Indonesian Technology and Education Journal
E-ISSN: 2985-8216; P-ISSN: 2985-8208
https://journal.diginus.id/index.php/ITEJ

Analysis of Fourth-Grade Students' Ability to Understand Fraction Word Problems at SD Negeri 168 Pekanbaru

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ARTICLE INFO

Keywords:

Mathematical Word Problems; Fraction Understanding; Unit Fractions; Diagnostic Assessment; Elementary School.

Article History

Received: Aug 15, 2026
Revised: Oct 20, 2026
Accepted: Nov 05, 2026

ABSTRACT

Background: Understanding fraction word problems requires students to interpret written information and relate it to mathematical representations and number magnitude.
Aim: This study described the initial performance of Grade IVB students at SD Negeri 168 Pekanbaru on three indicators: interpreting story information as fractions, comparing unit fractions, and ordering unit fractions.
Methods: A quantitative descriptive analysis was conducted using the recorded pre-cycle assessment scores of 23 students on 6 October 2026. The assessment comprised five multiple-choice and five open-ended items; descriptive statistics summarized the overall scores and percentage attainment for each indicator.
Results: The mean score was 43.22, with a minimum of 6 and a maximum of 83. Nineteen students (82.61%) scored below the assessment threshold of 75. Attainment was 55.98% for interpretation, 35.43% for comparison, and 33.26% for ordering.
Conclusion: The relatively lower attainment on comparison and ordering tasks identifies priorities for subsequent instruction. These descriptive data do not establish the causes of students' difficulties or the effectiveness of the planned Directed Reading Thinking Activity strategy.

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To cite this article : Putri, D. A., Putri, D. M., Nuzulah, G. F., Aisyi, H. R., Lestari, T. F., Guslinda, G., Nurdin, L. (2026). Analysis of Fourth-Grade Students' Ability to Understand Fraction Word Problems at SD Negeri 168 Pekanbaru. *Information Technology Education Journal* 4(3), 48-58. Doi. 10.61255/itej.v4i3.2479

INTRODUCTION

Elementary mathematics instruction asks students to move between written situations and mathematical relationships rather than rely only on numerical calculations (National Council of Teachers of Mathematics, 2000). Mathematical word problems make this demand visible because the student must first identify relevant quantities, interpret the relationships described in the text, and then select an appropriate representation or solution. Daroczy et al. (2015) distinguished linguistic and numerical demands, while Hickendorff (2021) demonstrated that arithmetic word problems draw on both language and cognitive resources. Recent evidence also indicates that features of word-problem tasks and accompanying images can influence performance (Vessonen et al., 2024; Vessonen et al., 2026). Consequently, a low test score alone provides limited information about which aspects of problem solving require instructional attention. A more informative starting point is to describe performance according to the distinct mathematical demands embedded in the assessment.

Fractions introduce an additional conceptual challenge because a fraction denotes a relationship between quantities rather than two independent whole numbers. Students must

connect part–whole information, fraction notation, and numerical magnitude when interpreting everyday situations. Studies on fraction magnitude show that representations and the structure of fraction tasks affect the strategies students use (Flores et al., 2022; Schwarzmeier et al., 2024; Kim, 2024). Research has also documented conceptual weaknesses in comparison tasks, including inappropriate reliance on the magnitudes of numerators or denominators considered separately (Maricau et al., 2026; Mao et al., 2026). These findings do not establish that any particular misconception is present in the current classroom, but they clarify why interpreting, comparing, and ordering fractions should not be treated as interchangeable skills. In an assessment of fraction word problems, differences between these demands may be educationally meaningful.

Language presents a further difficulty because students must construct a mathematical interpretation from sentences before evaluating the underlying fraction. King and Powell (2023) found that language proficiency was associated with word-problem outcomes in students with mathematical difficulties. Fuchs et al. (2024) examined transfer between reading comprehension and word-problem solving, whereas Domke et al. (2025) documented forms of linguistic complexity in elementary mathematics materials. Park and Matthews (2025) reported that mathematics-specific vocabulary predicted symbolic fraction performance in their sample. These studies suggest that text interpretation and fraction knowledge should be considered together, although they cannot be separated empirically using aggregate indicator scores alone. This distinction matters for the present study, whose title concerns understanding word problems but whose indicators also assess mathematical comparison and ordering.

Instructional research has proposed several ways to support fraction understanding, including number lines, multiple representations, and activities focused on magnitude. Flores et al. (2022) evaluated concrete–representational–abstract instruction, and Jayanthi et al. (2021) tested an intervention combining conceptual and procedural content. Rodrigues et al. (2024), Lesner et al. (2024), and Lee and Powell (2026) describe how representations can support different fraction concepts. Experimental and classroom-based studies have also examined magnitude-oriented learning and fraction sense (Jordan et al., 2024; Merkel et al., 2025). These studies offer plausible instructional options, but their findings should not be interpreted as evidence that a specific strategy has already improved performance at SD Negeri 168 Pekanbaru. Selecting an intervention for a particular class first requires a clear account of students' starting performance.

Recent research increasingly examines the heterogeneity of fraction competence rather than assuming that all fraction tasks measure a single ability. Kim (2024) identified different profiles on fraction number-line tasks, while Silla et al. (2026) reported distinct profiles of early fraction knowledge. Schadl and Lindmeier (2025) focused on the quality of prior-knowledge assessments, and Pittalis (2025) developed an empirically informed framework for rational number sense. Schwarzmeier and Obersteiner (2025) showed how prior knowledge and strategy use can differ in visual fraction comparison. Together, these studies support assessment that attends to the type of mathematical performance being measured, not only to a total score. However, their settings, tasks, and populations differ from the pre-cycle classroom assessment investigated here.

In the Indonesian elementary-school context, earlier studies have reported difficulties with story problems and fraction operations (Utari et al., 2019; Wulandari & Amir, 2022). During the authors' field teaching experience at SD Negeri 168 Pekanbaru, observations suggested that some students attempted to answer story problems before sufficiently examining the written information. This observation motivated a pre-cycle assessment of Grade IVB rather than an experiment testing a teaching strategy. The assessment grouped items into interpretation of story information as fractions, comparison of unit fractions, and ordering of unit fractions. Although previous research explains why these tasks may be demanding, it does not provide the descriptive

score distribution for this specific class or identify which of these three groups obtained the smallest share of available points. This local diagnostic need defines the gap addressed by the study; it is not presented as a claim of worldwide theoretical novelty.

The study therefore aimed to describe the initial ability of 23 Grade IVB students at SD Negeri 168 Pekanbaru to understand and solve fraction word problems through overall scores and percentage attainment for three predetermined indicators. The data were collected on 6 October 2026 as a pre-cycle component of a classroom action research plan. The planned subsequent stage involved Directed Reading Thinking Activity (DRTA), a reading-oriented strategy discussed in elementary literacy research (Kurniaman et al., 2021; Nurdiansah et al., 2023). Because the present dataset contained only pre-cycle results, the analysis did not test DRTA or infer its effectiveness. The intended contribution is a context-specific diagnostic account that distinguishes relative performance across interpretation, comparison, and ordering demands. Such an account can inform the focus of later instruction while preserving the limits of descriptive evidence.

RESEARCH METHODOLOGY

Research Design and Context

This study employed a quantitative descriptive design to characterize students' initial performance on fraction word problems. The analysis was restricted to a pre-cycle assessment conducted on 6 October 2026 at SD Negeri 168 Pekanbaru, Indonesia. Although the assessment formed part of the preparation for classroom action research, the present article reports neither an implemented instructional cycle nor intervention outcomes. Descriptive scores and indicator percentages were used because the research question concerned observed performance within one classroom rather than statistical differences, prediction, or causal effects. This use of descriptive measurement is consistent with the general methodological rationale presented by Jayusman and Shavab (2020).

Participants and Data Source

The data were obtained from the recorded assessment results of 23 students in Grade IVB. These 23 students constituted the group represented by the available pre-cycle score recap; the manuscript does not report a population-wide sampling procedure or selection probabilities. Consequently, no random-sampling claim is made, and the findings refer to the assessed class rather than to all fourth-grade students in Pekanbaru. The data source was the existing score record for fraction word-problem items. The analysis did not introduce new interviews, observations, or individual diagnostic classifications beyond those recorded scores.

Assessment Instrument and Scoring

The assessment contained ten fraction word problems, comprising five multiple-choice items and five open-ended items. The items were organized into three indicators: interpreting story information into fractional representations, comparing unit fractions in story contexts, and ordering unit fractions in story contexts. Multiple-choice items were scored 6 for a correct answer and 0 for an incorrect answer, contributing 30% of the maximum total score. Each open-ended item had a maximum score of 14, contributing the remaining 70%. The open-ended responses requested an answer accompanied by an explanation of the fraction or the reason for the selected answer. Table 1 presents the original item allocation and the maximum attainable points for each indicator.

Table 1. Indicators, item allocation, and maximum assessment scores

Indicator	Item numbers	Maximum score per student
Interpreting story information as fractions	1, 2, 6, 7	40
Comparing unit fractions in story contexts	3, 5, 8, 10	40
Ordering unit fractions in story contexts	4, 9	20
Total	10 items	100

Table 1 shows that the interpretation and comparison indicators were each represented by four items with a maximum score of 40. The ordering indicator contained two items with a maximum score of 20. Together, the three indicators covered all ten questions and 100 available points per student. The different indicator totals make a direct comparison of raw point totals inappropriate. Percentage attainment was therefore used to describe the relative share of available points earned in each indicator.

The study used the scores already recorded in the assessment recap and did not independently rescore students' responses. A written rubric for assigning partial credit to the open-ended items was not available in the reported records. Accordingly, the consistency of partial-credit scoring cannot be established from this dataset, a material limitation because open-ended responses accounted for 70% of the total points. No instrument validation coefficient, reliability estimate, expert review outcome, or pilot-test result was reported, and none has been added to the revision. These reporting limitations constrain how confidently score differences can be attributed to differences in underlying student ability rather than measurement characteristics.

Data Processing and Descriptive Analysis

The recorded scores were summarized using the mean, minimum, maximum, and the number and percentage of students above or below the assessment threshold of 75. The mean was calculated as the sum of all students' scores divided by 23. For each indicator, attainment was calculated as the sum of the students' scores for that indicator divided by the number of students multiplied by the maximum indicator score per student, expressed as a percentage. This produced denominators of 920 for interpretation, 920 for comparison, and 460 for ordering. Because the objective was descriptive, no significance tests, correlations, or causal models were used. Figure 1 summarizes the reported assessment and analytical sequence; the diagram does not imply that the later DRTA action stage had occurred.

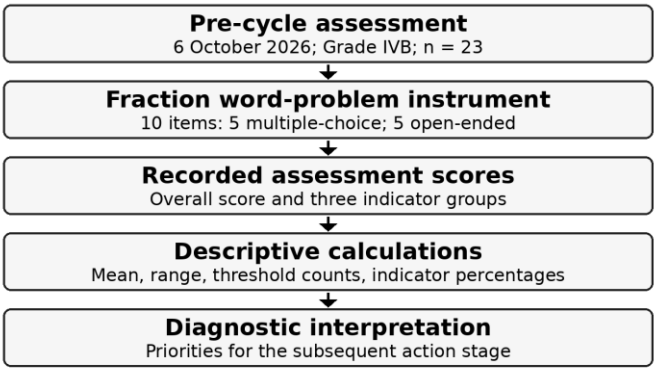


Figure 1. Pre-cycle assessment and descriptive analysis sequence

Figure 1 begins with the pre-cycle assessment of the 23 Grade IVB students. It identifies the ten-item test, with multiple-choice and open-ended response formats, as the source of the recorded scores. The existing scores were then grouped into an overall result and three predefined indicators. Descriptive calculations generated the mean, score range, threshold

distribution, and percentage attainment. The final box represents the diagnostic use of the results for subsequent instructional planning rather than an implemented or evaluated intervention.

The two calculations used in the analysis were: mean score = sum of student scores / 23; and indicator attainment (%) = [sum of scores obtained on the indicator / (23 × maximum score per student for that indicator)] × 100. The 75-point threshold was treated as the benchmark used in the original assessment, without assigning it a new externally validated interpretation. The results were reported with two decimal places where applicable and interpreted only in relation to this class and instrument.

RESULTS AND DISCUSSION

Overall Pre-cycle Performance

All 23 students in Grade IVB were included in the available pre-cycle score recap. The descriptive summary was used to determine the range and central level of performance and to show how many students met the assessment benchmark of 75. The overall results are presented in Table 2.

Table 2. Overall descriptive results of the pre-cycle assessment

Component	Result
Number of assessed students	23
Mean score	43.22
Highest score	83
Lowest score	6
Students scoring ≥75	4 students
Students scoring <75	19 students
Students scoring ≥75 (%)	17.39%
Students scoring <75 (%)	82.61%

Table 2 reports a mean score of 43.22 across the 23 assessed students. Individual scores ranged from a minimum of 6 to a maximum of 83. Four students, representing 17.39% of the class, scored at least 75. The remaining 19 students, or 82.61%, scored below the benchmark used in the assessment. These figures describe the observed overall distribution but do not identify the processes responsible for each student's responses.

Indicator-level Attainment

To locate the assessment demands associated with the greatest and smallest shares of attainable points, the recorded item scores were aggregated under the three predefined indicators. Because the groups comprised different numbers of items, each aggregate was divided by its respective maximum score. Table 3 shows the resulting indicator-level attainment.

Table 3. Attainment by fraction word-problem indicator

Indicator	Points obtained	Maximum available	Attainment
Interpreting story information as fractions	515	920	55.98%
Comparing unit fractions in story contexts	326	920	35.43%
Ordering unit fractions in story contexts	153	460	33.26%

Table 3 shows that interpretation tasks yielded the highest attainment, at 55.98% of available points. Comparison tasks yielded 35.43%, which was 20.55 percentage points lower than interpretation tasks. Ordering tasks had the lowest attainment, at 33.26%. The difference between comparison and ordering was 2.17 percentage points. These percentages describe scores obtained on different sets of items and do not, by themselves, establish the statistical significance of the differences or identify specific misconceptions.

Discussion

The overall mean score of 43.22 and the fact that 19 of 23 students scored below 75 indicate that performance on the pre-cycle fraction word-problem assessment was limited relative to the benchmark used in this class. This observation concerns assessed performance, not a direct measurement of every cognitive process involved in word-problem comprehension. Hickendorff (2021) and Daroczy et al. (2015) have shown that linguistic demands and numerical structures jointly shape performance on word problems, while Vessonen et al. (2024) synthesized evidence on the relevance of task characteristics. Recent studies also emphasize that students' general and mathematics-specific language skills and other individual characteristics can relate differently to word-problem outcomes (King & Powell, 2023; Lariviere et al., 2025; Vessonen et al., 2025a). The present scores are compatible with the broader literature on the challenges of solving mathematical text problems but cannot establish which challenge predominated for individual students. The appropriate interpretation is therefore diagnostic and bounded by the particular instrument, class, and recorded assessment results.

The highest attainment occurred on interpreting story information into fractions, yet the group obtained only 55.98% of the available points. This relative advantage should not be interpreted as mastery, since almost half of the available points in this group were not earned. Fuchs et al. (2024) and Hardy and Clemens (2024) describe why mathematical word-problem solving draws on reading, language, and mathematical knowledge rather than a single reading skill. Domke et al. (2025) further showed that apparently familiar word problems can contain complex linguistic and contextual features, and Park and Matthews (2025) linked mathematics-specific verbal skills to symbolic fraction abilities. These studies offer possible explanations for the need to reinforce interpretation, although the current assessment did not isolate reading comprehension or vocabulary as independent variables. Instructional follow-up could therefore emphasize identifying relevant quantities and representing them mathematically, while subsequent diagnostic work would be needed to distinguish language-based from concept-based errors.

Attainment on comparing unit fractions was 35.43%, substantially below the interpretation indicator. Comparison requires students to judge the relative value of fractions after understanding the situation, so it involves a distinct mathematical decision beyond extracting a fractional representation. Studies of fraction comparison have documented individual differences in strategy selection and difficulties caused by whole-number-based reasoning (Maricau et al., 2026; Schwarzmeier & Obersteiner, 2025). Cauté et al. (2026) provided further evidence that fraction magnitude errors can take several distinguishable forms, and Mao et al. (2026) discuss instructional responses to common misconceptions. None of these documented error types can be assigned to the present students from aggregated score totals alone. Nevertheless, the low share of available comparison points provides a defensible reason to prioritize explicit magnitude reasoning when planning subsequent instruction.

Ordering unit fractions produced the lowest attainment at 33.26%, but its difference from comparison was only 2.17 percentage points. Ordering involves relating more than one fractional magnitude within a sequence, and it may require coordinated judgments rather than a single pairwise choice. Kim (2024) reported varied fourth-grade profiles on fraction number-line tasks, while Starling-Alves et al. (2026) emphasized the importance of assessments sensitive to fraction-knowledge development. Pittalis (2025) described rational number sense as a construct with distinguishable components, which reinforces the value of reporting the present indicators separately. However, the ordering indicator comprised only two items and had a different maximum score from the other groups, so its apparent ranking should be considered cautiously. The data support identifying ordering as an instructional priority, but not a categorical claim that ordering is intrinsically harder than comparison for all students.

The pattern across indicators suggests a useful distinction between representing a fraction and reasoning about its magnitude. Research on representational support helps contextualize this distinction: Flores et al. (2022) evaluated an integrated concrete–representational–abstract approach; Rodrigues et al. (2024) and Lesner et al. (2024) explained the instructional use of number lines; and Lee and Powell (2026), Mohamed et al. (2021), and Van de Walle et al. (2019) emphasized connections among representations. Schwarzmeier et al. (2024) demonstrated that the visual form of a fraction can affect comparison behavior, while Schiller et al. (2024) documented variation in estimates of equivalent rational magnitudes across number formats. Merkel et al. (2025) examined how dynamic visual activities can support the development of a basic fraction concept. Taken together, this work suggests a possible sequence from interpreting a situation to representing fractions visually and then comparing and ordering their magnitudes. Such a sequence is a literature-informed instructional implication, not a procedure evaluated or shown effective in the current classroom.

Instructional planning should also recognize that aggregate scores may conceal heterogeneity within the 23-student class. Silla et al. (2026) identified different profiles of early fraction understanding, and Schadl and Lindmeier (2025) emphasized cognitively informed prior-knowledge assessment. Fisher and Dennis (2024) examined the role of supported self-explanation during fraction-magnitude instruction, while Grenell et al. (2024) studied children's confidence on fraction and equivalence problems. These investigations illustrate why students who earn similar total scores may still require different forms of support. The present dataset did not include analyzed explanations, confidence measures, or student-specific skill profiles, and therefore cannot determine these differences. A subsequent phase could examine recorded open-ended responses using an explicit scoring and error-classification rubric before selecting targeted learning activities.

Evidence on intervention effectiveness provides a rationale for considering instructional responses, but it also cautions against assuming that any named strategy will automatically improve the measured outcomes. Jayanthi et al. (2021) and Jordan et al. (2024) reported improvements from fraction-focused interventions in their respective settings, while Nuraydin et al. (2022) found that a fraction number-line game did not automatically transfer to broader fraction understanding. Bustamante et al. (2022) explored a playful approach to rational-number learning, while Powell et al. (2022) and Park and Kang (2025) evaluated word-problem instruction for learners with difficulties. Myers et al. (2025) and Vessonen et al. (2025b) synthesized evidence showing that the design and implementation of word-problem interventions matter. In the current project, DRTA was identified as a planned subsequent reading-oriented strategy, supported by prior studies of reading activities (Kurniaman et al., 2021; Nurdiansah et al., 2023). Since no post-intervention or comparison data are reported here, the effectiveness of DRTA remains outside the evidential scope of this article.

Several limits qualify the contribution of this study. The sample consisted of one class of 23 students, so the descriptive pattern should not be generalized to other schools or grade levels without additional evidence. The test combined multiple-choice and open-ended formats, but the analysis lacked a documented rubric for partial scores on the latter, even though they accounted for most available points; response format can alter apparent difficulty (Richter et al., 2026). The use of three item groups was analytically useful, but it did not establish construct validity, internal consistency, or the equivalence of difficulty between groups. More detailed analyses of representations and partitioning, as explored by Cutting (2026) and Sibiya and Essien (2025) in different settings, could inform future diagnostic work, but their findings do not substitute for local response-level evidence. The present article therefore contributes a transparent baseline for instructional planning rather than a causal explanation, validated diagnostic instrument, or evaluation of the planned intervention.

CONCLUSION

The pre-cycle assessment of 23 fourth-grade students at SD Negeri 168 Pekanbaru yielded a mean fraction word-problem score of 43.22, with scores ranging from 6 to 83; 19 students (82.61%) scored below the class assessment threshold of 75. Interpretation of story information as fractions obtained 55.98% of available points, compared with 35.43% for comparing unit fractions and 33.26% for ordering unit fractions. This profile indicates that the two magnitude-related indicators deserve particular attention in subsequent instructional planning, although the interpretation indicator also requires reinforcement. The findings apply to the recorded assessment of this class and cannot explain individual students' errors, establish instrument reliability, or demonstrate instructional effectiveness. The planned DRTA stage and any changes following it should be examined separately using appropriately documented procedures and post-action evidence.

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