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Differences in Students' Fraction Learning Outcomes Based on School Type at the Elementary Level

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Abstract

Fraction learning is widely recognized as one of the most challenging topics for elementary school students; however, empirical evidence comparing students' fraction learning outcomes across schools within similar educational contexts remains limited. This study aims to examine differences in students' fraction learning outcomes based on school origin at the elementary level. This research employed a quantitative ex post facto design involving 92 third-grade students from four Islamic elementary schools in West Bandung Regency. Students' fraction achievement scores were used as the primary indicator of learning outcomes. Data were analyzed using descriptive and non-parametric inferential statistics, specifically the Kruskal–Wallis test, due to non-normal data distribution. The results revealed statistically significant differences in students' fraction learning outcomes across schools. Post hoc analysis indicated that the most prominent difference occurred between MI Riyadhotul Janah and MIS Jauharul Huda. These findings suggest that, despite similarities in curriculum and educational level, variations in instructional practices and school learning environments contribute to unequal student achievement in fraction learning. This study offers a contribution by providing empirical evidence on inter-school disparities in fraction achievement within comparable institutional settings. The findings imply that improving instructional quality, particularly in the use of concrete representations and student-centered approaches, is essential to enhance students' understanding of fractions. Additionally, school-level interventions should focus on strengthening pedagogical support systems to reduce achievement gaps across schools.

Keywords: *Fraction Achievement, Elementary Students, School Type Differences*

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Introduction

Mathematics learning at the elementary level plays a fundamental role not only in developing computational skills but also in fostering students' logical and rational thinking[1]. As a structured and hierarchical discipline, mathematics requires learners to understand concepts progressively, where early comprehension becomes the foundation for more advanced reasoning. From a cognitive development perspective, students at the elementary level are in the transition from concrete to more abstract thinking; therefore, meaningful mathematical understanding is essential to support this development.

Mathematics is one of the subjects that in the learning process requires a higher level of understanding, because mathematics is not only limited to counting and not just memorization, but its scope is much broader than most people's perceptions so far [2]. In studying mathematics, students must be able to understand the concepts that underlie mathematics or the material being taught [3], Mathematics plays an important role in various disciplines and advances human thinking power [4]. One that is often a challenge for some students in learning mathematics is fractions, because the concept is abstract and requires symbolic understanding and good numerical abilities. Some students view mathematics as a subject that causes fear, anxiety and anger during lessons [5].

Fractions, taught systematically by the national curriculum, do not serve as a benchmark for student understanding in the early stages of education. This is evident not only among individuals but also between different schools. Schools are learning spaces that play a crucial role in shaping students' thinking through the way teachers present material, the academic climate they create, and the learning support they provide. Learning is a process

[1] Ardi Dwi Susandi and Santi Widyawati, "Implementation of Realistic Mathematics Education (RME) Learning Model in Improving Critical Thinking Skills," *Al-Jabar: Jurnal Pendidikan Matematika* 13, no. 2 (December 2022): 251–60, https://doi.org/10.24042/ajpm.v13i2.14996.

[2] Novita Karina Dewi, Zainuddin Untu, and Ariantje Dimpudus, "Analysis of Difficulties in Solving Mathematics Problems on Fractional Number Arithmetic Operations for Grade VII Students," *Primatika: Journal of Mathematics Education* 9, no. 2 (2020): 61–70.

[3] Helna Hakia Aziza, Alayda Aspiani, and Mira Sastiana, "The Effect of Realistic Mathematics Approach (RMAT) on Students' Understanding of Basic Mathematical Concepts," *Literasi: Journal of Innovation Literacy Studies* 1, no. 2 (2024): 122–26, https://ejournal.alfarabi.ac.id/index.php/literasi/article/view/692.

[4] Asep Ikin Sugandi, "The Role of Mathematics in Developing Student Character," in *Proceedings of the National Seminar on Mathematics and Mathematics Education, STKIP Siliwangi Bandung* , 2013, 88–95.

[5] Hikmah Fazariah, Rusi Ulfa Hasanah, and Reni Purnama Sari, "Systematic Literature Review: Learning Difficulties of Mathematics Education Students," *Bilangan: Scientific Journal of Mathematics, Earth and Space* 2, no. 3 (2024): 33–38, https://doi.org/https://doi.org/10.62383/bilangan.v2i3.48.

of interaction between students, educators, and learning resources [6]. In the learning process, teachers produce enlightening work and innovations that can be applied in the classroom, thereby fostering all students' potential, enabling them not only to achieve but also to exceed their aspirations [7]. Teachers' learning strategies, the use of media and learning methods, student motivation and attitudes, and the supportive school environment significantly impact student learning outcomes. Therefore, the results of learning fractions should not be viewed solely as an individual learning process, but rather as a reflection of the school's learning system.

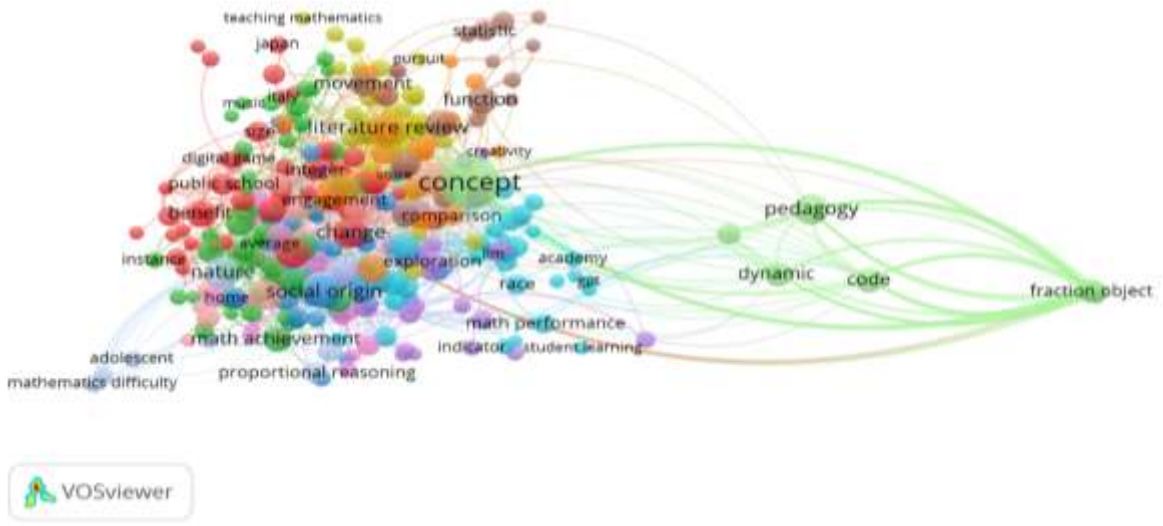


Figure 1.1 Bibliometric Analysis of Vos Viewer Regarding Whether the Success of Fraction Learning Differs Between Schools

Based on bibliometric analysis using the Vos Viewer application, researchers have reviewed several articles on whether the success of fraction learning differs between schools. With the help of the Publish or Perish application version 8, the reviewed articles then formed a bibliometric network to determine the extent of differences between schools regarding their success in learning fraction material. So far, regarding this research, several previous studies have examined students' difficulties in understanding fractions and the factors that influence success in learning mathematics. Some studies only emphasize internal student factors or specific learning media without comparing results across schools. This condition creates a

[6] Ika Firma Ningsih Dian Primasari, Arita Marini, and Mohamad Syarif Sumantri, "Analysis of Educational Policy and Management Related to Assessment Standards in Elementary Schools," *Jurnal Basicedu* 5, no. 3 (2021): 1479–91.

[7] Ahmad Anis Abdullah et al., "Culture-Based Mathematics Learning Workshop Through Batik Giriloyo, Wukirsari, Imogiri, Bantul," *ALKHIDMAH: Journal of Community Service and Partnership* 2, no. 1 (2024): 222–29, https://doi.org/https://doi.org/10.59246/alkhidmah.v2i1.745.

gap in knowledge regarding the extent to which differences in characteristics and conditions between schools contribute to the success of fraction learning.

However, existing research on fraction learning predominantly focuses on internal student factors, such as cognitive ability and motivation, or on the effectiveness of specific instructional media and methods. Comparative studies that examine differences in students' fraction learning outcomes across schools within relatively similar educational contexts remain limited. This indicates a gap in the literature, particularly in understanding the extent to which school-related factors contribute to variations in students' achievement in fraction learning.

Addressing this gap, the present study adopts a different perspective by positioning the school as the primary analytical variable in examining differences in students' fraction learning outcomes. Rather than focusing on individual characteristics or specific teaching interventions, this study seeks to identify patterns of variation in student achievement that emerge across schools. By using measurable indicators of learning outcomes, this approach provides a more objective basis for comparing students' mastery of fraction concepts. This study aims to examine differences in students' fraction learning outcomes based on school origin at the elementary level. Specifically, it seeks to determine whether the observed differences in achievement across schools reflect statistically significant variation or merely random fluctuation. Through a quantitative approach, this study is expected to provide empirical evidence regarding disparities in fraction learning outcomes across schools.

The findings of this study are expected to contribute both theoretically and practically. Theoretically, this study enriches the literature on mathematics education by providing empirical insights into inter-school differences in fraction learning outcomes. Practically, the results can serve as a reference for teachers in improving instructional strategies, for school leaders in strengthening academic support systems, and for policymakers in designing targeted interventions to reduce disparities in mathematics learning outcomes. Ultimately, this study is expected to support the development of more equitable and effective fraction learning in elementary schools.

Research Methods

This study employed a quantitative approach using an ex post facto design, in which variables were observed without experimental manipulation. The primary variable examined

was students' fraction learning outcomes, while school origin functioned as the independent grouping variable to identify variations in achievement across schools. The study was conducted in four Madrasah Ibtidaiyah in West Bandung Regency: MIS Muslimin Sindangkerta, MI Kubang, MI Riyadhotul Janah, and MIS Jauharul Huda. The population comprised all third-grade students enrolled in Madrasah Ibtidaiyah within the region. A total of 92 students were selected as the research sample, consisting of 35 students from MIS Muslimin Sindangkerta, 29 students from MI Kubang, 10 students from MI Riyadhotul Janah, and 18 students from MIS Jauharul Huda.

The sampling technique used was purposive sampling, based on the following criteria: (1) schools implementing the same national curriculum, (2) comparable grade levels (third grade), and (3) availability of documented student achievement data on fraction topics. These criteria were applied to enhance the comparability and internal consistency of the data across research sites. Data on students' fraction learning outcomes were obtained from documented mathematics assessment scores related specifically to fraction material. To ensure data validity, the scores were derived from standardized school assessments aligned with curriculum objectives. In addition, data verification was conducted through cross-checking with subject teachers to confirm the accuracy and relevance of the scores as indicators of students' conceptual understanding of fractions.

Data analysis was carried out using IBM SPSS Statistics version 26. The analysis procedure consisted of several stages. First, descriptive statistics (mean, standard deviation, minimum, and maximum scores) were used to provide an overview of students' learning outcomes across schools. Second, prerequisite tests were conducted, including tests of normality (Kolmogorov–Smirnov/Shapiro–Wilk) and homogeneity of variance (Levene's test), to determine the suitability of parametric analysis. If the assumptions of normality and homogeneity were met, differences in students' fraction learning outcomes across schools were analyzed using One-Way Analysis of Variance (ANOVA). However, if the data violated these assumptions, the non-parametric Kruskal–Wallis test was employed as an alternative analytical method. When significant differences were identified, post hoc analysis (e.g., Mann–Whitney test with Bonferroni adjustment or Tukey HSD for ANOVA) was conducted to determine specific group differences between schools. Through these systematic procedures, this study ensures that the analysis of differences in fraction learning outcomes

is conducted using appropriate statistical techniques, thereby enhancing the validity, reliability, and rigor of the research findings.

Results and Discussion

Result

This research results section presents the findings obtained from the analysis of student learning outcomes data on fractions based on their school of origin. The presentation of the results begins with descriptive statistics to illustrate the trends in scores and variations in student learning outcomes at each school, as an initial illustration of the differences in learning outcomes that emerged. Next, the results of the inferential statistical analysis are presented to empirically explain whether the differences in learning outcomes between schools are statistically significant according to the established analysis method.

Table 1. Descriptives

School	Mean	Standard Deviation
MIS Muslimin Sindangkerta	76.66	4.108
MI Kubang	74.14	9,643
MI Riyadhotul Janah	70.00	5,333
MIS Jauharul Huda	81.94	11.00
Total	76.17	8,516

Based on the descriptive statistics table, it appears that student learning outcomes in fractions show quite clear variations between schools. MIS Jauharul Huda displays the highest average score, indicating a relatively better level of mastery of fractions compared to other schools, although the distribution of scores is quite large so that students' abilities in this school vary. MIS Muslimin Sindangkerta is in the next position with a fairly high average score and a low standard deviation, indicating that student learning outcomes are not only good but also relatively even. MI Kubang has a slightly lower average score with a larger variation in scores, indicating a fairly wide difference in ability among students. Meanwhile, MI Riyadhotul Janah shows the lowest average score, indicating that students' mastery of fractions at this school is still relatively lower than other schools. Overall, the combined average score indicates that student learning outcomes are at a moderate level, with differences in achievement between schools that are quite prominent and worthy of further analysis through inferential statistical testing.

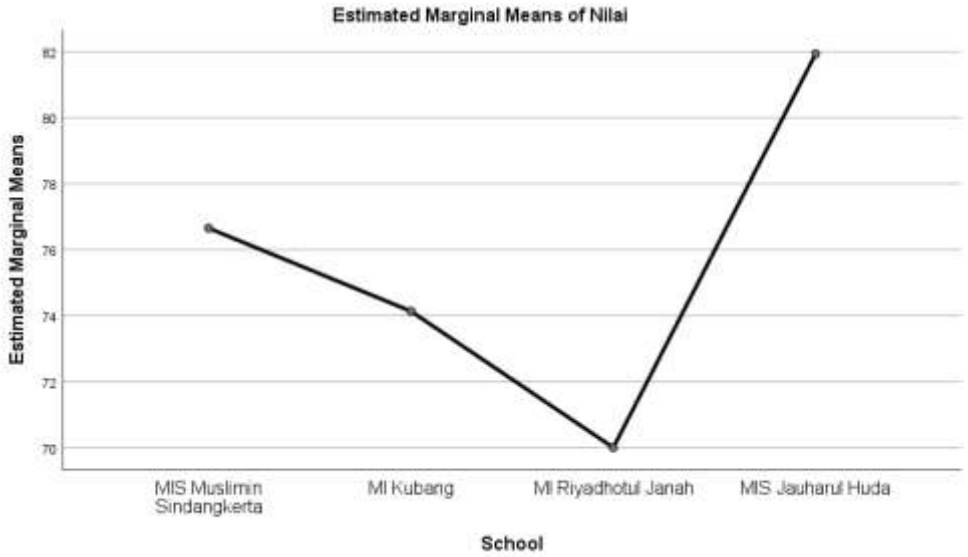


Figure 1. Means Plots

The figure shows the estimated marginal means of mathematics learning outcomes for fractions based on school of origin. MIS Jauharul Huda has the highest average score, indicating the best student learning outcomes compared to other schools. Conversely, MI Riyadhotul Janah occupies the lowest position, indicating relatively lower mastery of the material. MIS Muslimin Sindangkerta and MI Kubang are in the middle position with a decreasing trend in scores from MIS Muslimin Sindangkerta to MI Kubang. The decreasing and then sharply increasing line pattern indicates a fairly clear variation in learning outcomes between schools, thus strengthening the hypothesis that school of origin plays a role in differentiating student learning outcomes for fractions.

Table 2. Tests of Normality

	Kolmogorov-Smirnov [a]		Shapiro-Wilk	
School	Statistics	Sig.	Statistics	Sig.
MIS Muslimin Sindangkerta	.210	.000	.910	.007
MI Kubang	.252	.000	.908	.015
MI Riyadhotul Janah	.170	.200*	.918	.344
MIS Jauharul Huda	.195	.070	.868	.017

Based on the results of the normality test using Kolmogorov–Smirnov and Shapiro–Wilk in each group of schools, findings showed that not all data were normally distributed.

At MIS Muslimin Sindangkerta, the Kolmogorov–Smirnov significance value was 0.000 and Shapiro–Wilk was 0.007 (Sig. <0.05), so the learning outcome data at this school was declared not normally distributed. Similar results were also seen at MI Kubang, with a Kolmogorov–Smirnov significance value of 0.000 and Shapiro–Wilk of 0.015, indicating that the distribution of data at this school was also not normal.

In contrast to the two previous schools, student learning outcome data at MI Riyadhotul Janah showed a Kolmogorov–Smirnov significance value of 0.200 and a Shapiro–Wilk significance value of 0.344 (Sig. > 0.05), so it can be concluded that the data at this school is normally distributed. Meanwhile, at MIS Jauharul Huda, although the Kolmogorov–Smirnov test showed a significance value of 0.070 (Sig. > 0.05), the Shapiro–Wilk test results showed a significance value of 0.017 (Sig. < 0.05), which indicates that the data did not fully meet the normality assumption. Overall, because there were groups of data that were not normally distributed, the assumption of normality in general was not fully met, so for further statistical tests, non-parametric statistical tests were carried out using the Kruskal-Wallis test.

Table 3. Test of Homogeneity of Variance

	Levene Statistics	Sig.
Based on Mean	12,332	.000
Based on Median	7,656	
Based on Median and with adjusted df		
Based on trimmed mean	12,362	

Based on the results of the homogeneity of variance test using the Levene Test, a significance value (Sig.) of 0.000 was obtained for all testing approaches, both based on the mean, median, median with adjusted degrees of freedom, and trimmed mean. A significance value smaller than the 0.05 significance level indicates that the null hypothesis stating that the variance between groups is homogeneous is rejected. Thus, it can be concluded that the variance of learning outcomes between schools is not homogeneous or there is a significant difference in value variation between the compared groups. This condition indicates that the assumption of homogeneity of variance is not met.

Table 4. Kruskal-Wallis Test

	Mark
Kruskal-Wallis H	12,824
Asymp. Sig.	.005

Based on the results of the Kruskal–Wallis test, the H statistic value was 12.824 with a significance value of Asymp. Sig. = 0.005. Because the significance value is smaller than the significance level of 0.05, the null hypothesis is rejected. This indicates that there is a statistically significant difference in student learning outcomes for fractions based on school origin. Thus, it can be concluded that not all school groups have the same distribution or tendency of learning outcome values, so that school origin plays a role in differentiating student learning outcomes.

Table 5. Multiple Comparisons

School	**School**	**Sig.**
MIS Muslimin Sindangkerta	MI Kubang	.562
	MI Riyadhotul Janah	.015
	MIS Jauharul Huda	.233
MI Kubang	MI Riyadhotul Janah	.351
	MIS Jauharul Huda	.083
MI Riyadhotul Janah	MIS Jauharul Huda	.004

Based on the results of the post hoc test between pairs of schools, it was found that not all differences in learning outcomes were significant. The comparison between MIS Muslimin Sindangkerta and MI Kubang showed a significance value of 0.562 (Sig. > 0.05), so there was no significant difference in learning outcomes between the two schools. However, the comparison between MIS Muslimin Sindangkerta and MI Riyadhotul Janah produced a significance value of 0.015 (Sig. < 0.05), which indicates a significant difference in learning outcomes, where student achievement at the two schools was significantly different. Meanwhile, the comparison between MIS Muslimin Sindangkerta and MIS Jauharul Huda showed a significance value of 0.233, so no significant difference was found.

Furthermore, the comparison results between MI Kubang and MI Riyadhotul Janah showed a significance value of 0.351 (Sig. > 0.05), which means there is no significant difference between the two schools. The comparison between MI Kubang and MIS Jauharul Huda produced a significance value of 0.083, which is still above the significance level of 0.05, so the difference cannot be declared statistically significant. The comparison between MI

Riyadhotul Janah and MIS Jauharul Huda showed a significance value of 0.004 (Sig. < 0.05), which indicates a very significant difference in learning outcomes between the two schools. Overall, the results of this post hoc test indicate that MI Riyadhotul Janah is the group that is most significantly different compared to other schools, especially when compared to MIS Jauharul Huda.

Discussion

Consistency of Results with Previous Research Theory

The results of this study indicate that there are differences in learning outcomes for fractions across the elementary schools studied. This finding aligns with [8]the finding that using concrete media in fraction learning can significantly improve student learning outcomes, particularly in understanding fraction concepts. Learning that utilizes concrete media can help students better understand fraction concepts. The results of this study also support the findings.[9] This study shows that the use of learning media can improve students' understanding of fractions. Therefore, variations in learning outcomes between schools can be understood as a consequence of differences in learning quality and strategies. This finding reinforces the notion that the success of fraction learning depends not only on student ability but also on the learning approach used in schools. These differences indicate an imbalance in learning quality that requires attention.

This research supports the implementation of learning that emphasizes problem-solving in fractions. This finding aligns with research [10]that states that the application of Problem-Based Learning can improve elementary school students' mathematics learning outcomes. Furthermore, this research result is also in line with findings [11]that show that problem-based learning can increase student engagement and understanding of fractions. This approach provides students with opportunities to build concepts through meaningful

[8] Ulfah Islamiah, Atin Supriatin, and Istiyati Mahmudah, "Use of Concrete Media to Improve Learning Outcomes of Grade II Students on Fraction Material at SDIT Al Qonita," *Numerical: Journal of Mathematics and Mathematics Education* , 2025, 146–60.

[9] Theresia Ok'twoka Ekgiyoga et al., "Improving Mathematics Learning Outcomes on Fraction Material Through Fraction Spinner Media in Grade IV of SDN Pegambiran 2," *Jurnal Jendela Pendidikan* 5, no. 03 (2025): 429–35.

[10] Anyela Merici, "Implementation of Problem Based Learning to Improve Mathematics Learning Outcomes on Fractions of Second Grade Elementary School Students," *Prima Magistra: Jurnal Ilmiah Kependidikan* 4, no. 4 (2023): 607–18.

[11] Dita Mulyana Ramadhani and Abrar Abira, "Improving Mathematics Learning Outcomes in Fraction Material Using the Problem Based Learning (PBL) Method in Elementary Schools," *DIDIKA Journal: Wahana Ilmiah Pendidikan Dasar* 9, no. 1 (2023): 218–28.

learning experiences. Thus, schools that implement active learning strategies tend to achieve better learning outcomes. This finding strengthens the theory that contextual mathematics learning can improve understanding of fraction concepts. This condition demonstrates the importance of learning that positions students as active subjects.

However, the results of this study also indicate that not all schools are able to achieve optimal learning outcomes in fractions. This finding aligns with studies [12]that reveal that fractions remain a difficult topic for elementary school students to grasp. These results differ from studies that report uniform improvements in learning outcomes after the implementation of specific methods. This difference may be caused by limitations in the implementation of learning strategies or differences in student characteristics between schools. Furthermore, the lack of media utilization and varied learning methods can widen the gap in learning outcomes. Therefore, the differences in learning outcomes found indicate that success in fraction learning is not entirely equitable. Teacher readiness and learning support factors also influence this situation.

In addition to learning methods and media, the diversity of learning outcomes in fractions between schools is also influenced by teachers' pedagogical competence and the classroom learning environment. The presentation [13]shows that teachers' pedagogical competence and mastery of information and communication technology (ICT) significantly influence student learning outcomes in elementary schools, because pedagogically competent teachers are able to design learning that is more systematic and responsive to students' needs. Furthermore, the study [14]argues that teacher competence and the classroom environment play a joint role in shaping students' mathematical abilities, indicating that a supportive classroom climate can increase engagement and understanding of mathematical concepts. Thus, teacher and learning environment factors reinforce the understanding that variations in learning outcomes in fractions are influenced not only by learning strategies, but also by the quality of pedagogical implementation and the classroom context in each school.

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[12] Sukma Kurnia Syukra, Adrias Adrias, and Salmaini Safitri Syam, "Systematic Literature Review: Students' Difficulties in Understanding Fraction Material in Mathematics Learning in Elementary Schools," *Numbers: Scientific Journal of Mathematics, Earth and Space* 3, no. 2 (2025): 1–11.

[13] Iskanto Iskanto, Taufiqulloh Taufiqulloh, and Yoga Prihatin, "The Influence of Pedagogical Competence and Teachers' ICT Mastery on Learning Outcomes in Independent Curriculum Learning in Elementary Schools," *Journal of Education Research* 5, no. 3 (2024): 4050–59.

[14] Mervin Amba Osic, "Teachers' Competence, Classroom Environment, Learning Style of Students: A Structural Model on Mathematical Ability," *International Journal on Emerging Mathematics Education* 6, no. 1 (2023): 77.

The results of this study indicate that the success of fraction learning is also influenced by the availability and quality of teaching materials used in schools. This finding is in line with research [15]confirming that structured, Problem-Based Learning-based teaching materials can increase student engagement and understanding of fractions. However, the results of this study indicate that even though teaching materials are available, learning outcomes between schools still show significant differences. This difference indicates that the effectiveness of teaching materials is highly dependent on how teachers implement them in the classroom learning process. Thus, the variations in learning outcomes found reflect differences in the quality of learning implementation, not solely the availability of teaching materials. Furthermore, teachers' abilities to manage discussions and facilitate problem-solving also determine the success of the use of these teaching materials. This condition indicates that the role of teachers remains a key factor in learning fractions in elementary schools.

Overall, the results of this study confirm that school of origin plays a role in differentiating students' learning outcomes in fractions. This finding aligns with research [16]suggesting that problem-based learning can improve mathematics learning outcomes, but its success depends on the quality of the learning process. These results reinforce the notion that strategies, media, and teaching materials need to be consistently applied to achieve maximum impact. Furthermore, differences in learning outcomes between schools indicate that gaps in mathematics learning persist. Therefore, these results can be used as a basis for evaluation to improve the quality of fraction learning more equitably. These findings reinforce previous research on the importance of quality mathematics learning in elementary schools. Therefore, improving the quality of learning needs to be done continuously.

This indicates that there are differences in mathematics learning outcomes for third-grade students in Islamic Elementary Schools in West Badung Regency based on their school of origin. Although all schools are at the same level and implement relatively similar curricula, student learning outcomes do not fully reflect similarity. Differences in student learning outcomes are evident in test scores, conceptual understanding, and problem-solving abilities

[15] Natasya Putri Roesma Al-Dhani and Delia Indrawati, "Development of Electronic Student Worksheets for Fraction Number Material Based on Problem Based Learning for Elementary School Students," *Journal of Elementary School Teacher Education Research* 11, no. 8 (2023).

[16] Miftahur Rizqiyah S Pane, Erli Marlina Siregar, and Khotna Sofiyah, "Problem-Based Learning in Improving Elementary School Students' Mathematics Learning Outcomes," *Journal of Multidisciplinary Inquiry in Science, Technology and Educational Research* 1, no. 3c (2024): 1713–19.

based on fractions, which differ significantly across schools. These differences indicate that learning fractions is not simply about providing material, but is influenced by a number of contextual and pedagogical factors that differ in the learning practices at each school.

One of the reasons for the differences in learning outcomes for fractions between schools can be understood as a consequence of the differences in learning conditions that take place in each educational unit. Several studies have shown that student-centered learning approaches, such as problem-based learning, investigative learning with concrete activities, and the use of manipulative media, have been proven to improve student learning outcomes in fractions. Schools that show better learning outcomes generally implement student-centered learning and provide space for students to actively develop their understanding. Research [17]shows that the application of *Problem-Based Learning* supported by concrete media can significantly improve understanding of fraction concepts. This was also found by those [18]who stated that realistic mathematics learning helps students understand fraction concepts because the material is presented in a context close to everyday life.

In addition to learning factors and strategies, the use of instructional media is a crucial factor in differentiating success between schools. Concrete media such as fraction blocks, pictures, or other teaching aids help students understand the concept of parts and wholes, which often presents difficulties in learning fractions [19]. Research [20]shows that the use of fraction blocks can improve elementary school students' conceptual understanding and reduce errors in fraction operations.

This study used an ex post facto method, so the researchers did not provide direct treatment or learning intervention. Therefore, external variables influencing learning outcomes could not be fully controlled. [21]stated that learning assessment results not only

[17] Norma Dewi Anjani, Joko Sulianto, and Mei Fita Asri Untari, "Improving Fraction Learning Outcomes by Applying the Problem-Based Learning Model with Manipulative Media," *Journal of Education Action Research* 5, no. 2 (2021): 246–53.

[18] Safrida Handayani, "The Effect of Using a Realistic Mathematical Approach on Student Learning Outcomes on the Topic of Fractions in Grade IV of Sibulan-Bulan Elementary School" (UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan, 2023).

[19] Meitesya Putri, Salmaini Safitri Syam, and Chandra Chandra, "Difficulties of Elementary School Students in Understanding the Concept of Fractions," *Pentagon: Journal of Mathematics and Natural Sciences* 3, no. 2 (2025): 43–54.

[20] Ade Saputri, "Use of Fraction Block Media to Improve Students' Conceptual Understanding of Fraction Material in Class III MIN 1 South Tapanuli" (UIN Syekh Ali Hasan Ahmad Addary Padangsidimpuan, 2023).

[21] Triasari Andayani and Faisal Madani, "The Role of Learning Assessment in Improving Student Achievement in Elementary Education," *Jurnal Educatio Fkip Unma* 9, no. 2 (2023): 924–30.

reflect student abilities but are also influenced by the quality and characteristics of the assessment instruments used by educators.

Students' final grades can be used as learning outcome indicators, representing their mastery of fractional material. However, learning evaluation results are inseparable from the assessment standards, the form of the evaluation instrument, and the level of difficulty of the questions applied in each school. [22]stated that learning assessment results not only reflect student abilities but are also influenced by the quality and characteristics of the assessment instruments used by educators.

Data analysis was conducted through descriptive statistics to describe the trend and variation of values, as well as inferential analysis using the One Way ANOVA test and the Kruskal-Wallis test as a nonparametric alternative. The use of analytical techniques adapted to the characteristics of the data indicates that the researcher's conclusions were obtained through appropriate analytical procedures. Thus, the variation in mathematics learning outcomes for the material on a number of fractions between schools is a reasonable finding [23]confirming that school origin can be a factor in differentiating student learning outcomes, although it is still influenced by other internal and external factors.

The findings of this study align with the concept of learning outcomes, which views student academic achievement as the primary indicator of educational success. Learning outcomes represent changes in students' abilities after undergoing the learning process, encompassing cognitive, affective, and psychomotor aspects [24]. In this study, final mathematics grades for fractions were used as a representation of students' cognitive abilities, particularly in the areas of understanding and application of concepts.

According to [25]research, learning outcomes are influenced by two main factors: internal and external factors. Internal factors include students' initial abilities, interests, and motivation to learn, while external factors include teacher quality, learning methods, infrastructure, and the school environment. Research findings showing variations in learning

[22] Hidayat et al., (2023)

[23] Andri Yandi, Anya Nathania Kani Putri, and Yumna Syaza Kani Putri, "Factors Influencing Student Learning Outcomes (Literature Review)," *Jurnal Pendidikan Siber Nusantara* 1, no. 1 (2023): 13–24, https://doi.org/https://doi.org/10.38035/jpsn.v1i1.14.

[24] Ananda Aditya Sari Harahap, Yasmin Salsabila, and Nabila Fitria, "The Influence of Ability Development in Cognitive, Affective, and Psychomotor Aspects on Learning Outcomes," *Algebra: Journal of Education, Social Sciences, and Science* 3, no. 1 (2023).

[25] Angdy Erna et al., "Strategy for Analyzing Factors that Decline Mathematics Learning Achievement Using a Data Mining Approach," *Journal of Innovation Studies* 2, no. 4 (2022): 17–23.

outcomes between schools indicate that external factors, particularly the school context as an educational unit, play a role in shaping student achievement, even though they are at relatively the same level and curriculum.

Furthermore, the results of this study can be explained through the educational systems theory proposed by [26], which states that a school is a system consisting of input, process, and output. Inputs are student characteristics, processes are learning activities, and outputs are learning outcomes. Differences in outputs between schools reflect differences in the learning process taking place in each school, including learning strategies, classroom management, and academic climate.

From the perspective of contextual learning theory, [27]it is emphasized that learning effectiveness is greatly influenced by the learning environment and social interactions that occur in the classroom. Schools that create a conducive learning environment, encourage active student participation, and provide adequate academic support tend to produce higher learning outcomes. This is relevant to research findings that school of origin is a significant differentiating variable in students' mathematics learning outcomes.

Furthermore, the theory of individual and ecological educational differences proposed by [28]explains that children's development and learning achievement are influenced by their immediate environment, including schools. Schools, as part of the microsystem, play a strategic role in shaping students' learning experiences. Therefore, differences in school characteristics, even within the same area, can result in variations in student learning outcomes.

Thus, theoretically, the findings of this study reinforce the expert view that learning outcomes are not solely determined by individual student abilities, but rather are the result of interactions between students and the educational environment in which they learn. This ex post facto research shows that without any special learning treatment from the researcher, differences in educational units still contribute to variations in mathematics learning

[26] Sri Handayani, Agis Mulya Akbar, and Namira Septia, "The Concept of Education as a System and Components of the Education System," *Indonesian Star Education Journal* 3, no. 1 (2025): 322–29.

[27] Erina Mifta Alvira et al., "Analysis of Learning Problems: Factors of Effectiveness of the Learning Process in Students," *Journal of Education and Social Sciences (Jupendis)* 2, no. 1 (2024): 142–53.

[28] Nadya Khairunnisa and Henry Aditia Rigianti, "The Influence of Social Environment on Student Learning Achievement in Elementary School," *Didactics: Scientific Journal of PGSD STKIP Subang* 9, no. 3 (2023): 1360–69.

outcomes, in line with the learning outcome theory and educational system theory that have been put forward by experts.

Implications of Research Results

The results of this study have several important implications, both theoretically and practically. Theoretically, these findings confirm that students' abilities in learning fractions are not only owned by individual abilities, but are also influenced by contextual factors, such as the quality of learning, school characteristics, and the learning environment. Therefore, these findings expand the study of mathematics education on the importance of a contextual approach in understanding student learning outcomes in fractions. Practically, the implications of this study suggest the need for elementary school teachers to design more effective fraction learning, differences in achievement between schools indicate that the use of learning media, learning strategies, and pedagogical approaches applied by teachers play an important role in students' understanding of fractions.

These findings support the need for teachers, as learning agents, to play an active role in fostering positive student perceptions of mathematics learning, thereby supporting improved mathematical abilities [29]. Therefore, evaluations tailored to the learning methods used, along with the use of more contextual and concrete learning media, can help students understand fractions more easily. Furthermore, there are implications for education administrators and schools. Differences in learning outcomes between schools indicate the importance of equity in the quality of learning, both in terms of resources, facilities, and teacher competency development. Schools are expected to provide maximum support for the provision of adequate learning resources and teacher training programs. Principals, teachers, students, educational staff, and other components are the main foundation for achieving school quality [30].

Thus, disparities between schools can be minimized. This research also has implications for educational policymaking. Findings showing differences in fraction learning outcomes between schools can inform the formulation of more targeted policies, such as strengthening programs to improve the quality of learning in elementary schools or providing special assistance to schools with low achievement. Policies based on research data

[29] Elsa Susanti and Salmaini Safitri Syam, "The Role of Teachers in Improving the Mathematical Literacy Skills of Indonesian Students," in *Proceedings Presented at the Seminar on Mathematics and Mathematics Education, UNY*, 2017.

[30] Cucun Sunaengsih, *Textbook of Educational Management* (UPI Sumedang Press, 2017).

are expected to improve the quality and equity of education overall. Therefore, the implications of this research not only contribute to the development of mathematics education theory but also offer practical recommendations for schools, policymakers, and teachers to implement to improve fraction learning in elementary schools.

However, this study has limitations in scope, as it focused solely on comparing student learning outcomes based on school of origin, without considering other factors that could potentially influence student learning outcomes. The variables studied were limited, so the results of this study are unable to fully explain the causes of differences in learning outcomes between schools. However, various recent studies have shown that mathematics learning outcomes are influenced by many factors beyond school of origin. Research [31]indicates that learning motivation plays a significant role in improving students' mathematics learning outcomes. This finding is supported by research [32]that states that learning motivation and learning models together contribute positively to students' mathematics learning outcomes. In other words, students with high learning motivation tend to show better learning outcomes than students with low learning motivation.

In addition to motivation, students' interest and perceptions of mathematics are also variables that influence learning outcomes. Research [33]has found that interest and motivation to learn significantly influence students' mathematics learning outcomes. This is in line with research [34]that states that students with positive perceptions of mathematics tend to have better learning outcomes than students with negative perceptions. Research [35]also [36]shows a significant relationship between learning motivation and students' mathematics learning outcomes, confirming that motivation is an internal factor that cannot be ignored in

[31] Sobahiya, Improving students' motivation to learn mathematics through the TaRL-based PBL model in class III of SDN Noborejo 02 Salatiga, " *Journal of Education and Teaching", no. 2* (2024) : 188-189

[32] Lismayeni et al., "Motivation and learning outcomes of mathematics using the problem-based learning model in class VIII students of MTsN 10 Agam", *Innovative: Journal of Social Science Research* (2024) : 2153-2161

[33] Safitri et al., "The Influence of Interest and Motivation to Learn on Students' Mathematics Learning Outcomes", *Journal of Mathematics Education.* No. 7 (2025) : 1-10

[34] Safira and Astuti, "The relationship between learning motivation and students' perceptions of mathematics with mathematics learning outcomes of class X SMA Al Islam 1 Surakarta", *"Journal of Mathematics and Natural Sciences"* (2025)

[35] Irma Yulia and Medika, "The relationship between motivation and students' mathematics learning outcomes", *"DUSAINS: Journal of Education and Science", no. 2* (2024) : 28-36

[36] Endang Mayora et al., "The relationship between motivation and students' mathematics learning outcomes", *"Journal of Education and Science" no. 2* (2024) : 18-27

educational research. Furthermore, research [37]adds that students' learning styles also influence variations in mathematics learning outcomes, so differences in learning outcomes cannot be explained by a single variable.

Other research findings also indicate that learning process factors play a significant role in improving students' mathematics learning outcomes, particularly in fractions. The study [38]revealed that the application of a Problem-Based Learning model supported by manipulative media significantly improved student learning outcomes in fractions. These findings suggest that learning involving problem-solving activities and hands-on learning experiences can help students better understand the concept of fractions.

The study [39]also supports these findings by demonstrating that the application of the Problem-Based Learning model has a positive effect on learning outcomes in fraction arithmetic operations. Student-centered learning that emphasizes active involvement has been shown to improve students' conceptual understanding and mathematics learning outcomes. Furthermore, [40]it confirms that understanding the concept of fractions as they relate to everyday life plays a significant role in improving elementary school students' mathematics learning outcomes. This demonstrates that contextual and meaningful learning can help students master the concept of fractions.

Based on the above description, the differences in student learning outcomes in fractions based on school origin found in this study are likely influenced by various other factors that have not been examined in depth. Therefore, further research is recommended to develop a broader study, both in terms of research design and the variables used. Future research can add variables such as learning motivation, student interest and perceptions of mathematics, learning styles, learning models used by teachers, and learning environment factors so that the research results are more comprehensive and able to provide a more complete picture of the factors that influence students' mathematics learning outcomes, especially in fractions.

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[37] Sari et al., "The influence of mathematics learning outcomes viewed from the level of motivation and learning style of class VIII students of MTs Muhammadiyah Al Fatah Nangahale", " *Journal of Indonesian Education", no. 1* (2023) : 104-117

[38] Anjani et al., "Improving learning outcomes of fraction material by applying the Problem Based Learning model assisted by manipulative media", *"Journal of Education Action Research* " no. 2 (2021) : 246-257

[39] Gultom, Improving learning outcomes of mathematical fraction arithmetic operations through the Problem Based Learning (PBL) learning model " *Journal of Development Education and Learning (JODEL)"* (2024)

[40] Safari and Herman, "The concept of fractional numbers and its relationship to daily life in elementary school mathematics learning", " *Karimah Tauhid* " no. 4 (2025)

Conclusion

This study concludes that there are statistically significant differences in students' fraction learning outcomes among third-grade Madrasah Ibtidaiyah students in West Bandung Regency. The findings indicate that school origin functions as a differentiating factor in students' achievement, as reflected in the variation of average scores across schools. In particular, MIS Jauharul Huda demonstrates the highest level of achievement, while MI Riyadhotul Janah shows the lowest, with other schools positioned in between. These differences highlight the existence of achievement gaps in fraction learning despite similarities in curriculum, educational level, and regional context. The results suggest that students' fraction learning outcomes are not solely determined by individual abilities but are also associated with differences in school-level factors, including instructional practices and learning environments. This study contributes to the literature by providing empirical evidence of inter-school disparities in fraction learning outcomes within relatively comparable educational settings, emphasizing the role of the school as a key analytical factor in mathematics achievement.

However, this study is subject to several limitations. The use of non-parametric analysis limits the ability to estimate the magnitude of differences between groups. In addition, learning outcomes were measured solely through final scores, which may not fully capture students' conceptual understanding of fractions. The study also did not control for other influential variables, such as teaching strategies, teacher competence, and student motivation, and the unequal sample distribution across schools may affect the generalizability of the findings. Future research is recommended to involve larger and more balanced samples, incorporate additional variables related to instructional processes, and apply mixed-method or experimental designs to better explain the underlying causes of achievement differences. Such approaches are expected to provide more comprehensive insights and contribute to the development of more effective and equitable fraction learning practices in elementary education.

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