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Students' Perceptions of Field-Based Learning and Mathematical Problem-Solving Ability among Predominantly Kinesthetic Learners

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Abstract

Mathematical problem solving requires students to interpret contextual situations, formulate strategies, and evaluate mathematical solutions, yet the relationship between learner characteristics and instructional context remains insufficiently understood. This study examined the relationship between students' perceptions of field-based learning and mathematical problem-solving ability among Grade XI students with a predominantly kinesthetic learning style. A quantitative correlational design was employed with 50 students from SMAN 6 Gowa, Indonesia, purposively selected following VAK-based screening. The students participated in field-based mathematical activities integrated with problem-based learning in Statistics and Vectors. Data were collected using a four-point Likert-scale questionnaire measuring perceptions of field-based learning and an open-ended problem-solving test based on Polya's four stages. After transforming the perception scores using the Method of Successive Intervals, Pearson's product–moment correlation was conducted using JASP. The results showed a positive and statistically significant relationship between perceptions of field-based learning and mathematical problem-solving ability ($r = .5339$, $p < .001$), indicating a moderate association. The novelty of this study lies in examining variation within a predominantly kinesthetic learner group rather than comparing learning-style categories. The findings suggest that students' perceptions of contextual, physically engaging learning environments are meaningfully associated with their problem-solving performance, while the correlational design precludes causal interpretation. The study contributes empirical evidence for understanding mathematics learning through the interaction between learner characteristics and instructional context.

Keywords: Field-Based Learning; Kinesthetic Learning Style; Mathematical Problem Solving; Student Perceptions.

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1. Introduction

Mathematical problem solving is a central component of mathematics education because it requires students to interpret situations, identify relevant information, formulate and execute strategies, and evaluate the reasonableness of their solutions. Its importance extends beyond procedural accuracy to students' capacity to reason about non-routine situations and coordinate mathematical representations. Siswanto and Meiliasari (2024) identified problem solving as a sustained focus of mathematics education research, while Lit et al. (2026), in a systematic review of 104 studies, emphasized that productive problem-

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solving instruction depends on learning environments that maintain appropriate cognitive demand and support students' active involvement. Recent Indonesian evidence also shows that mathematical problem solving involves regulatory processes such as planning, monitoring, and evaluating during collaborative activity (Prastiti et al., 2026). These perspectives suggest that variation in problem-solving performance should be examined not only in relation to students' individual characteristics but also in relation to the instructional environments in which mathematical activity occurs.

Learner characteristics constitute one dimension through which students may differ in their engagement with mathematics. Putri et al. (2019) reported relationships among learning style, learning activity, and mathematics learning outcomes, whereas Mayung et al. (2023) examined learning-style profiles as a basis for differentiated mathematics instruction. Studies focusing more directly on problem solving have likewise considered individual differences. Ulya (2015) reported a positive relationship between cognitive style and mathematical problem-solving ability, Rahmatika et al. (2022) analyzed problem-solving processes across learning styles, and Imamuddin et al. (2019) compared mathematical problem-solving ability according to students' learning-style classifications. However, these findings should not be interpreted as evidence that learning-style categories independently determine mathematical performance. Rather, they indicate a need to examine how learner characteristics are situated within particular learning experiences and instructional contexts.

The evidence concerning predominantly kinesthetic learners is particularly inconsistent. Rahmatika et al. (2022) reported that kinesthetic students were able to engage with Polya's problem-solving stages, including reviewing their solutions, while Safira et al. (2024) reported differences in mathematical problem-solving ability between kinesthetic and non-kinesthetic students. In contrast, Imamuddin et al. (2019) found that visual learners demonstrated higher problem-solving performance than kinesthetic learners, and Sundayana (2016) reported no significant relationship between learning style and mathematical problem-solving ability, identifying learning independence as a more relevant factor. These contrasting results suggest that learning-style classification alone provides an insufficient explanation of mathematical problem solving. A more defensible question is whether students' engagement with and perceptions of a particular instructional environment are associated with their problem-solving performance within a defined learner group.

This contextual perspective is especially relevant when mathematics learning is organized around authentic, concrete, and physically observable situations. Field-based learning can provide opportunities for students to observe, measure, collect data, manipulate objects, construct representations, and connect formal mathematics with

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phenomena outside conventional symbolic exercises. Bedewy et al. (2022), for example, showed how open STEAM activities involving architecture, modelling, and physical representations can create opportunities for mathematical problem solving. Similarly, Wibawa et al. (2025) examined Indonesian students' metacognitive strategies when solving realistic mathematical word problems, reinforcing the relevance of contextual situations to mathematical reasoning. Putri et al. (2026) further demonstrated that spatially integrated mathematics instruction can support spatial reasoning and mathematical problem-solving outcomes. Although these studies did not investigate field-based learning in the same form as the present study, they support examining learning environments in which students coordinate concrete or spatial experiences with mathematical representations.

The instructional organization of such experiences is also important. In the present context, field-based activities were integrated with problem-based learning (PBL), rather than implemented as an isolated outdoor activity. Previous research has linked problem-oriented learning designs with mathematical problem solving. Nurfitriyanti (2016) examined project-based learning in relation to mathematical problem-solving ability, and Setyani et al. (2025) investigated PBL in mathematics following students' field-work practice. In the Scopus-indexed literature, Siagian et al. (2019) reported the development of PBL-oriented learning materials designed to improve mathematical problem solving and metacognition. Together, these studies indicate that contextual and problem-oriented learning environments can provide meaningful settings for problem-solving activity. However, they primarily address instructional models, learning materials, or performance outcomes and do not directly examine how students' perceptions of a field-based mathematics experience are associated with their measured problem-solving ability.

Students' perceptions warrant attention because learners may experience the same instructional environment differently. Zainal Abidin et al. (2024) explicitly examined secondary students' perceptions of mathematics problem solving, illustrating the relevance of students' perspectives to understanding their engagement with mathematical tasks. More recently, Davor et al. (2026) found that student engagement mediated relationships between learner characteristics and perceived mathematical problem-solving ability, highlighting the importance of considering the learning environment alongside internal learner characteristics. Existing studies have therefore established separate connections among learning style and mathematics outcomes (Mayung et al., 2023; Putri et al., 2019), learning style and mathematical problem solving (Imamuddin et al., 2019; Rahmatika et al., 2022; Safira et al., 2024; Sundayana, 2016), and contextual or problem-oriented learning and problem solving (Bedewy et al., 2022; Nurfitriyanti, 2016; Siagian et al., 2019; Wibawa et al., 2025). What remains insufficiently examined is the relationship between students' perceptions of a specific field-based mathematics learning environment and their

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mathematical problem-solving performance within a predominantly kinesthetic group.

Accordingly, this study examines the relationship between students' perceptions of field-based learning and mathematical problem-solving ability among Grade XI students at SMAN 6 Gowa, Indonesia, who were identified through VAK-based screening as having a predominantly kinesthetic learning style. The study addresses the following research question: Is there a significant relationship between students' perceptions of field-based learning and mathematical problem-solving ability among Grade XI students with a predominantly kinesthetic learning style at SMAN 6 Gowa? The contribution of the study lies in shifting the analytical focus from comparisons among learning-style categories to within-group variation in students' perceptions of an instructional context. Rather than assuming that kinesthetic learning style determines mathematical performance, the study investigates whether more favorable perceptions of a contextual, physically engaging, PBL-integrated learning environment are associated with higher mathematical problem-solving performance. This positioning responds to the broader emphasis on active involvement and supportive problem-solving environments identified in contemporary mathematics education research (Lit et al., 2026).

2. Methodology

Research Design and Setting

This study employed a quantitative approach with a correlational design. The design was selected because the study aimed to examine the direction and strength of the relationship between students' perceptions of field-based learning and their mathematical problem-solving ability, rather than to estimate the causal effect of an instructional treatment. The study was conducted at SMAN 6 Gowa, Indonesia, involving Grade XI students and two mathematics topics: Statistics in the compulsory Mathematics course and Vectors in the Advanced Mathematics course.

Participants and Sampling

The population comprised all Grade XI students at SMAN 6 Gowa. Participant selection was conducted in two stages. First, all Grade XI students completed a Visual–Auditory–Kinesthetic (VAK) learning-style questionnaire through the Aku Pintar application to identify their dominant learning modality. Second, 50 students identified as having a predominantly kinesthetic learning style were purposively selected as the study sample. These students subsequently participated in the field-based learning activities and completed both the perception questionnaire and mathematical problem-solving test.

The VAK instrument available through Aku Pintar was used only as a screening instrument for participant selection. It classifies students into Visual, Auditory, or

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Kinesthetic categories according to the highest score among the corresponding modality indicators. The manuscript reports that independent psychometric information concerning the construct validity and internal reliability of this application-based instrument is not publicly available from its developer. Accordingly, the VAK classification was treated as an initial screening result rather than as an independently validated psychometric measure.

Learning Context and Procedure

The instructional activities combined problem-based learning (PBL) with field-based learning. The same 50 participants engaged in contextual mathematical activities involving direct observation, measurement, data collection, and physical representation outside the conventional classroom setting. The activities were organized around the mathematical content being taught and incorporated opportunities for students to work with authentic data and concrete objects.

For the Statistics topic, students were introduced to a contextual problem involving the organization and presentation of anthropometric data in frequency-distribution tables. Working in groups, they collected primary data on the height, weight, and waist circumference of 40 other students who were not members of the research sample. Standard measuring instruments, including a height measurement device, digital scale, and measuring tape, were used. The groups then organized the collected data into grouped frequency-distribution tables, determining the number of class intervals using Sturges' rule. The resulting tables were presented and discussed in a whole-class session as part of the analysis and evaluation stages of the PBL process.

For the Vectors topic, students worked with a contextual problem concerning the magnitude of a displacement vector. The activity was conducted outdoors on the school grounds. Each group used raffia rope to represent two perpendicular vector components corresponding to the horizontal (x) and vertical (y) directions. The components were measured in meters using a measuring tape or measuring wheel. Students then connected the endpoints of the two components with a third rope to form the resultant vector and calculated its magnitude using the Pythagorean relationship, $| V |= \sqrt{x^2 + y^2}$. The calculated result was subsequently checked against a direct measurement of the resultant rope, providing an opportunity to verify the solution.

Instruments and Measurement

Two researcher-developed instruments were used for the main data collection. The first was a four-point Likert-scale questionnaire measuring students' perceptions of field-based learning. The response options ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). The questionnaire covered four dimensions: the relevance of field activities to the

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mathematical content, students' active involvement, the meaningfulness of the learning experience, and the ease of understanding concepts through real-world data or objects. The second instrument was an open-ended mathematical problem-solving test covering Statistics and Vectors. The test was constructed according to four stages of Polya's problem-solving process: understanding the problem, planning a solution, carrying out the plan, and checking the solution. Test scores ranged from 0 to 100.

Before administration, both researcher-developed instruments underwent content validation through expert judgment involving mathematics education lecturers and mathematics teachers at SMAN 6 Gowa. The validators assessed the correspondence between individual items and the intended indicators using a structured validation sheet. Items considered insufficiently relevant were revised or removed before empirical testing. The instruments were subsequently piloted with students outside the research sample. Item validity was examined using item–total correlations, while internal consistency was evaluated using Cronbach's alpha. Items showing inadequate item–total correlations or substantially reducing instrument reliability were excluded from the final instruments.

Data Collection

Data collection followed three sequential stages. First, the VAK questionnaire was administered to identify students with a predominantly kinesthetic learning style. Second, the 50 selected participants completed the field-based learning activities and subsequently responded to the questionnaire measuring their perceptions of field-based learning. Third, the same participants completed the mathematical problem-solving test after the Statistics and Vectors learning activities were completed. Thus, both measures were obtained from the same participants under the same instructional context.

Data Processing and Analysis

Because the perception questionnaire used a Likert response format, the resulting scores were initially treated as ordinal data. Before conducting the Pearson correlation analysis, the perception scores were transformed using the Method of Successive Intervals (MSI). The transformation involved converting response frequencies into proportions and cumulative proportions, obtaining corresponding standard-normal z values and density values, and deriving scale values so that the resulting scores could be treated as interval-level measurements. The resulting transformed scores were then used for the correlation analysis.

Normality was then assessed using the Shapiro–Wilk test. Pearson's product–moment correlation was used to examine the relationship between perceptions of field-based learning (X) and mathematical problem-solving ability (Y), with the analysis conducted in JASP. Statistical significance was evaluated at the .05 level. The magnitude of

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the correlation was interpreted using the study's predefined criterion, with coefficients from 0.40 to 0.599 classified as moderate.

3. Results and Discussion

Descriptive Statistics

The descriptive statistics for students' perceptions of field-based learning and mathematical problem-solving ability are presented in Table 2. The analysis involved 50 Grade XI students identified as having a predominantly kinesthetic learning style. Students' perceptions of field-based learning (X) ranged from 25.19 to 49.71, with a mean score of 39.53 (*SD* = 6.21). Mathematical problem-solving ability (Y) ranged from 65.00 to 95.00, with a mean score of 84.10 (*SD* = 6.72). The descriptive statistics provide an overview of the central tendency and variability of the two variables before the correlation analysis was conducted.

Table 2. Descriptive Statistics of the Study Variables (N = 50)

Variable	N	Minimum	Maximum	Mean	SD
Perception of field-based learning (X)	50	25.19	49.71	39.53	6.21
Mathematical problem-solving ability (Y)	50	65.00	95.00	84.10	6.72

Normality Assessment

Before testing the relationship between the two variables, normality was assessed using the Shapiro–Wilk test. The result is presented in Table 3. The Shapiro–Wilk statistic was 0.9672, with a significance value of p = .131. Because the p-value exceeded .05, the test did not indicate a statistically significant departure from normality. This result supported the use of Pearson's product–moment correlation for examining the association between perceptions of field-based learning and mathematical problem-solving ability.

Table 3. Shapiro–Wilk Normality Test

Variables	Shapiro–Wilk	*p*
X–Y	0.9672	.131

Relationship Between Perceptions of Field-Based Learning and Mathematical Problem-Solving Ability

The relationship between students' perceptions of field-based learning and mathematical problem-solving ability was examined using Pearson's product–moment correlation. The results are presented in Table 4. The analysis yielded a positive correlation coefficient of r = .5339, with p < .001. The positive direction indicates that higher perception scores were associated with higher mathematical problem-solving scores. The magnitude of the coefficient falls within the moderate range according to the criterion specified in the Methods section.

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Table 4. Pearson Product–Moment Correlation Between Study Variables

Variables	Pearson's *r*	*p*
Perception of field-based learning (X) – Mathematical problem-solving ability (Y)	.5339	< .001

The relationship between the two variables is further illustrated in **Figure 1**. The scatterplot shows an overall positive linear pattern, with observations tending to increase along the vertical axis as perception scores increase along the horizontal axis. The visual pattern is consistent with the positive direction of the Pearson correlation reported in Table 4.

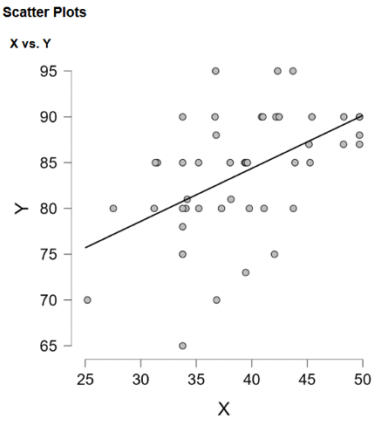


Figure 1. Scatterplot of the Relationship Between Perceptions of Field-Based Learning (X) and Mathematical Problem-Solving Ability (Y)

Discussion

The present study examined whether students' perceptions of field-based learning were associated with mathematical problem-solving ability among Grade XI students identified as predominantly kinesthetic learners. The Pearson correlation indicated a positive and statistically significant association between the two variables, with $r = .5339$, $p < .001$. The magnitude of the coefficient falls within the moderate range according to the classification used in the study. More importantly, the finding suggests that students who reported more favorable perceptions of the field-based learning experience also tended to demonstrate higher mathematical problem-solving performance. This pattern is meaningful because the two measures were obtained from the same students following participation in the same instructional context. The finding therefore extends the discussion of learning style beyond the question of whether kinesthetic students perform differently from other learning-style groups. Instead, it draws attention to the relationship between how students perceive a particular learning environment and how they perform when solving mathematical problems within that environment.

The positive association can be interpreted in relation to the nature of the learning

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activities implemented in the study. Field-based learning did not function as an isolated outdoor activity; it was integrated with problem-based learning and organized around mathematical situations requiring observation, measurement, data collection, representation, calculation, and verification. In the Statistics activity, students collected anthropometric data and transformed the observations into grouped frequency-distribution tables. In the Vectors activity, students physically represented vector components, measured them, constructed the resultant, calculated its magnitude, and compared the calculated value with a direct measurement. These activities required students to move repeatedly between observable situations and mathematical abstraction. This interpretation is consistent with Bedewy et al. (2022), who demonstrated the potential of open modelling activities that connect physical representations with mathematical problem solving, and with Siagian et al. (2019), who linked PBL-oriented learning materials with mathematical problem solving and metacognition. It is also compatible with evidence that realistic problem contexts can elicit metacognitive strategies (Wibawa et al., 2025) and that spatially integrated mathematics instruction can support problem-solving outcomes (Putri et al., 2026). These studies do not establish the mechanism operating in the present correlational study, but they provide relevant empirical contexts for interpreting why students' perceptions of concrete and physically engaging mathematical activities may be associated with problem-solving performance.

The finding is broadly consistent with previous research showing that learner characteristics and engagement are related to mathematics learning. Putri et al. (2019) reported a relationship between learning style, learning activity, and mathematics learning outcomes, while Mayung et al. (2023) examined learning-style profiles as a basis for differentiated mathematics instruction. Ulya (2015) also found a positive relationship between cognitive style and mathematical problem-solving ability, although cognitive style and VAK learning style should not be treated as interchangeable constructs. More recent evidence further supports attention to students' engagement with the learning environment. Davor et al. (2026) reported that student engagement mediated relationships between several learner characteristics and perceived mathematical problem-solving ability. The present study extends this contextual line of inquiry by showing that, within a group identified as predominantly kinesthetic, variation in perceptions of the same field-based instructional context was associated with variation in objectively assessed mathematical problem-solving scores. This result therefore supports examining learner characteristics together with instructional experiences rather than treating learning-style classifications as fixed predictors of achievement.

The finding also corresponds with studies that have reported relatively favorable problem-solving performance among kinesthetic learners. Rahmatika et al. (2022) found

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that kinesthetic students were able to engage effectively with the stages of Polya's problem-solving process, including reviewing the solution. Safira et al. (2024) similarly reported significant differences in mathematical problem-solving ability between kinesthetic and non-kinesthetic students. The present study does not reproduce the comparative designs used in these studies because it did not compare kinesthetic students with visual or auditory students. Instead, it demonstrates that within a group of predominantly kinesthetic students, variation in perceptions of field-based learning was accompanied by variation in mathematical problem-solving scores. This distinction is important. The finding should not be interpreted as evidence that kinesthetic students inherently possess superior problem-solving ability. Rather, it indicates that, within the specific group and instructional context studied, more positive perceptions of the field-based experience were associated with higher problem-solving performance.

At the same time, the result needs to be considered against contradictory findings in the literature. Imamuddin et al. (2019) reported that visual learners demonstrated the highest mathematical problem-solving ability, whereas kinesthetic learners obtained the lowest performance. Sundayana (2016), by contrast, found no significant relationship between learning style and mathematical problem-solving ability and identified learning independence as a relevant factor. These differences suggest that the relationship between learning style and mathematical problem solving is not stable across instructional and learner contexts. One plausible interpretation is that the instructional environment may influence how particular learner characteristics become relevant to mathematical activity. In the present study, kinesthetic students were not simply classified and then assessed under unspecified conditions. They participated in activities involving direct manipulation, physical measurement, authentic data, and spatial representation. Consequently, the current findings are consistent with the possibility that the relationship observed in this study is partly dependent on the compatibility between the opportunities afforded by the learning environment and the ways in which students engage with those opportunities. This interpretation is more cautious than claiming that field-based learning is universally more effective for kinesthetic students.

The instructional processes observed in the study also provide a plausible explanation for the association through Polya's problem-solving stages. During the stage of understanding the problem, physical engagement with measurable objects and situations may provide students with a more concrete representation of information that otherwise needs to be processed symbolically. The anthropometric activity, for example, required students to encounter the data-generating process directly before organizing the data mathematically. Similarly, the Vectors activity allowed students to physically construct the components of a displacement vector before calculating the resultant. These activities

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required students to move between physical experience and mathematical abstraction and may help explain why more favorable perceptions of the learning environment were associated with higher problem-solving scores. However, because the study did not directly measure cognitive or learning processes at each stage, these mechanisms should be regarded as interpretive explanations rather than empirically demonstrated mediating processes.

The same caution applies to the interpretation of the moderate correlation. Squaring the coefficient gives approximately $r^2 = .285$, indicating that the two measured variables shared approximately 28.5% of their variance. This value indicates a meaningful degree of statistical overlap, but it does not represent a 28.5% causal contribution of field-based learning perceptions to problem-solving ability. The remaining variance may be associated with other factors that were not examined in the present study. Sundayana (2016), for example, identified learning independence as relevant to mathematical problem solving, while the present study did not measure learning independence. Other characteristics, including prior mathematical knowledge, motivation, or other contextual factors, may likewise be related to students' perceptions and performance. Thus, the coefficient should be understood as evidence of an association rather than evidence that more positive perceptions cause higher problem-solving scores. This distinction is particularly important because the correlational design does not establish temporal or causal direction.

From a theoretical perspective, the study contributes a more contextual account of the relationship between learner characteristics and mathematical problem solving. Much of the earlier literature cited in this manuscript has focused on comparisons among learning-style groups, learning style and general mathematics outcomes, or associations between cognitive characteristics and problem solving (Imamuddin et al., 2019; Putri et al., 2019; Rahmatika et al., 2022; Ulya, 2015). The present study shifts the analytical focus toward students' perceptions of the instructional environment within a specific learner group. This positioning is consistent with Lit et al. (2026), whose systematic review emphasizes students' active involvement and the creation of learning environments that foster mathematical problem solving. It also complements contextual and problem-oriented research (Bedewy et al., 2022; Nurfitriyanti, 2016; Setyani et al., 2025; Siagian et al., 2019). The contribution therefore lies not in demonstrating that kinesthetic students constitute a superior or inherently distinct problem-solving group, but in providing quantitative evidence that differences in how students perceive a physically and contextually oriented learning experience are associated with differences in mathematical problem-solving performance.

The findings also have practical implications for mathematics instruction, although these implications should be interpreted within the boundaries of the study. The activities implemented suggest that field-based learning can be incorporated through relatively

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simple mathematical tasks involving measurement, physical representation, authentic data, and direct verification. Rather than treating field-based learning as a separate instructional program, teachers may integrate short contextual activities into problem-solving lessons when the mathematical content permits meaningful physical or spatial representation. The Statistics and Vectors activities in this study illustrate two possible forms of integration: collecting real data before performing statistical analysis and physically representing vector components before calculating and checking the resultant. Such activities may provide opportunities for students to connect concrete observations with formal mathematical representations. Importantly, however, the findings do not establish that a particular duration or instructional format is optimal, nor do they demonstrate that students classified as kinesthetic necessarily require field-based instruction.

Several methodological considerations further delimit the contribution of the study. The participants consisted of 50 Grade XI students from a single school who were identified as predominantly kinesthetic using the VAK screening instrument available through the Aku Pintar application. The manuscript explicitly treats this instrument as a screening device rather than an independently validated psychometric measure because publicly available information on its construct validity and internal reliability was not identified. Consequently, the findings should not be generalized automatically to visual or auditory learners or to other student populations. In addition, the study combined problem-based learning with field-based learning, making it impossible to isolate the specific association attributable to the field-based component. The perception measure also captures students' reported experiences rather than an independent measure of instructional fidelity. Future research could therefore compare field-based and conventional conditions, include visual and auditory groups, and incorporate variables such as prior mathematical ability, learning independence, and motivation. Experimental or quasi-experimental designs would be particularly useful for testing whether the observed association reflects an instructional effect and for examining whether learner characteristics moderate the relationship.

Overall, the findings provide empirical evidence that, among the kinesthetic-dominant students examined in this study, more positive perceptions of field-based learning were associated with higher mathematical problem-solving performance. The result is consistent with some previous findings concerning kinesthetic learners and active learning, while also offering a possible explanation for inconsistencies in the literature by drawing attention to instructional context. The central contribution is therefore not a claim that kinesthetic learning style determines mathematical performance, but an indication that the relationship between learner characteristics and problem solving may be better understood when the learning environment is considered simultaneously. Further research using comparative and experimental designs is needed to determine whether the observed pattern

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represents a genuine instructional fit and to identify the processes through which contextual, physical, and problem-based mathematical experiences may relate to students' problem-solving development.

4. Conclusion

This study examined the relationship between students' perceptions of field-based learning and mathematical problem-solving ability among Grade XI students at SMAN 6 Gowa identified as having a predominantly kinesthetic learning style. Based on data from 50 students, perceptions of field-based learning were positively and significantly associated with mathematical problem-solving ability ($r = .5339$, $p < .001$), with the magnitude of the association falling within the moderate range. The finding indicates that students who reported more favorable perceptions of the field-based learning experience tended to obtain higher scores on the mathematical problem-solving assessment. The learning activities, which integrated problem-based learning with direct observation, measurement, data collection, physical representation, calculation, and verification, provided the instructional context in which this association was observed. Importantly, the result should be interpreted as an association rather than a causal effect, because the correlational design does not establish that field-based learning or students' perceptions of it caused differences in problem-solving performance.

The findings should be interpreted in light of several limitations. The study involved a relatively small purposive sample from a single school and focused exclusively on students classified as predominantly kinesthetic using the VAK screening instrument available through the Aku Pintar application; therefore, the findings should not be generalized to other learning-style groups or educational contexts without further evidence. In addition, the instructional design combined problem-based learning and field-based learning, making it impossible to isolate the specific association attributable to the field-based component. Future research should therefore employ larger and more diverse samples, independently validated measures of learner characteristics, and comparative or experimental designs that can distinguish the effects of instructional approaches and examine whether the observed pattern is sustained across different learning-style groups and mathematical topics. Longitudinal and mixed-methods studies could also investigate how students' perceptions develop and how specific features of field-based activities relate to different dimensions of mathematical problem solving. Despite these limitations, the present study contributes an empirical perspective that shifts attention from simply comparing learning-style groups toward examining how students' perceptions of a specific instructional context are related to their mathematical problem-solving performance within a defined learner group.

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