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Guided Inquiry Method and Self-Efficacy on High School Students' Physics Learning Outcomes

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ABSTRAK

Perubahan paradigma pembelajaran diperlukan untuk mengembangkan sikap ilmiah sehingga dapat membentuk siswa yang kreatif, kritis, terbuka, inovatif dan kompetitif. Penelitian ini bertujuan untuk menganalisis pengaruh penerapan metode pembelajaran inkuiri terbimbing dan efikasi diri terhadap hasil belajar fisika siswa. Penelitian ini merupakan penelitian true experimental dengan membandingkan penerapan metode inkuiri terbimbing dan metode inkuiri bebas. Penelitian ini melibatkan 70 siswa dari 2 kelas berbeda yang dipilih secara simple random sampling. Instrumen yang digunakan dalam penelitian ini berupa kuesioner efikasi diri dan hasil belajar siswa. Data yang telah dikumpulkan selanjutnya dianalisis secara deskriptif dan inferensial menggunakan SPSS 20. Hasil penelitian menunjukkan bahwa penerapan metode inkuiri dan efikasi diri memengaruhi hasil belajar fisika siswa. Penerapan metode inkuiri terbimbing dan efikasi diri siswa yang tinggi menghasilkan hasil belajar yang tinggi. Sebaliknya, penerapan metode inkuiri bebas dengan efikasi diri yang rendah menghasil hasil belajar yang rendah. Namun, tidak terdapat interaksi antara metode inkuiri dan efikasi diri.

ABSTRACT

A change in the learning paradigm is needed to develop a scientific attitude to form students who are creative, critical, open, innovative, and competitive. This study aims to analyze the effect of the guided inquiry learning method and self-efficacy on students' physics learning outcomes. This research is true experimental research that compares the application of the guided and free inquiry methods. This study involved 70 students from 2 classes selected by simple random sampling. The instruments used in this study were self-efficacy questionnaires and student learning outcomes. The data collected were then analyzed descriptively and inferentially using SPSS 20. The results showed that applying the inquiry method and self-efficacy influenced students' physics learning outcomes. Applying the guided inquiry method and high student self-efficacy resulted in high learning outcomes. Conversely, they applied the free inquiry method with low self-efficacy, which resulted in low learning outcomes. However, there was no interaction between the inquiry method and self-efficacy.

1. INTRODUCTION

Education is a vital element in the progress of individuals and society, playing a vital role in unlocking human potential and driving socio-economic growth. The purpose of education is not only to teach academic subjects but also to foster critical thinking, creativity, and character necessary for active participation in society (Ikbal et al., 2018; Sujana, 2020). Graduates of each level of education are expected to be qualified, skilled, and independent. Creating quality education graduates certainly requires efforts that are challenging and require a relatively long time. Students have heterogeneous school backgrounds and basic knowledge, thus affecting the success of student learning. The benchmark for the learning process's success is the students' active role in the classroom and achieving good learning outcomes (Rustan & Rachmat, 2024; Yasmini, 2022). Physics is one of the most important subjects in developing students' skills in designing experiments, interpreting data, and utilizing scientific theories in everyday life. Quality physics education in secondary schools can also increase students' interest and proficiency in STEM (Science, Technology, Engineering, and Mathematics), which are important foundations for driving innovation and global competitiveness. Therefore, it is very important to have interactive and relevant physics teaching to inspire students and improve their understanding of complex scientific principles (Maharani et al., 2020; Muthmainna, 2021).

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However, the results of calculating the science literacy index measured through the 2018 PISA study show that Indonesia is ranked 70th out of 78 countries for the reading, mathematics, and science literacy skills of 15-year-old students. This shows that the science skills of students in Indonesia still need to catch up to the average science skills of other countries in the world, and it is important to follow up. Based on the results of interviews with physics subject educators at SMA Negeri 5 Enrekang, it was found that students had difficulty understanding the subject matter. This comes from their previous learning experiences with the impression that physics is a difficult and serious subject not far from mathematical calculation problems, so it is very complicated for them to understand properly. Students also tend to be passive in learning and only receive information educators provide. Some characteristics of class XI students at SMA Negeri 5 Enrekang are the lack of student curiosity about the subject when given assignments, the tendency to work together and rely on their friends to get answers because they are not confident with their answers, tend to hesitate to make decisions because they are worried about failing. Students also need to pay more attention when the teacher explains, are only enthusiastic at the beginning of the lesson, and feel bored and tired when the lesson is going on. This makes students less able to accept what has been conveyed by the teacher, as seen when the teacher asks questions that aim to attract student concentration. Most are silent and cannot answer (Muthmainna, 2021; Perdana et al., 2017).

Another problem is very obvious when educators allow students to ask questions; most are silent and do not raise their hands. Likewise, if educators ask questions, no students are interested in answering the questions. Physics learning at SMA Negeri 5 Enrekang by educators emphasizes that students must determine the problems to be investigated so that it will take a long time to complete the learning independently. This causes not all students to understand the topics being studied. The passive attitude of students or only receiving information provided by educators also causes the potential of students' abilities to be inactivated, and they are less skilled in communicating, which does not bring out critical thinking skills possessed by students (Mukti & Tentama, 2019; Roesitiyah, 2008).

Based on these problems, one of the efforts that can be made to change the learning process is to use the guided inquiry method. Guided inquiry learning can actively involve students in learning (Amijaya et al., 2018; Dewi et al., 2019; Rodriguez et al., 2020). The guided inquiry method is designed to teach concepts and relationships between concepts by emphasizing maximum student activity to search and discover. Still, its implementation requires a long time, making it difficult to adjust the time (Kurniawan et al., 2022; Roesitiyah, 2008). The guided inquiry method allows students to construct their knowledge and develop scientific attitudes through guidance from the teacher (Hamidah et al., 2018; Perdana et al., 2017). Guided inquiry learning begins with problems educators raise that cannot be explained easily or quickly. Then, students make observations until they reach the conclusion stage (Violadini & Mustika, 2021; Yasmini, 2022). However, educators play a role in controlling the questions asked, the hypotheses made, and what students observe (Sofiani, 2011; Sugiarta et al., 2016).

Inquiry-based learning emphasizes the process of discovery to gain knowledge. One of the goals is for students to have a scientific mindset and way of working like a scientist (Kurniawan et al., 2022; Violadini & Mustika, 2021)—previous studies on using guided inquiry methods in learning support this study. The study showed that students experienced increased physics learning outcomes through guided inquiry methods. This is indicated by students being more interested and enthusiastic in following the learning process and more motivated to explore their knowledge with educators' guidance (Juniati & Widiana, 2017; Lovisia, 2018). In addition, research states that by using guided inquiry methods, students can use learning tools and resources from the information they obtain beyond what they learn (Lovisia, 2018; Rodriguez et al., 2020).

In addition to changing learning methods, teachers also need to pay attention to students' self-efficacy. Self-efficacy is a belief or self-confidence that an individual will motivate students to succeed (Bandura, 1977; Lestari, 2020). Students with high self-efficacy will be more confident that they will achieve their goals (Hasbullah et al., 2020; Ningsih & Hayati, 2020). Conversely, a low self-efficacy student always feels less confident in his success. Low self-efficacy can be assessed from the responses and answers to problems given by students in the learning process. Low self-efficacy will result in a lack of student participation in the learning process, impacting the low learning outcomes that students will get, so self-efficacy needs to be studied. Positive self-efficacy possessed by students positively affects student learning outcomes (Akuba et al., 2020; Muthmainna, 2021). This is indicated by students being enthusiastic in completing the learning tasks given by the educator. Several previous studies have examined the application of guided inquiry methods and self-efficacy on student learning outcomes. Previous studies have only focused on applying guided inquiry methods (Amijaya et al., 2018; Dewi et al., 2019). Research also focuses solely on the influence of self-efficacy (Muthmainna, 2021; Ningsih & Hayati, 2020).

Meanwhile, (Akuba et al., 2020; and Ningsih and Hayati, 2020) examine the influence of reasoning, self-efficacy, and problem-solving ability on mathematics learning outcomes. Unlike those studies, this study

analyzed the impact of the guided inquiry method and self-efficacy on the physics learning outcomes of high school students. Referring to the background that has been explained, this study changed the physics learning method through practicum using the guided inquiry method and increasing students' self-efficacy. The purpose of this study is to analyze the influence of the application of the guided inquiry method and self-efficacy on the physics learning outcomes of students in high school.

2. METHOD

This research is a quantitative research with a true experimental design. This study involved the experimental group (using the guided inquiry method) and the control group (using the free inquiry method). The study was conducted at SMA Negeri 5 Enrekang, involving 70 students from 2 classes selected by simple random sampling. The selected classes were XI MIPA 3 as the experimental group and class XI MIPA 4 as the control group. The study began by providing a self-efficacy questionnaire as the basis for the sample size of each group consisting of high and low self-efficacy groups. After that, each group will receive different treatments. Class XI MIPA 3, as the experimental group, received a learning process by implementing the guided inquiry method, while in class XI MIPA 4, the learning process used the free inquiry method. The implementation of learning was carried out in 8 meetings where each meeting lasted 2 x 45 minutes in each class. The learning materials taught were mechanical, stationary, and traveling waves. After the learning was completed, a learning outcome test was given for 2 lesson hours.

Data collection will be done using a self-efficacy questionnaire and student learning outcomes. The student self-efficacy questionnaire comprises 35 statements covering three indicators: level, strength, and generality. This questionnaire sheet is arranged in the form of a written statement draft whose answer choices have been provided so that students give a check mark (√) on one of the answers. The answer choice format is adapted from the Likert scale, which consists of 5 (five) answer choices containing alternative answer choices: SS: Strongly Agree; S: Agree; KS: Less Agree; TS: Disagree and STS: Strongly Disagree. Self-efficacy consists of positive and negative statements, scored 5, 4, 3, 2, and 1, respectively. The learning outcome instrument is in the form of a multiple-choice test consisting of 32 questions. There are 5 (five) answer items with choice symbols A, B, C, D, and E. Each question item only has one correct answer choice. If the student answers correctly, they get a score of 1 (one); if wrong, they get a 0 (zero). The results of the instrument validity test through experts obtained V ≥ 0.4, a reliability value of 0.86 for the self-efficacy instrument and 1.00 for the learning outcome instrument.

The collected data were then analyzed descriptively and inferentially using SPSS 20. The prerequisite analysis test consists of two stages: the normality test and the homogeneity test. After the prerequisite test, hypothesis testing is continued. Hypothesis testing determines whether the proposed hypothesis has been accepted or rejected. Hypothesis testing uses parametric analysis, namely the two-way analysis of variance (ANOVA) by the design and 2×2 factorial design, assuming the population is normally distributed with the same variation and homogeneous.

3. RESULT AND DISCUSSION

Result

After implementing the guided inquiry method and the free inquiry method, it was found that the scores of students in the class using the guided inquiry method were higher than those using the free inquiry method. Student learning outcomes are presented in Table 1. The frequency distribution of learning outcome scores for students in grades XI MIPA 3 and XI MIPA 4 is presented in Table 2.

Table 1. Students' Physics Learning Outcome Scores

Description	Practicum method (A)	
	Guided Inquiry (A1)	Independent Inquiry(A2)
Number of Samples	35	35
Theoretical Highest Score	32	32
Theoretical Lowest Score	0	0
Empirical Highest Score	25	18
Empirical Lowest Score	18	12
Average	17.1	14.3
Standard Deviation	3.0	2.1

Table 2. Frequency Distribution of Students' Physics Learning Outcome Scores

Interval	Category	Frequency		%	
		MIPA 3	MIPA 4	MIPA 3	MIPA 4
1-7	Very Low	0	0	0	0
8-14	Low	7	19	21,8	59.3
15-21	Medium	23	13	71.8	40.6
22-28	High	2	0	6.2	0
29-32	Very High	0	0	0	0

Table 2 above illustrates that most students of class XI MIPA 3 have learning outcome scores in the medium category, which is 71.8%, while students of class XI MIPA 4 are in the low category, with a percentage of 59.3%. The learning outcome scores of these students are different because the treatment given is also different. Thus, the study results indicate that student learning outcomes for classes taught using the guided inquiry method have increased compared to classes taught using the free inquiry method. The self-efficacy of students taught using the guided and free inquiry methods is presented in Table 3.

Table 3. Frequency Distribution of Students' Self-Efficacy Scores

Interval	Category	Frequency		%	
		MIPA 3	MIPA 4	MIPA 3	MIPA 4
35-63	Very Low	0	1	0	2.8
64-92	Low	4	8	11,4	22.8
93-121	Medium	25	21	71.4	60.0
122-150	High	5	5	14.2	14.2
151-175	Very High	1	0	2.8	0

Based on the table above, it appears that most of the students of class XI MIPA 3 are in the moderate self-efficacy category with a percentage of 71.4%, and students of class XI MIPA 4 are in the moderate category with a percentage of 60.0% as written in the table above. Data hypothesis testing is differentiated based on student self-efficacy so that the data description is obtained as presented in Table 4.

Table 4. Students' Physics Learning Outcome Scores Based on Differences in Self-Efficacy

Self-efficacy (B)		Practicum method (A)	
		Guided Inquiry (A_1)	Independent Inquiry (A2)
High Self Efficacy (B_1)	Number of Samples	10	10
	Average	18,3	15,3
	Highest Score	25	18
	Lowest Score	16	13
	Standard Deviation	s 2.79	1.70
Low Self Efficacy (B_2)	Number of Samples	10	10
	Average	13,9	12,1
	Highest Score	16	14
	Lowest Score	12	8
	Standard Deviation	1.52	2.07

Based on Table 4 above, the standard deviation value for the high self-efficacy student group in the class implementing the guided inquiry method is smaller than the high self-efficacy student group implementing the free inquiry method. The standard deviation value for the low self-efficacy student group in the class implementing the guided inquiry method is greater than the high self-efficacy student group in the class with the implementation of the free inquiry method. This shows that students taught using the guided inquiry method with high self-efficacy get a higher average increase in learning outcomes compared to students in classes taught using the free inquiry method. A two-way ANOVA test was conducted to determine whether or not there is a difference in the effect of the implementation of the guided inquiry method and self-efficacy on student learning outcomes and their interactions. The results of the test are presented in Table 5.

Table 5. Two-Way ANOVA Test Results

Self-Efficacy (B)	Practicum method (A)	
	Guided Inquiry (A_1)	**Independent Inquiry (A_2)**
High Self Efficacy (B_1)	n = 10	n = 10
	$\sum (x)$ = 183	$\sum (x)$ = 153
	$\sum (x)^2$ = 3419	$\sum (x)^2$ = 2367
	$\bar{x}$ = 18,30	$\bar{x}$= 15.30
	S = 2,79	S = 1.70
	s^2 = 7.79	s^2 = 2.90
Low Self Efficacy (B_2)	n = 10	n = 10
	$\sum (x)$ = 139	$\sum (x)$ = 121
	$\sum (x)^2$ = 1953	$\sum (x)^2$ = 1503
	$\bar{x}$ = 13,90	$\bar{x}$ = 12.10
	S = 1.52	S = 2.08
	s^2 = 2.32	s^2 = 4.32
Total (∑)	n = 20	n = 20
	$\sum (x)$ = 322	$\sum (x)$ =
	$\sum (x)^2$ = 5372	$\sum (x)^2$ = 3870
	$\bar{x}$ = 32.20	$\bar{x}$ = 27.40
	S = 4.31	S = 3.78
	s^2 = 10.11	s^2 = 7.22

Table 5 shows that students who have high self-efficacy and are taught using the guided inquiry method are higher than those taught using the free inquiry method. Likewise, students with low self-efficacy who use the guided inquiry method are higher than those taught using the free inquiry method. A two-way analysis of variance with the same cells was conducted to analyze whether the method's influence on student self-efficacy on physics learning outcomes and the interaction between the inquiry method and self-efficacy differed. The following is a summary of the results of the analysis of variance presented in Table 6.

Table 6. Results of Analysis of Variance (ANOVA) Test

Source of Variance	JK	Db	RJK (s^2)	F_h	F_t 0.05	Keputusan Uji
Between Groups	9086.00	3	3028.67	698.92	4.2	Ho rejected
Between A	57.60	1	57.60	13.29	4.2	Ho rejected
Between B	144.40	1	144.40	33.32	4.2	Ho rejected
AxB Interaction	3.60	1	3.60	0.83	4.2	Ho accepted
Within Groups	156.00	36	4.33			
Total	**361.60**	**42**				

Table 6 shows F_{count} = 698.92 and F_{table} = 4.20 ($F_{count} \geq F_{table}$) so that H_0 is rejected. This means there is a difference in the physics learning outcomes of students who are taught using the guided inquiry method and those who are taught using the free inquiry method. For high self-efficacy, F_{count} = 13.29 and F_{table} = 4.20 ($F_{count} \geq F_{table}$), meaning that there is a difference between the learning outcomes of students who are taught using the guided inquiry method and students who are taught using the free inquiry method. Likewise, for low self-efficacy, F_{count} = 33.32 and F_{table} = 4.20 ($F_{count} \geq F_{table}$) so that it is concluded that there is a difference between the physics learning outcomes of students who are taught using the guided inquiry method and students who are taught using the free inquiry method on students. Meanwhile, the interaction effect with the source of variance of the inquiry method and self-efficacy produces F_{count} = 0.83 and F_{table} = 4.20 ($F_{count} \leq F_{table}$), meaning that there is no interaction between the inquiry method and self-efficacy on physics learning outcomes in students. The interaction pattern between the inquiry method and students' self-efficacy is presented in Figure 1.

Figure 1. Interaction Pattern Between Inquiry Method and Self-Efficacy

Based on Figure 1, it is known that the two lines do not intersect, so it can be concluded that there is no interaction between the inquiry method and self-efficacy in physics learning outcomes. Students taught using the inquiry method do not interact with students with high or low self-efficacy. When viewed from the high self-efficacy group, the learning outcomes in classes taught using the guided inquiry method get higher scores than those taught using the free inquiry method. The same thing also happened in the low self-efficacy group, where the learning outcomes of class XI MIPA 3, taught using the guided inquiry method, got higher scores than class XI MIPA 4, taught using the free inquiry method. So, students' learning outcomes using the guided inquiry method, both in terms of high and low self-efficacy, are better than the free inquiry method.

Discussion

The study results showed that student learning outcomes for classes taught using the guided inquiry method increased compared to classes taught using the free inquiry method. The application of the guided inquiry method provides students with the opportunity to decide what experiences they focus on, what skills they want to develop, and how to find concepts from the experiences they have experienced by thinking independently and constructing ideas that exist in themselves through concrete experiences, observations, and active experiments. This study's results align with previous studies, which state that the guided inquiry method improves student learning outcomes. The direction of educators influences this in the learning process, so the effectiveness of students in the learning process is also different (Rodriguez et al., 2020; Sujana, 2020). Research also reinforces this, which reveals that guided inquiry methods increase students' learning motivation and process skills, thus influencing learning completion (Lusidawaty et al., 2020; Yasmini, 2022). The guided inquiry method challenges students to discover new knowledge (Dewi et al., 2019; Sugiarta et al., 2016). Applying this guided inquiry method also helps students find and transfer their knowledge to understand real-life problems and develop ideas when conducting data analysis. This differs from the free inquiry method, where the teacher plays a small role in learning or is not given (Amijaya et al., 2018).

In applying the guided inquiry method, students must develop their thinking awareness to form their knowledge and seek meaning from something they learn to indirectly remember what they learned for longer (Yang et al., 2022; Yasmini, 2022). Implementing guided inquiry methods can make learning activities valuable for students by finding concepts, expressing ideas they already have, and testing and discussing them openly. This helps students construct concepts constructively to reduce misconceptions and improve learning outcomes (Rodriguez et al., 2020; Violadini & Mustika, 2021). Students in class XI MIPA 3 are taught using the guided inquiry method. In contrast, in structured learning, the teacher only acts as a facilitator who will facilitate students to foster curiosity about the learning material. Teaching materials are distributed to review the learning material, and student worksheets are distributed as a guide for practicums. After doing the practicum, students can find concepts, present their findings, and then work on questions to apply the concepts they find in different situations. In class XI MIPA 4, the free inquiry method is applied where, in learning activities, the teacher does not play an active role in the learning process; students are given a problem and then carry out the learning/practicum process themselves. Guided inquiry

learning can provide a more meaningful learning process and impact learning outcomes that are more optimal than the free inquiry method.

The study also showed that students taught using the guided inquiry method with high self-efficacy obtained a higher average score increase in learning outcomes than students in classes taught using the free inquiry method. The difference in self-efficacy between students taught using the guided and free inquiry methods can also be seen from the fact that students with high self-efficacy are more enthusiastic and have a high sense of curiosity. Applying the guided inquiry method for two basic physics competencies has been shown to help students think creatively, critically, and actively, which can create student self-efficacy in class. This aligns with the statement that self-efficacy influences students in motivating themselves, thinking, and making decisions, especially those related to problems in the scope of physics (Hasbullah et al., 2020; Ikbal et al., 2018). Students with high self-efficacy also desire to succeed and have the drive and ambition to achieve good learning outcomes (Ningsih & Hayati, 2020; Thaha & Rustan, 2017). In teaching and learning activities, students with high self-efficacy will try harder to overcome their challenges (De Backer et al., 2022; Wu et al., 2020).

In contrast to students with high efficacy, students with low self-efficacy always feel inferior compared to other friends. In applying the guided inquiry method, self-confidence is needed to be actively involved in the learning process. In addition, external factors influence students' self-efficacy, namely peers, parents, and educators (Mukti & Tentama, 2019; Yang et al., 2022). This is similar to the statement stating that external factors influencing students' self-efficacy are parental support, educators, and the environment. Parental support greatly influences students' self-confidence (Mukti & Tentama, 2019; Widodo & Kurniawan, 2021). Students who receive more support from their parents to learn tend to have good learning outcomes and can follow the learning process with a high level of efficacy. In addition, teachers must improve students' self-efficacy by using interesting learning models and methods (Lestari, 2020; Thaha & Rustan, 2017).

Another result of this study is that there is no interaction between the inquiry method and self-efficacy in physics learning outcomes. Students taught using the inquiry method do not interact with students with high or low self-efficacy. When viewed from the high self-efficacy group, the learning outcomes in classes taught using the guided inquiry method obtained higher scores than students taught using the free inquiry method. The same thing also happened in the low self-efficacy group, where the learning outcomes of class XI MIPA 3, taught using the guided inquiry method, obtained higher scores than class XI MIPA 4, taught using the free inquiry method. So, the learning outcomes of students taught using the guided inquiry method, both in terms of high and low self-efficacy, are better or better than the free inquiry method.

This study was conducted to determine the influence of guided and free inquiry methods seen from the differences in student self-efficacy on high school students' learning outcomes. This study shows that learning by implementing guided inquiry methods provides a new influence for students to improve their learning processes and outcomes further. In addition, high self-efficacy also affects the improvement of student learning outcomes. This study has advantages because it provides knowledge related to the influence of the application of inquiry methods and student self-efficacy on learning outcomes. The implications of this study are to support the use of guided inquiry methods as an effective learning strategy in improving physics learning outcomes and the importance of strengthening student self-efficacy to achieve better academic performance. However, this study still needs to improve. The shortcomings of this study may include limited samples and lack of variation in educational contexts, which can affect the generalization of findings. Suggestions for further research are to expand the scope of the study by involving more schools from various regions and backgrounds to ensure the effectiveness of this method more broadly.

4. CONCLUSION

Based on the results of the research that has been conducted, there are differences in the physics learning outcomes of high school students who are taught using the guided inquiry method and the free inquiry method. Students taught using the guided inquiry method have higher learning outcomes than those taught using the free inquiry method. The level of student self-efficacy also influences learning outcomes. However, there is no interaction between the inquiry method and self-efficacy in achieving high school students' physics learning outcomes. This study provides theoretical implications about the knowledge of the influence of the application of the inquiry method and student self-efficacy on learning outcomes. Practically, this study provides an overview of the guided inquiry method that can be applied in learning, especially physics, to improve student learning outcomes.

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