

## The Effect of Practicum-Based Learning on Elementary Students' Achievement in Magnetism

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Received: 2025-06-16; Revised: 2025-09-19; Accepted: 2025-12-22; Published: 2025-12-26

**How to cite:** Dila, A. S., Shalihah, S., Khairunnisa, K. & Hasanah, M. (2025). The Effect of Practicum-Based Learning on Elementary Students' Achievement in Magnetism. *Al-Adzka: Jurnal Ilmiah Pendidikan Guru Madrasah Ibtidaiyah*, 15(2), 272-281. <https://doi.org/10.18592/aladzkapgmi.v15i2.17081>

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**Abstract:** This study empirically examines the instructional effectiveness of the practicum method on the learning achievement of Grade 5 students in Integrated Science and Social Studies (IPAS), with a focus on the topic of magnetism at MIS Muhammadiyah 3 Al-Furqan. Conventional IPAS instruction remains largely teacher-centered, limiting students' understanding of abstract scientific concepts. To address this issue, the study implemented a practicum-based learning approach. A quantitative quasi-experimental design with a nonequivalent control group was employed, involving 52 fifth-grade students divided into an experimental class and a control class. Learning outcomes were measured using pretest and posttest instruments and analyzed using an independent samples t-test. The results showed that the experimental class achieved significantly higher posttest scores ( $M = 77.62$ ) than the control class ( $M = 66.19$ ) ( $p = 0.004$ ). The effect size analysis revealed a significant practical effect of the practicum method on learning achievement (Cohen's  $d = 0.84$ ), indicating strong pedagogical significance. This study provides empirical evidence supporting the integration of practicum-based learning to enhance elementary IPAS instruction within the madrasah ibtidaiyah context.

**Keywords:** Integrated Science and Social Studies (IPAS); practicum-based learning; elementary education; magnetism; learning achievement

**Abstrak:** Penelitian ini secara empiris menguji efektivitas metode praktik dalam meningkatkan prestasi belajar siswa kelas 5 pada mata pelajaran Ilmu Pengetahuan Alam dan Sosial Terpadu (IPAS), dengan fokus pada topik magnetisme di MIS Muhammadiyah 3 Al-Furqan. Pengajaran IPAS konvensional masih didominasi oleh pendekatan guru-sentris, yang membatasi pemahaman siswa terhadap konsep-konsep ilmiah abstrak. Untuk mengatasi hal ini, penelitian ini menerapkan pendekatan pembelajaran berbasis praktik. Desain kuasi-eksperimental kuantitatif dengan kelompok kontrol non-ekuivalen digunakan, melibatkan 52 siswa kelas 5 yang dibagi menjadi kelas eksperimen dan kelas kontrol. Hasil belajar diukur menggunakan instrumen pretest dan posttest, dan dianalisis menggunakan uji t sampel independen. Hasil menunjukkan bahwa kelas eksperimen memperoleh skor posttest yang secara signifikan lebih tinggi ( $M = 77,62$ ) dibandingkan kelas kontrol ( $M = 66,19$ ) ( $p = 0,004$ ). Analisis ukuran efek menunjukkan efek praktis yang signifikan dari metode praktik terhadap pencapaian belajar (Cohen's  $d = 0,84$ ), menunjukkan signifikansi pedagogis

yang kuat. Studi ini memberikan bukti empiris yang mendukung integrasi pembelajaran berbasis praktik untuk meningkatkan pengajaran IPAS di tingkat dasar dalam konteks madrasah ibtidaiyah.

**Kata kunci:** Ilmu Pengetahuan Alam dan Sosial (IPAS); Pembelajaran Berbasis Praktik; Pendidikan Dasar; Magnetisme; Pencapaian Belajar

## Introduction

Education is a learning process that encourages students to actively develop their potential through interactions between teachers, students, and learning resources. Learning functions both as a system and a process, comprising objectives, content, methods, media, classroom management, assessment, and follow-up activities (Ariani et al., 2022). Learning is a system designed to support internal learning processes through structured instructional events (Bunyamin, 2021). One crucial component of this system is the learning method, which plays a key role in achieving effective and efficient learning outcomes. The selection of appropriate methods can enhance students' curiosity and improve learning outcomes (Aluvalu et al., 2024).

IPAS is an integrated subject in the Merdeka Curriculum that combines Natural Sciences (IPA) and Social Sciences (IPS) to promote holistic learning (Syar, 2018). This integration fosters critical thinking, problem-solving, and inquiry skills, as well as the development of 21st-century competencies such as communication, collaboration, and innovation (Friani, 2025; Sari & Maemonah, 2024), and applies knowledge to real-life contexts (Surul & Septiliana, 2023). However, its implementation still faces challenges, including limited resources and resistance to curricular change.

In practice, IPAS learning is still dominated by conventional, textbook-based instruction, resulting in passive students and low learning engagement (Sari & Maemonah, 2024; Alpionita & Baihaqi, 2025). Many science concepts require direct experience for meaningful understanding. Hands-on science activities significantly enhance students' engagement, leading to deeper conceptual understanding and improved academic performance, thereby supporting the notion that direct experience is crucial for meaningful comprehension in science education (Gyeltshen et al., 2025). Preliminary observations at MIS Muhammadiyah 3 Al-Furqan Banjarmasin showed that approximately 67% of fifth-grade students scored below the minimum mastery criterion (75) in IPAS. Teacher interviews revealed that reliance on lecture-based methods resulted in low student focus and limited conceptual understanding.

Limited teaching facilities and materials led teachers to rely on conventional methods, highlighting the need for more effective instruction to improve students' IPAS achievement, particularly in magnetism. One suitable alternative is the practicum method, which actively involves students in the learning process (Nisa, 2017). Practicum activities offer several benefits, including the development of students' skills, the integration of theory with practice, the fostering of scientific inquiry, and the building of appreciation for science (Nisa, 2017).

Through practicum activities, students construct their own knowledge while teachers act as facilitators. This approach aligns with constructivist theory, emphasizing knowledge construction through active learning (Allen, 2022). Through practicum activities, students are not merely passive recipients of information; they actively test and validate scientific concepts.

Previous studies indicate that practicum methods improve students' scientific skills, conceptual understanding, and critical thinking abilities (Kurti, 2016). Practicum-

based learning also increases students' enthusiasm, focus, and positive attitudes toward IPAS. (Nisa, 2017) Claim that practicum methods stimulate curiosity and active involvement in learning. Student engagement during practicum-based group discussions enhances communication skills and social interaction. Thus, the practicum method influences not only cognitive development but also affective and social aspects of learning. Therefore, this study aims to determine the effect of the practicum method on students' learning outcomes in IPAS, particularly on the topic of magnetism in Grade 5 at MIS Muhammadiyah 3 Al-Furqan. This study extends previous research by providing effect size-based empirical evidence on practicum-based IPAS learning within the Madrasah Ibtidaiyah context, an area that remains underrepresented in quantitative elementary science research. By combining quasi-experimental analysis with practical classroom implementation, this study offers both theoretical and pedagogical contributions.

### Method

This study employed a quantitative approach using a quasi-experimental design with a nonequivalent control group model. The study selected this design to examine the causal effect of practicum-based learning on students' learning achievement in Integrated Science and Social Studies (IPAS), particularly in the topic of magnetism, where random assignment of participants was not feasible.

The study took place at MIS Muhammadiyah 3 Al-Furqan, Banjarmasin, and involved 52 fifth-grade students selected through purposive sampling. The researchers divided the participants into two intact classes:

**Table 1 Research Design of Experimental and Control Groups**

Group	Class	Number of Students	Instructional Method	Learning Topic	Measurement	
Experimental Group	Grade 5B	26	Practicum-based learning	Magnetism (IPAS)	Pretest Posttest	-
Control Group	Grade 5C	26	Lecture-based learning	Magnetism (IPAS)	Pretest Posttest	-

Both groups followed the duplicate curriculum content and learning objectives, differing only in the instructional method applied. The experimental group participated in practicum-based learning activities designed to provide hands-on experiences related to magnetic properties and magnetic force using simple and accessible materials. Students actively observed, manipulated, and experimented with magnetic phenomena under the guidance of their teacher. In contrast, the control group received conventional instruction through teacher explanations and textbook-based learning, without participating in practicum activities. The intervention took place during regular IPAS instructional sessions.

Students' learning achievement was measured using a multiple-choice achievement test administered as a pretest and posttest. The study developed the instrument based on IPAS learning indicators for the magnetism topic. Experts established content validity through judgment, while the researchers tested empirical validity and reliability through item analysis. The final instrument demonstrated acceptable reliability, with a Cronbach's alpha coefficient of 0.710, indicating high internal consistency.

The study used SPSS version 26 to analyze the data and summarize pretest and posttest scores using descriptive statistics. Prior to hypothesis testing, normality and homogeneity of variance assumptions were examined and met. The study used an

independent samples t-test to examine differences in learning achievement between the experimental and control groups.

The study complemented significance testing with effect size analysis to assess the magnitude of the instructional effect. Cohen's  $d$  was calculated based on the independent samples t-test results using the following formula:

$$d = t \times \sqrt{1/n_1 + 1/n_2}$$

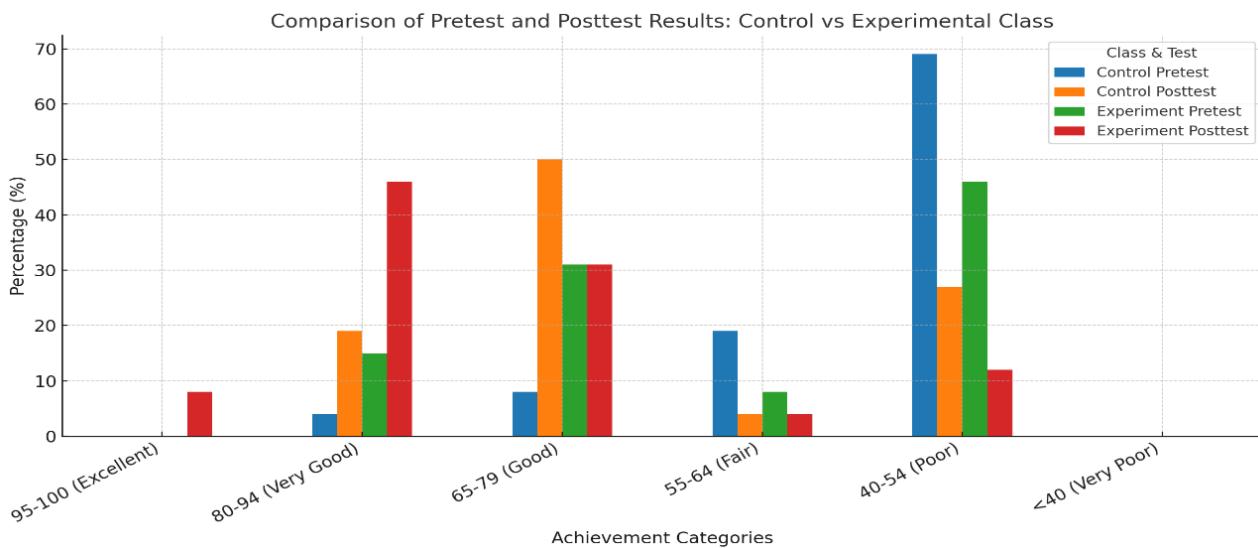
where  $t$  represents the t-test value, and  $n_1$  and  $n_2$  denote the sample sizes of the experimental and control groups. The study interpreted effect size according to Cohen's criteria: 0.20 (small), 0.50 (medium), and 0.80 (large).

The researchers conducted this study in accordance with ethical standards for educational research. They obtained permission from school authorities and parental consent prior to data collection, informed participants of voluntary participation, and ensured data confidentiality and anonymity.

## Result and Discussion

### Result

The study derived the results from comparisons of pretest and posttest scores between the control and experimental classes. It classified learning outcomes into six categories, from 'very poor' to 'very good'. This comparison aimed to demonstrate changes in students' learning outcomes before and after the treatment, as well as to evaluate the effectiveness of the instructional methods applied. The control class employed a lecture method, while the experimental class implemented the practicum method.



**Figure 1. Distribution of Pretest and Posttest Score**

Based on the score distribution graph, the control class showed improvement from the pretest to the posttest, particularly in the "good" and "very good" categories. However, some students remained in the "poor" category. In contrast, the experimental class experienced a more substantial improvement, indicated by a dominant shift from the "poor" category to the "good," "very good," and "excellent" categories. These findings indicate that the practicum method is more effective in improving learning outcomes than the lecture method.

**Table 2. Statistical Description**

	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation	Std. Variance
Experiment Pretest	26	73	20	93	1557	59.88	17.056	290.906
Experiment Posttest	26	53	47	100	2018	77.62	14.219	202.166
Control Pretest	26	73	20	93	1313	50.50	14.844	220.340
Control Posttest	26	53	40	93	1721	66.19	12.763	162.882
Valid N (listwise)	26							

Based on the statistical description, the pretest scores of the experimental class ranged from a minimum of 20 to a maximum of 93, with an average of 59.88. Similarly, the control class had a minimum value of 20 and a maximum value of 93, with an average of 50.50. After the treatment, the posttest scores of the experimental class increased, with a minimum value of 47 and a maximum value of 100, and an average of 77.62. Meanwhile, the control class obtained a minimum value of 40 and a maximum value of 93, with an average of 66.19. This difference in mean scores indicates a higher increase in learning outcomes in the experimental class:

**Table 3. Calculation Result of Pretest and Posttest Data Normality Test for Experimental and Control Classes**

Tests of Normality							
		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Student Learning Achievement	Experiment Pretest	.125	26	.200*	.968	26	.567
	Experiment Posttest	.142	26	.190	.953	26	.266
	Control Pretest	.146	26	.164	.930	26	.078
	Control Posttest	.218	26	.003	.955	26	.309

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Normality testing showed that pretest and posttest data in both groups were normally distributed ( $p > 0.05$ ). Furthermore, the homogeneity test demonstrated that the data were homogeneous, as indicated by the pretest significance value of 0.235 and the posttest significance value of 0.451, both of which were greater than 0.05.

**Table 4. Result of Homogeneity Test Calculation of Pretest Data for Experimental and Control Classes**

		Levene Statistic	df1	df2	Sig.
Student Learning Achievement	Based on Mean	1.445	1	50	.235
	Based on Median	1.525	1	50	.223
	Based on Median and with adjusted df	1.525	1	49.351	.223
	Based on trimmed mean	1.437	1	50	.236

**Table 5. Result of Homogeneity Test Calculation of Posttest Data for Experimental and Control Classes**

		Levene Statistic	df1	df2	Sig.
Student Learning Achievement	Based on Mean	.577	1	50	.451
	Based on Median	.591	1	50	.446
	Based on Median and with adjusted df	.591	1	49.953	.446
	Based on trimmed mean	.544	1	50	.464

The pretest ( $p = 0.235$ ) and posttest ( $p = 0.451$ ) results for both groups exceeded the 0.05 significance level, indicating homogeneous populations. After confirming normality and homogeneity, the study conducted hypothesis testing using an independent samples t-test with SPSS version 26.

**Table 6: T-test Results of Experimental and Control Classes**

		Levene's Test for Equality of Variances			t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)		Mean	Std. Error	95% Confidence Interval of the Difference	
						Diff.	nce	Diff.	nce	Lower	Upper
IPAS Learning	Equal variances assumed	.577	.451	3.04	50	.004	11.423	3.747	3.897	18.949	
	Equal variances not assumed			9							
Achievement	Equal variances assumed			3.04	49.42	.004	11.423	3.747	3.895	18.951	
	Equal variances not assumed			9	8						

After meeting the prerequisite assumptions, the study applied an independent samples t-test for hypothesis testing. The test results showed a significance value of 0.004 ( $< 0.05$ ), indicating a statistically significant effect of the practicum method on students' IPAS learning outcomes in the topic of magnetism in Grade 5 at MIS Muhammadiyah 3 Al-Furqan.

The study also calculated effect size using Cohen's d. Based on the t-test results ( $t = 3.049$ ,  $n = 52$ ), the effect size was  $d = 0.84$ , indicating a significant practical effect of the practicum method on students' IPAS learning achievement.

## Discussion

The findings of this study demonstrate that practicum-based learning has a statistically significant and practically meaningful effect on Grade 5 students' IPAS learning achievement in the topic of magnetism. Students in the experimental group achieved higher posttest scores than those in the control group, with a large effect size (Cohen's  $d = 0.84$ ), indicating that the practicum method exerts a substantial pedagogical impact. This result confirms that hands-on learning is particularly effective for teaching abstract scientific concepts at the elementary level.

One possible explanation for this finding lies in the concept of magnetism, which is an abstract concept that requires a concrete representation for effective comprehension. Elementary school students are generally in the concrete operational stage of cognitive development, in which learning is optimized through direct interaction with physical objects (Hayat et al., 2024; Sormin, 2023). Practicum activities allow students to observe, manipulate, and verify magnetic phenomena directly, thereby transforming abstract ideas into tangible experiences. This learning process aligns with constructivist theory by emphasizing knowledge construction through experience (Olusegun, 2015; Allen, 2022).

The results of this study are consistent with previous research, which shows that practicum-based learning improves students' conceptual understanding, scientific skills, and academic achievement (Khotimah et al., 2023; Nulziyati et al., 2023; Kurti, 2016; Nisa, 2017). Through practicum activities, students are encouraged to engage in inquiry processes such as observing, predicting, experimenting, and drawing conclusions. These activities not only enhance cognitive outcomes but also increase students' learning motivation and engagement, as reflected in their active participation during instructional sessions. Gyeltshen et al. (2025) similarly found that hands-on science activities significantly improve student engagement and learning outcomes in primary education.

From a pedagogical perspective, the large effect size observed in this study suggests that practicum-based learning has substantial practical relevance. Effect size analysis provides insight beyond statistical significance by demonstrating the magnitude of the instructional impact. The strong effect observed ( $d = 0.84$ ) indicates that the practicum method meaningfully improves learning achievement, supporting its implementation as an effective instructional strategy in IPAS learning. This finding aligns with studies that highlight the contribution of experiential learning approaches to a deeper understanding and longer retention of scientific concepts (Abulais et al., 2023; Ilvayani et al., 2023).

Moreover, the use of simple and accessible practicum materials plays a crucial role in the effectiveness of this instructional approach. Simple tools allow students to focus on conceptual understanding rather than technical complexity, making the learning process more inclusive and feasible in schools with limited facilities (Ojating & Ojating, 2022; Hendratno, 2021). The integration of practicum activities using locally available materials also supports the practical implementation of IPAS learning within the Merdeka Curriculum framework, which emphasizes contextual and student-centered learning (Surul & Septiliana, 2023).

In addition to cognitive benefits, practicum-based learning fosters the development of essential twenty-first-century skills, including collaboration, communication, and problem-solving. Group-based practicum activities encourage students to discuss observations, test hypotheses, and articulate scientific reasoning, thereby enhancing both social interaction and critical thinking skills (Sari & Maemonah, 2024). These competencies are increasingly important in contemporary education and align with the broader goals of integrated science learning.

Beyond confirming the effectiveness of practicum-based learning, this study contributes to elementary science pedagogy by demonstrating that simple, low-cost practicum activities can generate large learning gains in resource-limited madrasah settings. This finding strengthens the practical relevance of IPAS implementation within the Merdeka Curriculum framework.

Despite these positive findings, this study has several limitations that should be taken into account when interpreting the results. The relatively small sample size and the focus on a single school limit the generalizability of the findings. Additionally, the study examined only one IPAS topic, magnetism, over a short instructional period. Therefore, the observed effects may differ when practicum-based learning is applied to other IPAS topics or implemented over a longer duration.

Overall, this study contributes empirical evidence supporting the effectiveness of practicum-based learning in elementary IPAS instruction, particularly for abstract science topics such as magnetism. By demonstrating both statistical significance and a significant practical effect, the findings strengthen the argument for integrating structured practicum activities into elementary science classrooms to enhance learning achievement and student engagement.

## **Conclusion**

This study demonstrates that practicum-based learning has a significant and meaningful impact on the learning achievement of Grade 5 students in Integrated Science and Social Studies (IPAS), particularly in the topic of magnetism. Students who participated in practicum-based instruction achieved higher learning outcomes than those taught using conventional lecture methods, supported by a large effect size (Cohen's  $d = 0.84$ ). These findings highlight the pedagogical value of hands-on learning in facilitating elementary students' understanding of abstract scientific concepts and promoting active engagement in the learning process. Practicum-based learning, therefore, represents a practical instructional approach for improving the quality of IPAS instruction at the elementary education level. These findings position practicum-based learning as a scalable instructional strategy for improving elementary IPAS learning outcomes in diverse madrasah contexts.

Despite its positive findings, this study has several limitations. The study involved a single madrasah with a relatively small sample size, which limits the generalizability of the results. Additionally, the study focused on a single IPAS topic and was implemented over a brief instructional period, thereby limiting the examination of long-term learning effects. Future research is encouraged to involve larger and more diverse samples, apply practicum-based learning across different IPAS topics and grade levels, and adopt longitudinal or mixed-method designs to explore its sustained impact on students' conceptual understanding, higher-order thinking skills, and learning motivation.

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