and too complex, as well as education that is still uneven, placement problems and the low quality of teachers owned, and the cost of education that tends to be expensive (Ginting et al., 2022). Each individual learner is equipped with basic skills from birth consisting of the skills of behaving, thinking, and doing. Thus, each learner should be able to develop their talents and basic skills (Arsy and Octarya, 2022). In addition to skills, other challenges faced are subject matter that is more difficult and complex, as well as learning process standards for higher-level thinking skills. So that teachers have a role to be able to behave professionally, have creativity and intelligence in action. Not only giving lessons in the form of theories but teachers can also provide practices to increase capacity and ability in learning, so that students can develop the talents they have. Teachers must also be able to create a lesson that can shape the character of independence in students (Islami et al., 2022).

DL is a learning model that prioritizes learners actively participating and not just passively receiving knowledge. Creating an active learning process where the material or content is not given by the teacher at the beginning of learning directly, where students are asked to be able to find ways to solve problems during the learning process is the intention of this learning model. The model is carried out through observation, classification, measurement, prediction, determination, and inference activities (Khasinah, 2021). In essence, the DL learning model is a learning model that requires students to be able to think critically in solving a problem and play an active role in learning activities, be independent in finding and discovering material and being able to develop their creativity so that the teacher only acts as a facilitator in learning activities. The main purpose of this model is to guide students to be able to identify what they want to know by finding their own information which is then formed into the final form of things that are already known and understood by the students. The steps in applying the Discovery Learning model are providing stimulation (Stimulation), identifying problems (Problem Statement), collecting data (Data Collection), processing data (Data Processing), proving (Verification), drawing conclusions (Generalization). This model has several advantages, one of which is increasing the ability of students to solve problems. So that through this model it is hoped that students can be more motivated to study hard to improve students' abilities in various aspects to achieve educational targets (Sunarto & Amalia, 2022).

The application of the DL model in chemistry material has been widely carried out to improve students' skills, activities, critical thinking abilities and learning outcomes, one of which is Thermochemical material. Like the research conducted by Erlidawati and Habibati (2020), the application of the Discovery Learning model was carried out to improve the activities and learning outcomes of students on thermochemical material using a method that was carried out in cycles through four stages, namely planning, implementation, observation and reflection. The results showed that students were more active in the teaching and learning process at the implementation stage, where students were more eager to work on discussion questions from the teacher and made students take

the initiative to read books or other literature to answer the discussion questions. Thus, it is found that the learning activities of students are categorized as high and have increased due to several factors including the DL learning model used which requires students to be more active in finding material concepts through discussion activities that train students to be active in the learning process.

Based on the findings of observations made at SMA Swasta Methodist Tanjung Morawa, more precisely the results of interviews with high school chemistry teachers in class XI, currently students still have difficulty in calculating, especially the basics of mathematics that they have are still relatively low, do not have adequate initial knowledge for any material to be studied both in chemistry and other subjects. Learners are also still not able to work well together in a group discussion with fellow students. Learners are also not very responsive in asking questions to the teacher because they feel insecure and do not really care about learning.

▪ **METHOD**

This research is descriptive research with a quantitative approach. The population in this study were students XI PSP 1 – XI PSP 4, totaling ±124 people with a sample of 34 people. The sampling technique was carried out by purposive sampling. The research design used is a multiple paradigmshows the relationship between two independent variables and one dependent variable, with inThe variables used in this research consist of two variables, namely the independent variable (X) and the dependent variable (Y). The independent variables consist of EPA (X1) and LKPD (X2) while the dependent variable is the evaluation of learning outcomes to measure the high-level thinking abilities of class XI students for the 2023/2024 academic year on thermochemical material.

The types of data in this research were obtained from: (1) quantitative data, namely data obtained from EPA, LKPD and EHB results; (2) qualitative data, namely student observation sheets. Data collection took the form of initial research observations, interviews with teachers, namely obtaining basic information about students' initial conditions during chemistry learning, especially thermochemical material, initial ability test results data, LKPD filling results and learning outcomes evaluation test results as well as student observation sheet data.

▪ **RESULT AND DISCUSSION**

1. **Tools Used in the Learning Process**

The research was conducted at Methodist Tanjung Morawa Private High School in mid-January to early February 2023/2024 School Year with a population of all XI PSP classes consisting of 4 classes, namely XI PSP 1-XI PSP 4. The class sample was obtained by purposive sampling technique so that, XI PSP class was selected which took Chemistry subjects on Thursdays with a total of 34 students as the experimental class taught with the Discovery Learning (DL) learning model integrated with Science Generic Skills (KGS) on Thermochemical Material.

In this study, there are several learning tools used during the learning process in the form of; EPA, BA, LKPD and Quiz, and EHB. The learning tools were obtained from previous researchers and have been validated by experts, so that the learning tools are valid for use. EPA is an Evaluation of Initial Knowledge in the form of a scholastic test consisting of verbal and numerical reasoning made by Ambarita & Dibyantini (2023) with the form of a test that is an objective test (multiple choice) with five alternative

answers. The number of questions used for EPA during the study was 25 questions. BA is teaching material used during the learning process and to be distributed to students. BA that has been integrated with KGS in the form of E-Modules was made by Aulia & Dibyantini (2023). LKPD made by Ad'dhalia & Sutiani (2023) is a Learner Worksheet that is done in groups which is used to see the activeness of students in groups during the learning process. Quiz is done after working on LKPD individually. The Quiz instrument was taken from the chemistry questions in the EPA instrument developed with the number of questions used during the study, namely 25 questions. Furthermore, EHB, namely: Evaluation of Learning Outcomes in the form of chemistry questions made by Tobing & Sinaga (2023) in the form of objective tests (multiple choice) with five alternative answers and HOTS to improve students' higher order thinking skills with the number of questions used, namely 25 questions.

2. Implementation of Learning

This study began with orientation activities in the form of greetings, where students answered greetings and greetings from researchers, then researchers and students prayed before starting the lesson, and researchers checked the attendance of students. After the class situation was conducive, an Initial Knowledge Evaluation (EPA) sheet consisting of 15 questions was given to students for the first meeting and 10 questions for the second meeting. Learners are given 10 minutes to answer the evaluation sheet. The purpose of giving EPA is to see the initial ability of students before entering into the learning process and see the preparation that students have to take part in learning. After 10 minutes the students' answer sheets were collected, learning was carried out using the DL integrated KGS learning model, which the researcher began by providing apperception, conveying learning objectives and KGS developed in the first and second meetings. Before the learning process, thermochemical teaching materials in the form of E-modules in PDF form were distributed to students. Researchers use additional learning media in the form of PPT. In the first syntax of this model, namely providing stimuli, researchers ask questions in the form of pictures related to thermochemistry about; 1) System and environment, 2) Drying clothes and burning wood fire, 3) Types of standard enthalpy changes and told students to observe the picture and answer the questions asked. Images and questions given are asked gradually according to the sub-material studied at each meeting. Then the researcher provides a brief lesson so that students get initial knowledge about the given sub-material.

In the second syntax to the sixth syntax, namely problem identification, data collection, data processing, proof and drawing conclusions are carried out simultaneously. Students sit according to the groups that have been formed by researchers, where the division of groups of students is carried out heterogeneously according to the results of the EPA that students have previously done. The groups formed were 6 groups consisting of 5-6 students per group. Then, LKPD was distributed to each group. Learners work together and discuss to find and answer the problems given. The role of the researcher is as a facilitator and the researcher will help when students have difficulty. When students focus on working on LKPD, researchers observe students using an observation sheet. Learners are given 45 minutes to discuss in filling out LKPD. After that, students will be given a question sheet in the form of a quiz totaling 15 questions at the first meeting and 10 questions at the second meeting which students do individually to see the extent of students' understanding during the initial learning to the LKPD stage. The quiz was conducted for 10 minutes. In the next stage, namely closing. In the closing

stage, EHB should be given to students, but due to insufficient time allocation, EHB is carried out at the same time at the next meeting. Thus, the class ended with an explanation of the material to be studied at the next meeting by the researcher and greetings by students and researchers. The next meeting is a special meeting to give EHB to students. At this meeting, a brief orientation stage was carried out, then an EHB sheet consisting of 25 questions was distributed to students and students were given 45 minutes to answer the evaluation sheet. The purpose of giving EHB is to measure the higher-level abilities or learning outcomes of students during the treatment of the previous two meetings.

Based on the data obtained, the average value of EPA, LKPD and EHB from the first meeting to the second meeting. The average value of student learning outcomes can be seen in Figure 1.
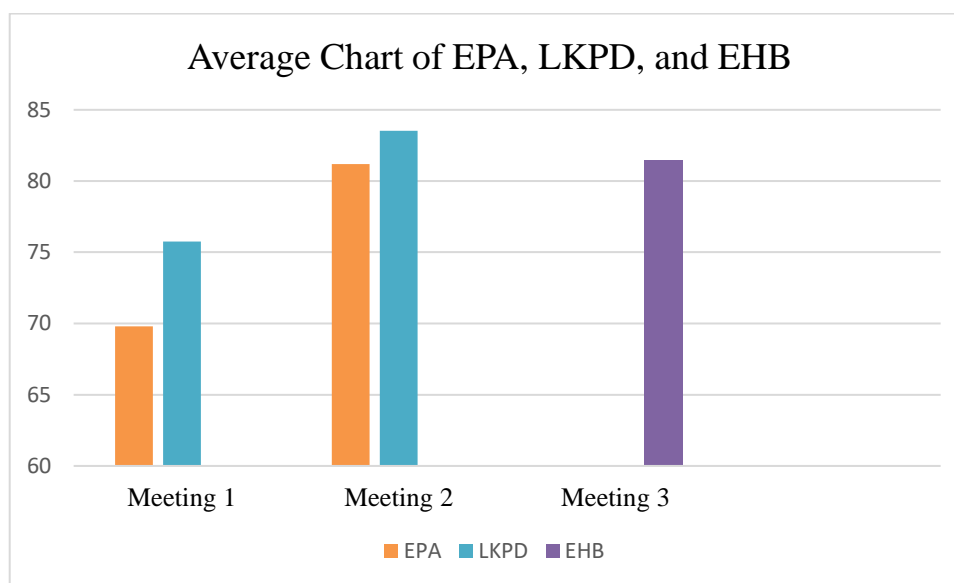

Figure 1. Average Chart of EPA, LKPD, and EHB

Based on this graph, it can be seen that each meeting there was an increase in the average value of EPA and LKPD. Where the average EPA at the first meeting was 64,79 and at the second meeting was 81,18 The average LKPD at the first meeting was 75,76 and at the second meeting was 83,53. While the EHB is carried out at once in one meeting with an average value of 81,41.

During the learning process of students observed by researchers (observers) with observation sheets there are still students who are passive or less active. Based on the results of the activeness of students observed by the researcher (observer) through the observation sheet that at the first meeting there were 11 students whose criteria were classified as moderate (score 56 – 75,9) by 27,5% and there were 23 students whose criteria were classified as high (76 - 100) by 57,5%. In the second meeting there were 7 students whose criteria were classified as moderate, namely 17,5% and there were 27 students whose criteria were classified as high, namely 67,5%. From the observation results there were no learners whose criteria were classified as low (score 0-55,9). During the learning process, researchers get closer to students by going to students one by one and asking about the difficulties that students experience. However, there are still students whose criteria are classified as moderate, because there are still some students who do not dare to ask when experiencing difficulties, the lack of active students when solving problems in group discussions, and the lack of learning time per meeting where each

meeting only has 80 minutes (2 x 40 minutes). The average value of the student observation sheet during meetings one and two is 82,94 and 82,79 respectively. Tabulation of observation sheet data on students can be seen in Table 1 below.

Table 1. Tabulation of observation sheet data on students

No	Student Code	Meeting 1	Criteria	Meeting 2	Criteria
1	S1	75	Medium	75	Medium
2	S2	70	Medium	75	Medium
3	S3	95	Hight	85	Hight
4	S4	100	Hight	87,5	Hight
5	S5	67,5	Medium	65	Medium
6	S6	87,5	Hight	87,5	Hight
7	S7	95	Hight	85	Hight
8	S8	87,5	Hight	87,5	Hight
9	S9	100	Hight	100	Hight
10	S10	77,5	Hight	80	Hight
11	S11	97,5	Hight	92,5	Hight
12	S12	100	Hight	87,5	Hight
13	S13	100	Hight	87,5	Hight
14	S14	97,5	Hight	95	Hight
15	S15	100	Hight	100	Hight
16	S16	80	Hight	85	Hight
17	S17	95	Hight	90	Hight
18	S18	65	Medium	65	Hight
19	S19	82,5	Hight	82,5	Hight
20	S20	80	Hight	75	Medium
21	S21	67,5	Medium	80	Hight
22	S22	65	Medium	65	Medium
23	S23	65	Medium	80	Medium
24	S24	77,5	Hight	82,5	Hight
25	S25	77,5	Hight	80	Hight
26	S26	82,5	Hight	82,5	Hight
27	S27	87,5	Hight	82,5	Hight
28	S28	80	Hight	85	Hight
29	S29	65	Medium	80	Hight
30	S30	70	Medium	80	Hight
31	S31	100	Hight	85	Hight
32	S32	90	Hight	95	Hight
33	S33	70	Medium	72,5	Medium
34	S34	70	Medium	77,5	Hight
	Sum	2820		2815	
	AVERAGE	82.94		82.79	

3. Description of Hypothesis Testing Results

After all the data was collected, the researcher conducted a normality test, homogeneity test and hypothesis testing. At the initial stage, researchers conducted a normality test using the Shapiro-Wilk test and a homogeneity test using the Levene test to ensure that the data obtained was normally distributed and homogeneous. From the results of the data analysis test; EPA, LKPD and EHB conducted, it can be concluded that the data is normally distributed and homogeneous because the sig. value is greater than 0,05 (sig> 0,05). The sig. value of the Shapiro-Wilk test for EPA, LKPD and EHB data is 0,702; 0,273; and 0,409 respectively and the sig. value of the Levene test for EPA, LKPD and EHB data is 0,909; 0,492; and 0,572 respectively. The next stage is to conduct hypothesis testing. The hypothesis test carried out is multiple linear regression test and t-

test with a significance level of 5%. The regression test carried out consists of partial t test, F test, and R2 test with the aim of seeing a significant influence between EPA and LKPD on EHB. EPA (X1) and LKPD (X2) data on EHB (Y) shows the regression coefficient of X1 of 0,397 and X2 of 0,634 which states that every additional value of one unit on X1 and X2, the value of Y will increase by 0,397 and 0,634. Normality test data, Homogeneity test and Partial t test can be seen in Tables 2, 3 and 4 below.

Table 2 normality test data

Data	Shapiro-Wilk Sig	Sig. Level	Inf.
EPA	0,702	0,05	Normally Distributed
LKPD	0,273	0,05	Normally Distributed
EHB	0,409	0,05	Normally Distributed

Table 3 homogeneity test data

Data	Levene Sig	Sig. Level	Inf.
EPA	0,909	0,05	Homogen
LKPD	0,492	0,05	Homogen
EHB	0,572	0,05	Homogen

Table 4. EPA and LKPD partial t data on EHB

Model		Unstandardized Coefficients		Sig.
		B	Std. Error	
1	**(Constant)**	1.857	3.867	.634
	EPA	.397	.144	.010
	LKPD	.634	.138	.000
a. Dependent Variable: EHB				

The significant value of the partial t test of EPA and LKPD on EHB is obtained <0,05, it can be concluded that X1 and X2 partially have a significant effect on Y, which means that Ha is accepted and H0 is rejected. This means that there is a significant influence between EPA and LKPD on EHB by applying the KGS integrated DL model with a calculated F value of 214,065 with a sig. value of 0,000. From the results obtained, it shows that the sig. value is smaller than 0,05, it can be concluded that EPA and LKPD have a significant effect on EHB. From the correlation / relationship value (R) which is 0,966 and the coefficient of determination (R square) is 0,932, it can be concluded that the effect of EPA and LKPD on EHB is 93,2% and 6,8% is influenced by other variables. The next stage is carried out a different test. The different test carried out is the independent sample T-test test with the aim of knowing whether there is a difference in EHB between students with EPA classified as high and students with EPA classified as low. If the sig value. 2-tailed is smaller than 0,05, then Ho is rejected and Ha is accepted. From the data obtained that the sig value. 2-tailed value of 0,000 or smaller than 0,05 which means that Ha is accepted, so it can be concluded that there is a difference in EHB between students with high EPA and students with low EPA.

In this study, the learning process that begins with an evaluation of prior knowledge will have an impact on the process and acquisition of student learning outcomes. Learners'

prior knowledge plays an important role in the formation of their scientific knowledge during the learning process. However, initial knowledge is not the only factor that determines the success of learners, because there are other factors that influence such as solving a problem in the learner worksheet by discussing in groups, then taking quizzes that increase the scientific knowledge and higher order thinking skills of learners.

From the conclusion of the independent t-test test, there is a difference in EHB between students with high EPA and students with low EPA, where according to Sudarma (in Payung, 2016). if students who have high initial knowledge, they have a higher understanding and have better learning outcomes than students who have low initial knowledge. Initial knowledge itself is an indicator of the success or quality of knowledge that has been mastered by students. If the initial knowledge of students is high, then in the next learning process students will find it easier to understand the concept of material and easier in subsequent learning activities and will not experience difficulties. If the initial knowledge of students is low, then students will experience difficulties during the learning process and will take a long time to obtain the goals they want to achieve. Thus, initial knowledge is very important in improving students' learning outcomes. This is also in accordance with what Shapiro stated (in Irawati, 2014), where initial ability influences student learning outcomes including high-level learning outcomes.

Based on the explanation above, it can be stated that the research conducted can be said to be effective because it can improve learning outcomes including students' higher-level thinking skills by using the DL learning model integrated with KGS, although the completeness is still not 100% complete because there are still students who do not have good or lack of learning preparation, because of the low EPA scores of students, low LKPD / Quiz scores, and low learning outcomes. Low EPA, LKPD and EHB scores of students can occur due to internal factors and external factors such as motivation, interest, family environment and students' friendship environment. In addition to these factors, the completeness of students can also be seen from the activeness of students in learning activities obtained from the results of observation sheets of students during the learning process.

▪ **CONCLUSION**

Based on the results of data analysis that has been carried out in this study, the authors can conclude as follows: (1) There is a significant influence between EPA and LKPD on the ability of student learning outcomes The effect of EPA and LKPD on student learning outcomes is 93,2% while 6,8% is influenced by other variables. (2) There are differences in learning outcomes between students whose initial abilities are classified as high and students whose initial abilities are classified as low. Learners with high initial abilities have high learning outcomes, but on the contrary, students with low initial abilities also have low learning outcomes. (3) The results obtained from the value of the observation sheet are that there are students with medium criteria (score 56 – 75,9) by 27,5% and there are 23 students whose criteria are classified as high (76 - 100) by 57,5% at the first meeting and there are 7 students whose criteria are classified as medium by 17,5% and there are 27 students whose criteria are classified as high by 67,5% at the second meeting. The factors that influence students whose criteria are classified as moderate include; there are still some students who do not dare to ask questions when experiencing difficulties, lack of active students when solving problems in group discussions, and lack of learning time per meeting.

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