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Gender and School-Origin Differences in Elementary Students' Mastery of the Greatest Common Factor

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Abstract

Mastery of the Greatest Common Factor (GCF) is a fundamental component of number learning in elementary mathematics, as it supports students' understanding of arithmetic operations and later mathematical reasoning. However, differences in students' mathematical achievement may be associated with individual and institutional factors, including gender and school type. This study aims to examine the effects of school type and gender on elementary school students' mastery of the Greatest Common Factor and to determine whether an interaction exists between these variables. The study employed a quantitative approach using an ex post facto comparative factorial design. The sample consisted of 28 sixth-grade students from three Islamic elementary schools in West Bandung Regency, Indonesia. Data were analyzed using descriptive statistics and Two-Way ANOVA after meeting the assumptions of normality and homogeneity. The results indicate that school type significantly affects students' GCF mastery. Gender also shows significant differences in learning outcomes between male and female students. However, no significant interaction effect was found between school type and gender. These findings suggest that variations in GCF mastery are influenced more by institutional context and gender differences independently rather than by their combined effect. This study contributes empirical evidence on how student characteristics and school context relate to numeracy achievement in elementary mathematics learning..

Keywords: *Greatest Common Factor, Mathematics Achievement, Elementary School Students, School Type, Gender Differences*

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Introduction

Mastery of number concepts is the core of mathematics learning in elementary schools [1], because it is the foundation for understanding arithmetic operations and mathematical reasoning at a later stage [2]. The Greatest Common Factor as one of the number materials requires students' ability to identify relationships between numbers in a structured manner and apply these concepts in problem solving [3]. Students' success in mastering GCF not only reflects procedural abilities, but also shows the level of conceptual understanding that has developed since elementary school education [4]. In learning practice, elementary school students' mastery of GCF shows quite striking variations in achievement. These variations cannot always be explained solely by students' individual abilities, but are also closely related to the scope of their learning [5]. The school environment, the learning patterns applied, and student characteristics are interrelated factors in shaping mathematics learning outcomes [6]. Therefore, analysis of GCF mastery should be placed in a container that takes into account more than one factor simultaneously.

Although the Greatest Common Factor (GCF) material has been systematically taught in elementary schools, most previous research has focused on improving learning outcomes through the use of specific learning methods or media [7]. Meanwhile, research that specifically examines differences in students' GCF understanding abilities by simultaneously

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[1] Siti Maulida Rahmalia and Yusuf Safari, "The Importance of Basic Mathematical Concepts in Elementary School," *Karimah Tauhid* 3, no. 9 (2024): 9847–55, https://doi.org/https://doi.org/10.30997/karimahtauhid.v3i9.14671.

[2] Eka Oktapiana, Karlimah Karlimah, and Ika Fitri Apriani, "Understanding of the Concept of Arithmetic Operations of Addition and Subtraction of Whole Numbers in Grade III Elementary School Students," *DIDAKTIKA: Journal of Educational Thought* 31, no. 2 (2025): 207–15, https://doi.org/https://doi.org/10.30587/didaktika.v31i2.10063.

[3] Anita Andriani et al., "Mathematics Learning on Greatest Common Factor and Least Common Multiple in Elementary School," *Journal of Primary Education Research* 3, no. 1 (2025): 7–13, https://doi.org/https://doi.org/10.57176/primer.v3i1.42.

[4] Dwi Trisnawati, Sumarno Sumarno, and Joko Sulianto, "Effectiveness of Using Dakota Learning Media for FPB and KPK Material for Grade IV SDN 12 Kendari," *Primatika: Journal of Mathematics Education* 14, no. 1 (2025): 63–72, https://doi.org/https://doi.org/10.30872/primatika.v14i1.4733.

[5] Tua Siregar et al., "Analysis of Learning Difficulties of Students of SD Negeri 167102 Rambutan in Mathematics," *Jurnal Guru Kita* 8, no. 2 (2024): 223–36, https://doi.org/10.24114/jgk.v8i2.53823.

[6] 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.

[7] Siti Komariyeh and Andi Mariono, "Interactive Multimedia Based on Problem Based Learning as an Effort to Improve the Mathematics Learning Experience of Fifth Grade Students on the KPK–FPB Material," *Didaktika: Jurnal Kependidikan* 14, no. 4 November (2025): 7115–26, https://doi.org/https://doi.org/10.58230/27454312.3171.

considering school type and gender characteristics is still relatively limited. Some studies tend to examine the influence of gender or learning context separately, for example, the relationship between gender and mathematics learning in general [8]. This approach is not fully able to describe the complexity of learning that occurs in the classroom. In reality, the influence of gender on GCF understanding can vary depending on the type of school where students study, and vice versa [9]. Therefore, research that simultaneously examines the influence of school type and gender on elementary school students' GCF understanding abilities is important to obtain a more complete picture and can serve as a basis for developing fairer and more effective mathematics learning.

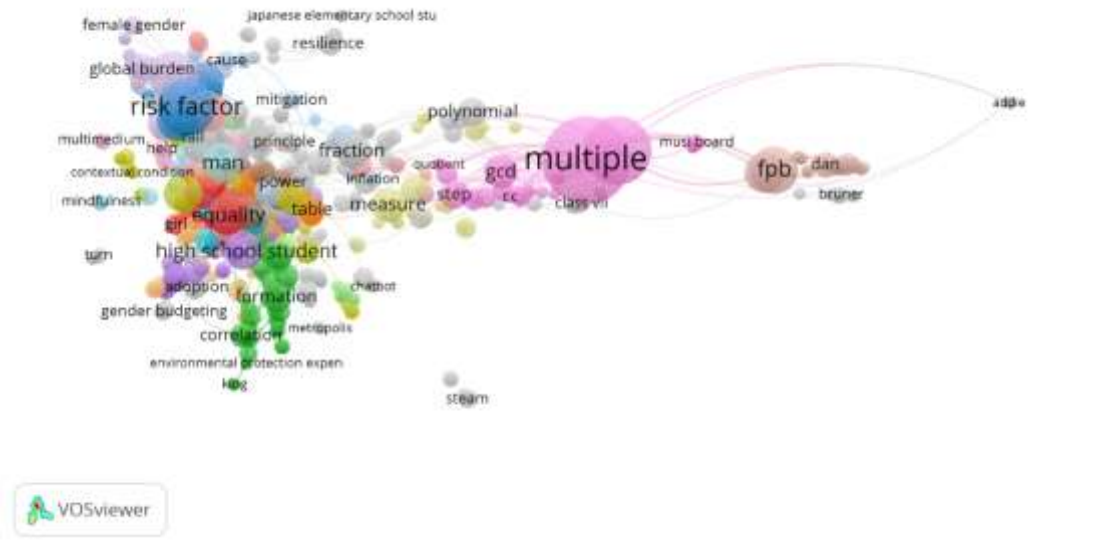


Figure 1. VOSviewers results

Based on these conditions, this study positions the mastery of the Greatest Common Factor (GCF) as a dependent variable influenced by two main factors, namely school type and student gender. The determination of these two factors is based on previous findings that show that differences in school institutional characteristics and student gender influence variations in students' mathematical abilities, especially in understanding basic mathematical

[8] Suesthi Rahayuningsih, "Cognitive Process of Mathematics Learning in Gender Perspective," *MAJAMATH: Journal of Mathematics and Mathematics Education* 7, no. 2 (2024): 140–50, https://doi.org/https://doi.org/10.36815/majamath.v7i2.3604.

[9] Della Agata, Ema Butsi Prihastari, and Ifa Hanifa Rahman, "Analysis of Learning Styles of 5th Grade Students of Sambirejo Elementary School on Mathematics Absorption of KPK and GCF Material," *Journal of Elementary Education* 12, no. 1 (2024): 34–43, https://doi.org/https://doi.org/10.20961/jpd.v12i1.84466.

concepts such as GCF [10]. This study is based on the assumption that school type and gender do not work separately, but have the potential to interact with each other in influencing the level of GCF mastery. In other words, differences in GCF mastery are not only influenced by one individual factor, but also by a combination of both factors, so the analysis used is expected to capture these influences simultaneously [11]. To gain a deeper understanding of the differences in GCF mastery between student groups, Two-Way Analysis of Variance (Two-Way ANOVA) was used. This method allows testing differences in average GCF mastery based on school type and student gender simultaneously, as well as identifying the interaction effects between the two factors. This approach is considered more appropriate than one-way analysis because it is able to describe the pattern of differences in student abilities more comprehensively [12].

The novelty of this research lies in the effort to integrate two things, namely the analysis of the context of school conditions and gender differences in one complete quantitative structure using the Two Way ANOVA statistical method, so that this research not only looks at differences in learning outcomes between groups, but also how school type and gender interact in influencing the ability to master FPB in elementary school students. This approach is expected to produce more in-depth, real data-based findings that are useful for the development of mathematics learning. In line with this, the purpose of this study is to test whether differences in school type and gender can influence the ability to master FPB in elementary school students, as well as to identify whether the interaction between these two factors can have a real influence on FPB mastery. Thus, this research is expected to provide a strong fact-based basis in understanding differences in FPB learning outcomes and become a reference in making more data-based learning decisions.

[10] D Rahmawati, H Susanto, and E Lestari, "The Effect of School Type and Gender on Elementary School Students' Mathematical Concept Understanding Ability," *Journal of Mathematics Education* 18, no. 2 (2024): 145–56, https://doi.org/10.21831/jpm.v18i2.61234.

[11] AR Putra and N Hidayah, "Analysis of the Interaction of Gender and School Background on Students' Mathematics Learning Outcomes Using Two-Way ANOVA," *Journal of Mathematics Education Research* 10, no. 1 (2023): 55–66, https://doi.org/10.21831/jrpm.v10i1.49872.

[12] DP Sari, S Supiat, and N Nurhasanah, "Analysis of Differences in Students' Mathematical Ability Based on Gender and School Type Using Two-Way ANOVA," *Journal of Mathematics and Science Education* 13, no. 1 (2025): 149–56, https://doi.org/10.21831/jpms.v13i1.84706.

Research Methods

This study was designed with a quantitative approach using an ex post facto comparative factorial design. In this design, the researcher acts as an observer of events that have occurred without providing any specific treatment or intervention. This approach was used to examine differences in mathematics learning outcomes on the Greatest Common Factor (GCF) material based on available value data. This study focused on two differentiating variables: school of origin as a reflection of the learning context at the school and gender as a student characteristic. Therefore, a factorial design was deemed appropriate because it could examine the influence of each variable while simultaneously examining the relationship between the two [13].

The implementation of this research involved three Madrasah Ibtidaiyah in West Bandung Regency, namely MI Darussyifa Al-Musri'1, MIS Jauharul Huda, and MI Kubang. These three schools were chosen to illustrate the diversity of educational units in the region. The population of this research was all sixth grade students of Madrasah Ibtidaiyah in West Bandung Regency, with a sample of 9 students each at MI Darussyifa Al-Musri'1 and MIS Jauharul Huda, and 10 students at MI Kubang, so that the total sample size reached 28 students. This research emphasizes the depth of comparative analysis between groups rather than broad generalization efforts, so that the results of the research are expected to describe the conditions and trends that occur in the field more realistically.

Data processing and analysis were performed using SPSS version 26 software. The initial stage of analysis began with the use of descriptive statistics to obtain a general overview of the data characteristics. Through the average value and standard deviation, researchers were able to observe the level of achievement and variation in student learning outcomes in each group combination. Next, inferential statistical analysis was used to test whether the differences observed descriptively were statistically significant. At this stage, normality and homogeneity assumptions were first tested as a methodological precaution in determining the most appropriate analysis technique.

The selection of Two Way ANOVA as the main analysis technique was used to assess the influence of school origin and gender simultaneously, while also looking at the possibility of

[13] Triana Wulandari, Farid Gunadi, and Runisah Runisah, "Students' Mathematical Reasoning Ability in the Use of RME Based on Gender and Student Motivation," *MATHEMA: JOURNAL OF MATHEMATICS EDUCATION* 7, no. 1 (January 2025): 68, https://doi.org/10.33365/jm.v7i1.4487.

interaction between the two factors on FPB learning outcomes [14]. However, this study still opens up room for flexibility in analysis by considering the use of nonparametric tests in the form of Median Tests if the normality assumption is not met. Thus, the analysis method applied not only emphasizes the accuracy of the procedure, but also the suitability between the characteristics of the data and the analysis techniques used, so that the results of the study are expected to have a strong statistical basis and can be interpreted more precisely [15].

Results and Discussion

Result

This research results section outlines the findings of the data analysis aimed at answering the research focus. The presentation begins with descriptive statistics to provide a basic overview of the trends in scores and the distribution of student learning outcomes in the FPB material based on school origin and gender differences. This description provides an initial foundation for understanding the patterns of differences between groups. Next, inferential statistics are presented to empirically test whether the observed differences are statistically significant.

Table 1. Descriptive Statistics

School	Gender	Mean	Standard Deviation	N
MI Darussyifa Al-Musri'1	Man	85.00	9,487	6
	Woman	98.33	2,887	3
	Total	89.44	10.14	9
MIS Jauharul Huda	Man	72.50	4,183	6
	Woman	76.67	7,638	3
	Total	73.89	5,465	9
MI Kubang	Man	66.20	2,168	5
	Woman	68.60	1,949	5
	Total	67.40	2,319	10
Total	Man	75.06	9,940	17
	Woman	78.91	13.52	11
	Total	76.57	11.40	28

[14] Jing Zhang and Yinan Guo, "Examining the Impact of Blended Learning on Test Scores: A Statistical Analysis Using an ANOVA Model," ed. N Mohamad Nasri, S Amat, and Y Chen, *SHS Web of Conferences* 190 (April 2024): 1019, https://doi.org/10.1051/shsconf/202419001019.

[15] Jonghae Kim, Dong Hyuck Kim, and Sang Gyu Kwak, "Comprehensive Guidelines for Appropriate Statistical Analysis Methods in Research," *Korean Journal of Anesthesiology* 77, no. 5 (October 2024): 503–17, https://doi.org/10.4097/kja.24016.

Based on the table above, it can be seen that the comparative learning outcomes of students in the FPB material are based on school origin, gender, and number of students (N), thus providing a more complete context in understanding the achievements and differences in scores. At MI Darussyifa Al-Musri'1, from a total of 9 students consisting of 6 male students and 3 female students, it can be seen that female students show very high achievements with higher average scores and narrower score distribution, this indicates strong consistency of learning outcomes, while male students have more diverse value variations. A similar pattern is also seen at MIS Jauharul Huda, which involves 9 students with a composition of 6 males and 3 females, where the average difference between genders is relatively small, thus indicating learning outcomes that tend to be balanced even though there are still variations in scores within the group.

In contrast to the two schools, MI Kubang involved 10 students with a balanced number of boys and girls, 5 students each, and showed a small average difference and low standard deviation in both groups, which reflects a fairly high homogeneity of learning outcomes. Overall, of the total 28 students analyzed, consisting of 17 boys and 11 girls, girls had a slightly higher average learning outcome, but with a greater variation in scores. The integration between achievement scores, data distribution, and the distribution of the number of students shows that differences in learning outcomes are not only related to gender, but are also influenced by the characteristics of each school and the comparison of students in each group.

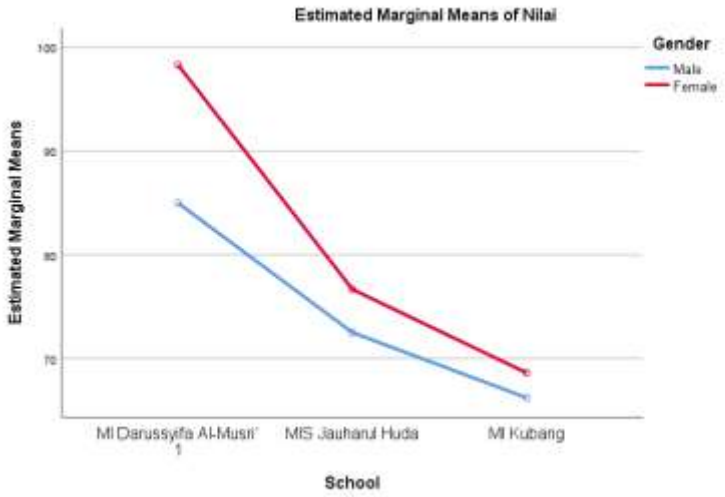


Figure 1. Estimated Marginal Means

Based on the Figure above, a comparative pattern of learning outcomes between groups is visible. It can be seen that in the three schools, namely MI Darussyifa Al-Musri'1, MIS Jauharul Huda, and MI Kubang, the average scores of female students are consistently above those of male students, as indicated by the consistently higher position of the female line. MI Darussyifa Al-Musri'1 shows the most striking difference between male and female students, with the average scores of female students being significantly higher than those of male students. At MIS Jauharul Huda, the difference in average scores between genders is still visible, but with a smaller difference. Meanwhile, at MI Kubang, the two lines show a relatively narrow distance, indicating a not too large difference in learning outcomes between male and female students. The pattern of decreasing average scores from MI Darussyifa Al-Musri'1 to MI Kubang for both genders indicates a variation in learning outcomes between schools. Overall, this graph indicates that although girls tend to have higher average grades in each school, the magnitude of the difference varies depending on the individual school context.

Table 2. Tests of Normality

	Kolmogorov-Smirnov [a]		**Shapiro-Wilk**	
	Statistics	**Sig.**	**Statistics**	**Sig.**
Standardized Residual	.163	.056	.927	.052

Based on the table above, it can be seen that the significance value for the standardized residual in Komogorov -Smirnov and Shapiro-Wilk is 0.056 and 0.052 with statistical values of 0.163 and 0.927. Based on the decision-making criteria, H0 $_{is}$ accepted or it can be said that the Sig. value is > 0.05 so it can be said that the standard residual value data is normally distributed

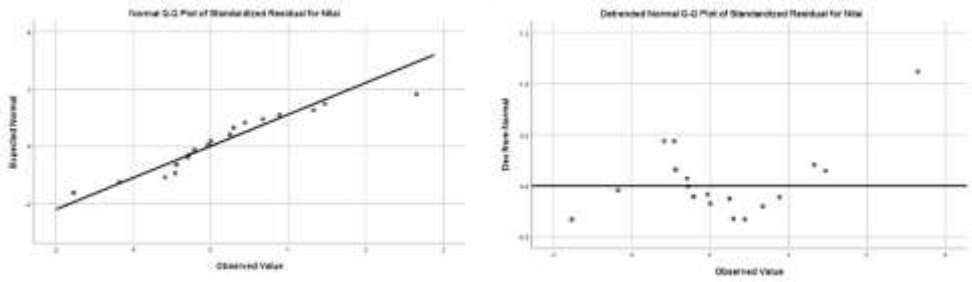


Figure 2. Normal QQ Plot of Standardized Residual

Based on the Normal Q–Q Plot and Detrended Normal Q–Q Plot graphs, it can be seen that most of the standard residual data points are located around and follow the direction of the diagonal line that represents the theoretical normal distribution. The proximity of these points to the line indicates that the difference between the observed residual values and the expected residual values in a normal distribution is relatively small. In the Normal Q–Q graph, there are no extreme deviations at the beginning or end of the distribution, thus indicating the absence of excessive skewness or kurtosis. Meanwhile, in the Detrended Normal Q–Q graph, the residual points are randomly distributed around the zero line without forming a specific pattern, indicating that the deviation from normality is random and unsystematic. Such a distribution pattern indicates that the assumption of normality of the standard residuals has been met, so the data is suitable for analysis using parametric statistical techniques.

Table 3. Levene's Test of Equality of Error Variances [a, b]

	Levene Statistics	**Sig.**
Based on Mean	4,600	.103

Based on the table above, it can be seen that the significance value based on the mean is 0.103 > 0.05, so it can be said that the data is homogeneous or has the same variance among students' mathematics learning abilities in the FPB material in each school.

Table 4. Test of Between-Subjects Effects

	Sig.
Which school are you from	.000
Gender	.007
School of Origin * Gender	.126

Based on the table above, the significance value for each source of variation tested was obtained. The school origin factor has a Sig. value of 0.000 < 0.05, so it can be concluded that school origin has a significant effect on student learning outcomes. The gender factor also shows a Sig. value of 0.007 < 0.05, which means there is a significant difference in learning outcomes between male and female students. Meanwhile, the interaction between school origin and gender has a Sig. value of 0.126 > 0.05, thus indicating that there is no significant interaction effect between the two factors on student learning outcomes. These results

indicate that school origin and gender separately affect learning outcomes, but their effects are not interdependent.

Table 5. Multiple Comparisons

School	School	Sig.
MI Darussyifa Al-Musri'1	MIS Jauharul Huda	0.000
	MI Kubang	
MIS Jauharul Huda	MI Kubang	0.062

Based on the table above, it can be seen that the test results indicate that there is a significant difference between MI Darussyifa Al-Musri'1 and MIS Jauharul Huda with a significance value of 0.000, as well as between MI Darussyifa Al-Musri'1 and MI Kubang with a significance value of 0.000 <0.05. This shows that student learning outcomes at MI Darussyifa Al-Musri'1 are statistically significantly different compared to the two schools. Meanwhile, the comparison between MIS Jauharul Huda and MI Kubang produces a significance value of 0.062 > 0.05, so it can be concluded that there is no significant difference in learning outcomes between the two schools. Thus, the results of this post hoc test confirm that the difference in learning outcomes lies mainly in MI Darussyifa Al-Musri'1 compared to other schools, while MIS Jauharul Huda and MI Kubang have relatively equal learning outcomes statistically.

Discussion

The results of statistical analysis show differences in academic achievement of FPB based on gender and school origin. In general, female students tend to obtain higher average scores than male students, while male students have a more plural variation in scores. This condition reflects that FPB learning achievement is not only related to students' cognitive abilities, but is also influenced by how students interact with the learning environment at school [16]. At MI Darussyifa Al-Musri' 1, female students have higher average scores, with a variation in scores that is not too far compared to male students. This indicates that the understanding of the FPB concept in female students tends to be more balanced. This pattern

[16] Lu'lu Azmi Agustina and Siti Masyithoh, "The Influence of School Environment on Student Learning Achievement in Elementary Schools: A Literature Review," *Journal of Education and Teacher Training* 3, no. 3 (2025): 692–702, https://jutepe-joln.net/index.php/JURPERU/article/view/875.

is likely related to basic mathematics learning which requires precision and structural understanding. With more regular study habits, the learning outcomes obtained become more consistent [17].

A group of male students at MI Darussyifa Al-Musri'1 showed a more plural variation in scores. This variation indicates differences in the level of mastery of GCF among male students within the same school. This variation can be understood as a reflection of differences in student motivation and engagement in mathematical problem-solving activities. These differences are related to interest and persistence in learning mathematics, which often affect the consistency of learning outcomes [18].

At MIS Jauharul Huda, the difference in average scores between male and female students appears relatively small, although there are still differences in GCF achievement between students. This condition illustrates that the learning environment at the school allows both genders to receive relatively equal learning opportunities. The applied learning pattern appears to provide a balanced space for male and female students, so that both have the same opportunity to develop an understanding of the GCF concept. When learning is structured comprehensively and provides equal space for all students regardless of gender, differences in academic mathematics achievement between students tend to be less pronounced [19].

Different results were seen at MI Kubang, where the achievement of male and female students' scores showed a higher level of uniformity. The small difference in average scores and the low level of dispersion of scores indicate that students' mastery of the GCF concept at this school is relatively even. This condition shows that the learning process is able to reach all students, so that most students achieve a nearly equal understanding. Consistency in the implementation of learning, both in the delivery of material and the application of teaching strategies, also influences the formation of relatively similar learning experiences in

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[17] Fadilatun Nikmah, Sekar Dwi Ardianti, and Ika Ari Pratiwi, "The Relationship Between Learning Intensity and Elementary School Students' Mathematics Learning Outcomes," *Didactics: Scientific Journal of Elementary School Teacher Training and Education, STKIP Subang* 9, no. 4 (2023): 2397–2407, https://doi.org/https://doi.org/10.36989/didactics.v9i04.1831.

[18] Darmawan Harefa, "The Relationship Between Students' Interest in Learning and Mathematics Learning Outcomes," *Afore: Jurnal Pendidikan Matematika* 2, no. 2 (2023): 1–11, https://doi.org/https://doi.org/10.57094/afore.v2i2.1054.

[19] Rahmat Kusharyadi and Dadang Juandi, "Analysis of Students' Mathematical Reasoning between Different Genders," *Union: Scientific Journal of Mathematics Education* 11, no. 2 (July 2023): 339–47, https://doi.org/10.30738/union.v11i2.14939.

the classroom. This shows that consistent teaching methods and similar learning experiences reduce differences in learning outcomes between students [20].

Overall, the data shows that although female students have slightly higher average GCF learning outcomes than male students, these outcomes are not always accompanied by an even level of understanding across students. The variations in scores that still emerge indicate differences in early learning experiences and levels of confidence in mathematics, particularly in basic material such as GCF [21]. Furthermore, differences in GCF learning outcomes across schools indicate that student learning outcomes are influenced not only by gender, but also by the conditions and ways in which schools organize the learning process and the structure of their classes. This supports the view that elementary school students' mathematics achievement is the result of an interaction between individual factors and the school context [22].

The results obtained from Figure 1. (Estimated Marginal Means) show that the average value of female students' learning outcomes tends to be higher than male students in three different schools, namely MI Darussyifa Al-Musri'1, MIS Jauharul Huda, and MI Kubang. This is in line with the findings in research that show differences in academic achievement based on gender, although not always comprehensive [23]. In general, this event reflects the role of psychological, social, and school environmental factors in shaping student learning outcomes. For example, it can be seen from previous research [24]that found a strong relationship between psychology and learning achievement, and there are differences in this relationship based on gender. This supports the findings of this study that female students tend to get higher academic results than male students, possibly because the psychological aspect of learning is stronger for women, especially in certain aspects. In addition, the findings

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[20] Arlene Borbon, Gemma Baguio, and Regina Galigao, "Teacher's Quality Impact on Student Outcomes," *Pantao (International Journal of the Humanities and Social Sciences)* 4, no. 3 (2025), https://doi.org/10.69651/PIJHSS0403332.

[21] Blaine Pedersen et al., "Most Mathematics Classrooms Contain Wide-Ranging Achievement Levels," *Gifted Child Quarterly* 67, no. 3 (July 2023): 220–34, https://doi.org/10.1177/00169862231166074.

[22] Rasmuin Rasmuin et al., "Factors Contributing to Fourth Graders' Mathematics Achievement: A Multilevel Study," *International Journal of Evaluation and Research in Education (IJERE)* 13, no. 4 (August 2024): 2218, https://doi.org/10.11591/ijere.v13i4.27223.

[23] Babang Loty, "Comparison of Mathematics Learning Achievement Between Male and Female Students of Grade V of GMIT Elementary School," *Paradigma: Journal of Philosophy, Science, Technology, and Socio-Culture* 31, no. 2 (2025): 31–44, https://doi.org/https://doi.org/10.33503/paradigma.v31i2.1681.

[24] Danda Leica Ramdhani Futri and Kartika Nuradina, "The Relationship between Academic Self-Concept & Self-Efficacy and Self-Confidence in the Learning Process of Grade 10 Students of SMA X Bandung City," *Indonesian Research Journal on Education* 5, no. 4 (2025): 668–79, https://doi.org/https://doi.org/10.31004/irje.v5i4.3094.

of this study also show significant differences between schools, where MI Darussyifa Al-Musri'1 shows the largest gap between female and male students, while at MI Kubang the difference is smaller.

This is in line with literature findings that emphasize that school contexts such as the classroom environment, learning quality, teacher quality, and educational policies can be factors in differences in learning outcomes [25]. One study showed that gender compatibility between students and teachers can influence student learning, especially in certain aspects, indicating that gender effects are not universal, but can also depend on the school environment [26]. However, these results also support and expand the understanding of the relationship between gender and student learning achievement in a broader context. For example, the results of a study conducted by one researcher [27]showed that extracurricular involvement did not differ significantly in learning outcomes, where overall female students excelled in academic achievement. This finding is in line with this study, which shows that female learning outcomes are more dominant, while also confirming that the reasons for success are not only based on involvement in learning activities, but can also include internal and external factors.

Not all research is consistent, as some studies have found differing or even contradictory results. One study [28]found no significant differences in algebra achievement based on gender, but rather significant variations based on school location. This finding contradicts our own research, which shows that the relationship between gender and achievement can vary depending on subject context, curriculum, and other factors. Furthermore, several other studies have explored non-gender factors that can influence academic achievement. For example, research has shown that [29]a good teacher-student

[25] Mursida Mursida, "The Effect of Teaching Quality, Learning Facilities, and Learning Resources on Student Learning Achievement," *Cendekia: Journal of Science* 5, no. 2 (2025): 579–91, https://doi.org/https://doi.org/10.51878/cendekia.v5i2.4727.

[26] Moh Hayatul Ikhsan, "Gender-Based Character Education," *INCARE, International Journal of Educational Resources* 4, no. 4 (2023): 365–87, https://doi.org/https://doi.org/10.59689/incare.v4i4.1061.

[27] Maisaroh Ritonga, Nurpani Nurpani, and Nursalimah Nursalimah, "The Influence of Extracurricular Activity Management on Student Learning Achievement," *JIIP-Jurnal Ilmiah Ilmu Pendidikan* 8, no. 5 (2025): 4699–4706, https://doi.org/https://doi.org/10.54371/jiip.v8i5.7829.

[28] Dian Nurikawai, Laela Sagita, and Setiyani Setiyani, "Analysis of Students' Difficulties in Understanding Mathematical Concepts in Solving Algebraic Form Problems Using the Newman Procedure," *Journal of Honai Math* 4, no. 1 (2021): 49–66, https://doi.org/https://doi.org/10.30862/jhm.v4i1.157.

[29] Fitria Hanaris, "The Role of Teachers in Improving Student Learning Motivation: Effective Strategies and Approaches," *Journal of Educational and Psychological Studies* 1, no. 1 (2023): 1–11, https://doi.org/https://doi.org/10.61397/jkpp.v1i1.9.

relationship significantly influences motivation and learning achievement. This can also influence student learning outcomes regardless of gender.

These findings indicate that although gender is a relevant factor, interpersonal factors and the school environment also have a significant influence on the continuity and outcomes of student learning. Theoretically, these findings confirm that gender plays a role in the learning process, but not as a sole factor [30]. Implementing more effective education, such as paying attention to students' psychological aspects, providing emotional support, and providing conducive learning facilities and environments, will help minimize the achievement gap that arises due to gender differences. Therefore, the findings of this study further support a complex pattern in the relationship between gender and student achievement, where the interaction between individual student factors, school characteristics, teacher-student relationships, and the educational environment can simultaneously influence learning outcomes.

From Table 2. The results of the Normality Test show that the standardized residual data from the study is normally distributed. The Kolmogorov-Smirnov test gives a value of 0.056 with a statistical value of 0.163, while the Shapiro-Wilk test gives a value of 0.052 with a statistical value of 0.927. Because both values are greater than 0.05, the null hypothesis (H_0) is accepted or it can be stated that the standardized residual is normally distributed, where the Sig. value is > 0.05. This means that the assumption of normality in statistics, such as regression analysis, is met. So the results of the study can be trusted to make conclusions [31]. These results are in line with previous studies that found that the residual data in a regression model is often normally distributed, especially if the sample data is large enough and there is no anomalous data. In many real cases, the difference in the decrease in data values fulfills the normal requirements, which supports the truth of the statistical model [32].

These results add to the explanation stating that normality is an important step in proving the validity of the results of regression analysis [33]. This finding reinforces that even

[30] Ikhsan, "Gender-Based Character Education."

[31] Estri Nastiti, Tahta Tahta Damayanti, and Sila Amali Madina, "The Impact of Violation of Classical Assumptions on Econometric Model Estimation," *Jurnal Pijar* 2, no. 1 (2023): 150–58, https://doi.org/https://doi.org/10.65096/pmb.v2i1.1177.

[32] Giatma Dwijuna Ahadi and Neni Nur Laili Ersela Zain, "Checking Normality Tests Using Kolmogorov-Smirnov, Anderson-Darling And Shapiro-Wilk," *Eigen Mathematics Journal* , 2023, 11–19, https://doi.org/https://doi.org/10.29303/emj.v6i1.131.

[33] Nastiti, Damayanti, and Madina, "The Impact of Violation of Classical Assumptions on Econometric Model Estimation."

though the p-value is close to the 0.05 limit, normality remains good. From Figure 2, the Normal QQ Plot Results of Standardized Residuals show that most of the standard residual points are close to and follow the diagonal line in the Normal QQ Plot and the points in the Normal QQ Detrendet are randomly scattered around the zero line without forming a particular pattern, indicating that deviations from normality are random and not systematic. This identifies that the normality of the residuals has no significant deviation from the normal distribution [34]. This means that the residuals do not show large deviations from the normal distribution, so that this distribution pattern has fulfilled one of the important assumptions for parametric statistical analysis and is worthy of analysis.

These results are in line with previous research which emphasized that if the data is normally distributed, then the points in the QQ plot will form a diagonal line [35]. This is important, because if the residuals follow the diagonal line, then the normality assumption can be considered fulfilled to a certain tolerance limit. These results also add to the perspective of previous research which shows that when the QQ Plot shows points following the diagonal line, this is used to support the results of other statistical normality tests such as Shapiro-Wilk and also concludes that the residual normality assumption is met [36]. Furthermore, the results in Table 3 Levene's Test of Equality of Error Variances, obtained a Levene Statistic value of 4.600 with a significance value of 0.103.

Because the significance value obtained is greater than 0.05, the assumption of homogeneity of variance is declared fulfilled. This indicates that the variance between groups of students' mathematics learning ability data on the FPB material is considered homogeneous or relatively the same between schools. With the fulfillment of this assumption, the parametric statistical test that requires equality of variance can be continued [37]. This study is in line with the homogeneity test criteria commonly used in quantitative research, namely data is declared homogeneous if the Sig value is > 0.05, and is declared inhomogeneous if the

[34] Devi Ayuningtyas and Rola Manjaleni, "Financial Performance Analysis of Stock Price Changes in Tobacco Sector Companies Listed on the Indonesia Stock Exchange for the Period 2020-2023," *ECo-Buss* 8, no. 1 (2025): 564–79, https://doi.org/https://doi.org/10.32877/eb.v8i1.2774.

[35] Muhammad Isnaini et al., "Data Analysis Techniques for Normality Test," *J-CEKI: Jurnal Cendekia Ilmiah* 4, no. 2 (2025): 1377–84, https://doi.org/https://doi.org/10.56799/jceki.v4i2.7007.

[36] Isnaini et al.

[37] NPLS Devi, IBP Arnyana, and IM Gunamantha, "Implementation of Tri Hita Karana-Oriented Problem Based Learning (PBL) Learning Model on Environmental Care Attitudes and Science Learning Outcomes," *Indonesian Elementary Education Journal* 7, no. 2 (2023): 218–29, https://doi.org/https://doi.org/10.23887/jurnal_pendas.v7i2.2399.

Sig value is < 0.05 [38]. Thus, the results of previous studies support the findings of this study which show the homogeneity of variance in students' mathematics learning ability on the FPB material in each school.

The results of this study indicate that elementary school students' ability to master the Greatest Common Factor (GCF) is significantly influenced by their school of origin and gender. This finding confirms that mathematics learning outcomes are not only related to individual student abilities but also influenced by the school environment in which students study and their characteristics. By examining both factors simultaneously, this study is able to provide a more comprehensive picture of the differences in GCF mastery at the elementary school level. The significant influence of school origin on FPB learning outcomes indicates that differences in learning environments between schools play a significant role in student academic achievement [39]. Schools with higher average FPB scores can be assumed to have more supportive learning processes, both through teacher teaching strategies, the use of appropriate learning media, and the academic culture that develops within the school environment [40].

This finding is in line with various previous studies which state that the quality of mathematics learning is greatly influenced by the conditions of the learning environment, such as the availability of facilities, the learning approach used, and the intensity of teacher guidance [41]. Therefore, differences in GCF learning outcomes between schools cannot be understood solely as differences in student abilities, but also reflect differences in the quality of the learning process implemented in each school. In addition to school factors, gender has also been shown to influence GCF mastery [42]. The analysis results show that female students tend to obtain higher average scores than male students. This finding is in line with several

[38] Ifa Dwi Astutik and Henry Januar Saputra, "The Effect of Number Dakon Media on Student Learning Outcomes in FPB and KPK Material in Grade IV," *Elementary School: Jurnal Pendidikan Dan Pembelajaran Ke-SD-An* 12, no. 2 (2025): 1043–52, https://doi.org/https://doi.org/10.31316/esjurnal.v12i2.4588.

[39] Burniati Azmi, Rhini Fatmasari, and Henny Jacobs, "Motivation, Discipline, School Environment: Keys to Learning Achievement," *Aulad: Journal on Early Childhood* 7, no. 2 (2024): 323–33, https://doi.org/https://doi.org/10.31004/aulad.v7i2.654.

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[42] Wisnu Juli Wiono and Nadya Meriza, "Efforts to Improve Critical Thinking Skills with Scientific and Gender-Based Liveworksheets," *Phenomenon: Journal of Mathematics and Natural Sciences Education* 13, no. 1 (2023): 31–46, https://doi.org/https://doi.org/10.21580/phen.2023.13.1.13249.

studies which reveal that female students are generally more careful, organized, and consistent in completing mathematics assignments, especially on materials that require precise steps and procedures such as GCF [43]. Accuracy in determining number factors and consistency in following the stages of problem solving are advantages that contribute to the achievement of female students' learning outcomes.

Although there are differences in mathematical ability between male and female students, the results of this study indicate that these differences are not decisive. The differences in scores that emerged were relatively small, so they reflect a general trend rather than a real difference in ability. This indicates that with appropriate learning design, both male and female students have an equal opportunity to optimally master the concept of GCF [44]. Furthermore, this study also found no significant interaction effect between school origin and gender on GCF learning outcomes. This finding indicates that the effect of gender on GCF mastery tends to be similar across schools, and conversely, differences in school origin are not influenced by student gender. In other words, the differences in learning outcomes that occur are more due to the influence of each factor separately. These results differ from several previous studies that suggest that certain school contexts can strengthen or weaken differences in mathematics achievement based on gender [45].

These differences in results are likely influenced by sample characteristics, the number of respondents, and the uniformity of the learning approaches implemented in the schools used in the study. The absence of an interaction effect can also be interpreted as an indication that the schools in this study have provided relatively equal learning opportunities for male and female students. Therefore, the differences in learning outcomes that emerged are more due to the influence of each factor separately, rather than the combination of school origin and gender. This finding is important because it demonstrates that gender-equitable

[43] Adi Setiawan, Dimas Anditha Cahyo Sujiwo, and Indah Rahayu Panglipur, "Analysis of Students' Learning Independence in Mathematics Learning from the Perspective of Gender," *Prismatika: Journal of Mathematics Education and Research* 7, no. 1 (2024): 178–91, https://doi.org/https://doi.org/10.33503/prismatika.v7i1.204.

[44] Hasnawiyah Hasnawiyah and Maslena Maslena, "The Impact of Using Interactive Learning Media on Students' Science Learning Achievement," *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan Dan Hasil Penelitian* 10, no. 2 (2024): 167–72, https://doi.org/https://doi.org/10.26740/jrpd.v10n2.p167-172.

[45] Daniel Williams Fointuna, "Gender Equality in Students' Mathematical Literacy: Implications for Gender Equality in STEM Fields," *Fractal: Journal of Mathematics and Mathematics Education* 6, no. 1 (2025): 32–46, https://doi.org/https://doi.org/10.35508/fractal.v6i1.21158.

mathematics learning in elementary schools is not difficult to achieve, especially if teachers are able to implement learning strategies that are open and neutral to student differences. Overall, the results of this study align with the constructivist perspective, which emphasizes that understanding of mathematical concepts is built through learning experiences and students' interactions with their environment [46]. Mastery of FPB material cannot be achieved simply through mechanical practice problems, but requires meaningful, contextual learning that allows for differences in student characteristics [47]. Therefore, the findings of this study have an important impact on teachers and schools to pay more attention to the quality of FPB learning, avoid gender-based labeling, and make differences in school contexts a consideration in evaluating and improving mathematics learning in elementary schools.

Conclusion

Based on the research results, it can be concluded that elementary school students' mastery of the Greatest Common Factor (GCF) material is significantly influenced by their school of origin and gender. These findings indicate that differences in school context significantly contribute to variations in GCF learning outcomes, indicating differences in the quality of the learning process, teaching strategies, and academic climate between schools. Schools with higher average GCF achievements reflect a more effective learning process in helping students understand number concepts in a structured manner. Furthermore, gender factors were also shown to have a significant influence, with female students tending to achieve higher GCF learning outcomes than male students. This difference indicates a tendency for different learning characteristics, particularly in GCF material that requires precision, consistency of steps, and procedural understanding. However, the absence of a significant interaction effect between school of origin and gender indicates that the two factors operate independently. This means that the influence of gender on GCF mastery is relatively consistent across schools, and the influence of school of origin is independent of differences in student gender. This indicates that learning opportunities for male and female

[46] Intan Ayu Lestari, Laela Fitria Ramadhani, and Nur Elda Azaria, "The Essence of Learning Mathematics in the Independent Curriculum Through the Deep Learning Approach," *Jurnal Ilmiah Matematika (JIMAT)* 6, no. 2 (2025): 641–54, https://doi.org/https://doi.org/10.63976/jimat.v6i2.1076.

[47] M Amin and II Jamilah, "Introducing KPK and FPB Material Using Pahima Media (Mathematics Counting Board) for Grade V Students in Elementary School," *Journal of Insan Mulia Education* , 2024, https://doi.org/https://doi.org/10.59923/joinme.v2i2.182.

students in the schools studied are relatively equal, so there is no strengthening or weakening of gender influence by a particular school context.

In addition to these findings, this study also faces several challenges that require attention in interpreting the results. One major challenge is the relatively small sample size, which only included three Islamic elementary schools (Madrasah Ibtidaiyah), thus limiting the generalizability of the findings to the context of the schools studied. Furthermore, this study used learning outcome data as the sole indicator of GCF mastery, thus not fully describing students' thinking processes, level of conceptual understanding, and strategies used in solving GCF problems. Variations in learning methods, teacher teaching styles, and the use of learning media in each school were also not directly controlled, even though these factors theoretically have a strong influence on mathematics learning outcomes. Another challenge is the difference in the distribution of male and female students in each school, which could potentially affect the sensitivity of statistical analysis in detecting differences between groups.

Based on these findings and limitations, further research is recommended to involve a larger sample size and cover a wider variety of school types, both public elementary schools and Islamic elementary schools, to ensure stronger generalizability. Further research is also recommended to incorporate other variables directly related to the learning process, such as teaching methods, teacher competency, the use of instructional media, and student motivation and attitudes toward mathematics. Furthermore, the use of a mixed methods approach is highly recommended so that quantitative analysis of learning outcomes can be enriched with qualitative data that more deeply illustrates students' understanding processes. Experimental or quasi-experimental research can also be conducted to test the effectiveness of specific FPB learning strategies in reducing learning gaps between students and improving overall conceptual understanding. Thus, further research is expected to provide a more comprehensive contribution to the development of equitable, effective, and conceptually oriented elementary school mathematics learning.

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