



Creative Thinking Profiles of Fifth-Grade Students in Solving Least Common Multiple Word Problems: A Cognitive Style Perspective

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ABSTRACT

This study describes the creative thinking profiles of fifth-grade students solving least common multiple (LCM) word problems from the perspective of field-independent (FI) and field-dependent (FD) cognitive styles. A descriptive qualitative design was used at SD Al-Azhar Mandiri Palu, Indonesia. Twenty-two students completed the Group Embedded Figure Test (GEFT), resulting in 18 FI and 4 FD classifications. One high-performing and communicative student from each category was purposively selected as a focal participant. Data were obtained from two equivalent LCM written tasks and semi-structured interviews, with consistency examined through time triangulation. Analysis followed data condensation, data display, and conclusion drawing/verification using the four indicators of fluency, flexibility, originality, and elaboration. The FI participant, AAR, used two relevant conventional strategies, listing multiples and prime factorization, and explained the solution in detail. AAR therefore met fluency, flexibility, and elaboration and was classified at Level 3 (creative). The FD participant, AKW, used one conventional listing-multiples strategy and explained it in detail, meeting elaboration only and corresponding to Level 1 (less creative). Within these two focal cases, the main difference concerned the breadth and variation of strategy use rather than answer correctness.

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INTRODUCTION

Mathematics learning at the elementary level requires students to do more than reproduce procedures because even familiar topics can demand interpretation, comparison of strategies, and explanation of reasoning. Creative thinking becomes relevant when students must generate more than one mathematical idea, vary a procedure, or develop a solution in sufficient detail. Recent studies have examined this capacity through mathematical tasks that reveal how students produce and organize alternative responses (Alwi et al., 2022; Handayani, 2023; Nurhanifah, 2022). Other work has reported that creative performance can be strengthened when learning environments give students room to construct, compare, and communicate mathematical ideas (Salsabila & Delyana, 2023; Widiyanto & Yuniarta, 2021). These studies place fluency, flexibility, originality, and elaboration among the observable indicators used to interpret students' creative mathematical activity. For elementary mathematics, the issue is therefore not only whether students obtain a correct answer, but also what their solution process reveals about the breadth and organization of their thinking.

The need for such analysis is visible in the context of SD Al-Azhar Mandiri Palu, where an initial teacher interview indicated that fifth-grade students did not always use the same procedure when

solving least common multiple problems. Some students could reach the same numerical result through different routes, whereas others relied on one familiar method. This variation is important because answer correctness alone cannot distinguish between students who can generate alternatives and students who can only execute one procedure. Studies on mathematical creative thinking similarly report that students may differ in the number, variation, and detail of ideas they can produce even when they work on comparable tasks (Bangsawan & Baso, 2024; Handayani, 2023; Widyastuti et al., 2021). A qualitative account of written work and interview explanations can therefore provide evidence about how these differences appear during problem solving. In this study, the classroom phenomenon is treated as a question about the structure of students' reasoning rather than as a comparison of test scores.

One lens for interpreting such variation is cognitive style, particularly the distinction between field independent (FI) and field dependent (FD) processing. The literature cited in this study describes FI learners as tending to analyze information by separating relevant components, whereas FD learners are more likely to rely on the surrounding structure or an established organization of information (Badjeber & Mailili, 2018; Marwazi & Putra, 2019). In mathematical problem solving, these tendencies may be associated with differences in strategy selection, representation, and the amount of external structure a student uses when working through a task (Risani & Nuriyatin, 2021; Siahaan et al., 2018). Cognitive style does not determine creativity, and it should not be treated as a permanent label for students. It can, however, provide an interpretive framework for examining why two students facing the same problem may organize and communicate their solutions differently. This perspective is particularly useful when the analysis focuses on process evidence such as alternative strategies, procedural shifts, and detailed explanations.

Least common multiple (LCM) word problems offer a focused context for examining these processes because students must connect a recurring-event situation with a numerical structure. Solving such a problem usually requires identifying the relevant intervals, recognizing that the next shared occurrence is an LCM situation, and selecting a procedure such as listing multiples or using prime factorization. Research on LCM learning has emphasized the need for conceptual understanding rather than isolated procedural execution (Qomariyah et al., 2021). For creative-thinking analysis, the same task can reveal whether students generate several relevant ideas, move between procedures, propose an uncommon route, or elaborate the reasoning behind a selected method. These four forms of evidence correspond to fluency, flexibility, originality, and elaboration as operationalized in the present study. The LCM context is therefore narrow enough for close comparison while still allowing meaningful variation in students' solution pathways.

Previous studies have investigated mathematical creative thinking across different topics, learner characteristics, and instructional settings. Widyastuti et al. (2021) reported variation in students' creative-thinking levels in problem-posing activities using open-ended story problems, while Widiyanto and Yuniarta (2021) examined learning materials designed to train mathematical creativity. More recent work has continued to document creative-thinking profiles in geometry, number patterns, and higher-order problem-solving situations (Alwi et al., 2022; Bangsawan & Baso, 2024; Handayani, 2023; Nurhanifah, 2022). Salsabila and Delyana (2023) also examined a collaborative creativity model as a way to optimize students' creative-thinking skills. Taken together, these studies show sustained attention to fluency, flexibility, originality, and elaboration, but their contexts differ from a close qualitative analysis of elementary students solving LCM word problems. The existing literature therefore provides relevant indicators and comparison points without resolving how those indicators appear in the specific FI and FD cases examined here.

Research that explicitly combines creative thinking with cognitive style has generally reported that FI and FD students can display different patterns in mathematical problem solving. Napfiah (2018) found that FI students tended to occupy higher creative-thinking levels than FD students in the cases examined, and Risani and Nuriyatin (2021) documented differences in mathematical problem-solving profiles across the two cognitive styles. Earlier work also connected field independence with more analytical organization and broader procedural control (Badjeber & Mailili, 2018; Marwazi & Putra, 2019). However, these studies did not focus specifically on fifth-grade students' LCM word problems at SD Al-Azhar Mandiri Palu. They also leave room for a more indicator-based account that separates the ability to generate several ideas from the ability to

explain one idea in detail. The research gap addressed here is therefore the lack of a context-specific qualitative description of how fluency, flexibility, originality, and elaboration are expressed by FI and FD elementary students within the same LCM problem structure.

This study aims to describe the creative thinking profiles of fifth-grade students at SD Al-Azhar Mandiri Palu in solving LCM word problems from FI and FD cognitive-style perspectives. It asks how each focal student demonstrates fluency, flexibility, originality, and elaboration through written solutions and interview explanations. The theoretical contribution lies in distinguishing the four creative-thinking indicators within two cognitive-style cases instead of treating creativity as a single undifferentiated outcome. Practically, the analysis can help teachers recognize whether a student needs support in generating alternatives, shifting procedures, or explaining an already selected strategy. Because the design is descriptive and case-based, the intended contribution is an in-depth account of the observed reasoning patterns rather than a statistical generalization to all FI or FD students.

METHOD

Research Design

The study used a descriptive qualitative design to characterize how students' creative thinking appeared in written LCM solutions and follow-up interview explanations. This design was selected because the research questions concern the form and organization of reasoning shown by focal students rather than the estimation of relationships or effects in a population. The analysis therefore treated the two selected students as information-rich cases representing different GEFT classifications while preserving the descriptive purpose of the research.

Research Setting and Time

The research was conducted at SD Al-Azhar Mandiri Palu, Palu, Central Sulawesi, Indonesia. GEFT screening was administered on 22 May 2026 during a mathematics lesson, and students were given 45 minutes for the screening session. Subsequent written LCM tasks and interviews formed the qualitative data used to develop the creative-thinking profiles. The data collection sequence was organized so that cognitive-style classification preceded the written and interview-based analysis of creative thinking.

Participants and Sampling

All 22 fifth-grade students in the class completed the Group Embedded Figure Test (GEFT). Screening classified 18 students as field independent and 4 as field dependent. One student from each category was then selected purposively with teacher input, using high mathematical ability and communicativeness as the selection criteria so that the reasoning process could be explored in depth. The focal participants were coded AAR for the FI case and AKW for the FD case to preserve anonymity. No additional exclusion criteria were specified.

Table 1. GEFT screening results and focal participants

No.	Cognitive style	Screening result	Focal participant
1	Field independent (FI)	18 students	AAR
2	Field dependent (FD)	4 students	AKW
Total		22 students	2 focal cases

Research Instruments

Three instruments were used: GEFT for cognitive-style classification, written LCM tasks for eliciting creative-thinking evidence, and a semi-structured interview guide for clarifying students' reasoning. The GEFT form used in this study consisted of three sections: seven practice items in the first section and nine scored items in each of the second and third sections. Correct scored responses received one point, whereas incorrect or unanswered items received zero; scores of 0-9 were classified as FD and scores of 10-18 as FI. The written instrument contained two equivalent LCM word problems, M1 and M2, which were designed by the researcher to represent recurring-event situations. Interview questions were used to clarify the information identified by students,

the reasons for choosing a strategy, the availability of alternative methods, and the justification of the final answer.

Table 2. Operational indicators of creative thinking

Indicator	Operational description
Fluency	Produces several relevant mathematical ideas or answers for the task.
Flexibility	Uses varied solution approaches and can view the mathematical problem from different perspectives.
Originality	Generates an unusual, uncommon, or relatively novel idea or solution.
Elaboration	Completes the task in detail and explains the reasoning and solution steps thoroughly.

Instrument Validation and Data Credibility

The two written LCM problems were developed by the researcher and underwent two rounds of validation by a mathematics education lecturer before use. Because the written and interview components generated qualitative evidence, consistency was examined through time triangulation by comparing each participant's responses to the two equivalent problems at different times and by checking whether written work and interview explanations conveyed the same reasoning pattern. Data were treated as credible when the essential meaning and indicator pattern remained consistent across these sources and occasions.

Data Collection Procedure

Data collection began with GEFT screening of the fifth-grade class, followed by classification into FI and FD groups and purposive selection of AAR and AKW. Each focal participant then completed two equivalent LCM word problems, M1 and M2, and participated in semi-structured interviews after the written work. M1 involved two school activities recurring every 6 and 8 days, while M2 used a comparable recurring-activity structure with intervals of 3, 4, and 6 days. Written responses and interview transcripts were documented and compared across the two occasions. Figure 1 summarizes the procedure from screening to qualitative profile analysis.

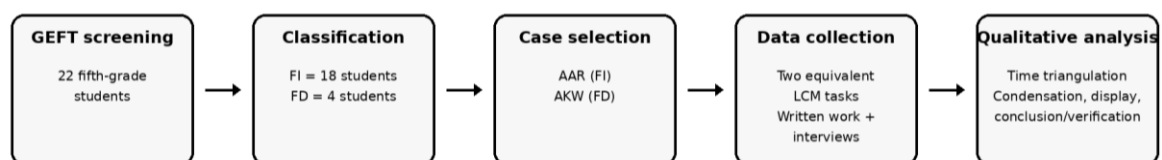


Figure 1. Research procedure from cognitive-style screening to qualitative profile analysis

Data Analysis

Analysis followed the qualitative activities described by Miles, Huberman, and Saldaña (2014): data condensation, data display, and conclusion drawing/verification. During condensation, relevant segments of written work and interview transcripts were selected and coded deductively against the four operational indicators of fluency, flexibility, originality, and elaboration. Data displays organized the evidence by participant, task, strategy, and indicator so that consistency across M1 and M2 could be examined. Conclusions were then drawn by comparing the observed response patterns with the indicator definitions and with the creative-thinking level classification adopted in this study. Interpretation remained case-based, and no statistical generalization was made from the two focal participants.

RESULTS AND DISCUSSION

Results

GEFT screening classified 18 of the 22 students as FI and 4 as FD, after which AAR and AKW were selected as the focal participants. Across the two equivalent tasks and follow-up interviews, each participant showed a stable response pattern that supported the use of the data for indicator-based interpretation. AAR consistently used more than one procedure and could explain the reasoning attached to both procedures, whereas AKW relied on one familiar procedure but could explain that procedure in detail. The contrast was therefore visible in strategy breadth and

variation rather than in answer correctness, because both focal students reached correct LCM results in the analyzed tasks.

Table 3. Equivalent LCM tasks used for time triangulation

Task	Context and numerical structure	Purpose
M1	Two school activities recur every 6 and 8 days; students determine when they will occur together again.	Primary qualitative analysis
M2	Three recurring activities occur every 3, 4, and 6 days; students determine the next common occurrence.	Time-triangulation comparison

For the FI case, AAR solved M1 by first listing the multiples of 6 and 8 until identifying 24 as the first common value. AAR then used a second procedure based on prime factorization, decomposing 6 into 2×3 and 8 into $2 \times 2 \times 2$ before obtaining 24 from the required prime factors. The interview confirmed that the second procedure was intentionally available to the participant rather than reconstructed only after prompting. Because AAR produced two relevant procedures and shifted between different procedural representations, the evidence met the fluency and flexibility indicators. AAR also identified the known and unknown information, showed intermediate steps, explained why 24 was the first shared multiple, and stated the conclusion, which met elaboration. Originality was not observed because both procedures were conventional approaches for finding an LCM, resulting in a Level 3 (creative) profile under the classification used in this study.

For the FD case, AKW solved the problem by listing multiples of 6 and 8 until the common value 24 was reached. During the interview, AKW stated that no other method was known and did not produce an alternative strategy when asked about another possible procedure. The evidence therefore did not meet fluency or flexibility, and originality was also not observed because the listing-multiples method is conventional. AKW nevertheless explained the recurrence information, the sequence of multiples, the identification of the common value, and the final conclusion in a detailed and coherent manner. This evidence met elaboration and supported the Level 1 (less creative) classification used in this study. The same indicator pattern appeared across the written and interview evidence used for the case analysis.

Table 4. Cross-case creative thinking profile

Indicator	AAR (FI)	AKW (FD)	Cross-case interpretation
Fluency	Met: two relevant methods	Not met: one method	AAR generated a broader set of relevant ideas.
Flexibility	Met: multiples and prime factorization	Not met: no alternative strategy	AAR shifted between different procedural representations.
Originality	Not met: both methods conventional	Not met: method conventional	Neither case produced a non-routine LCM strategy.
Elaboration	Met: detailed information, steps, reasons, and conclusion	Met: detailed sequence and explanation	Both cases elaborated a selected strategy, although AKW used only one.

Discussion

The cross-case comparison indicates that the main difference between AAR and AKW concerned the range and flexibility of available strategies, not whether they could obtain a correct LCM answer. AAR's FI profile included two relevant methods and detailed justification, whereas AKW's FD profile consisted of one familiar method that was nevertheless explained coherently. This pattern is consistent with studies that describe FI students as more likely to reorganize mathematical information analytically and to use alternative procedures when solving problems (Badjeber & Mailili, 2018; Marwazi & Putra, 2019; Risani & Nuriyatin, 2021). The present evidence should not be read as showing that cognitive style causes a particular level of creativity, because the design is descriptive and case-based. Instead, the two cases suggest that cognitive style may be associated with how readily a student shifts from one procedural representation to another within the same problem. For teachers, this distinction matters because two correct answers can conceal different needs for support in strategy generation and strategic variation.

AAR's performance provides the clearest evidence of fluency and flexibility because the participant generated both a listing-multiples solution and a prime-factorization solution for the same LCM situation. Fluency in this case was not simply the production of more written steps; it referred to the availability of more than one relevant mathematical idea. Flexibility was visible because the second method changed the structure of the solution rather than repeating the first procedure in a slightly different form. Similar distinctions between the number of ideas and the variation of approaches appear in studies of mathematical creative thinking that use fluency and flexibility as separate indicators (Alwi et al., 2022; Handayani, 2023; Widyastuti et al., 2021). The FI pattern observed here also corresponds with Napfiah's (2018) report that FI students in the cases examined tended to reach higher creative-thinking levels than FD students. Within the present study, the important point is that AAR could move between two conventional procedures while preserving the same mathematical conclusion.

AAR did not meet originality, even though the participant met three other indicators, and this distinction prevents the analysis from equating multiple strategies with novelty. Listing multiples and prime factorization are both established LCM procedures, so using both demonstrates procedural breadth without providing evidence of an unusual solution. Studies that classify creative mathematical performance through several indicators similarly separate originality from fluency and flexibility rather than treating them as interchangeable constructs (Nurhanifah, 2022; Widiyanto & Yunianta, 2021; Widyastuti et al., 2021). AAR's elaboration, however, was strong because the participant identified relevant information, showed intermediate reasoning, justified the common value, and stated a conclusion. Handayani (2023) and Bangsawan and Baso (2024) also describe detailed development of mathematical ideas as an important part of creative-thinking performance. The FI profile in this study therefore reflects a combination of breadth, variation, and detail, but not novelty.

AKW's FD profile shows that limited strategy generation does not imply an absence of mathematical reasoning. The participant used one conventional listing-multiples procedure and did not produce another method, which explains why fluency and flexibility were not met under the study's operational definitions. Even so, AKW could explain the recurrence information, list the multiples in sequence, identify 24 as the first common value, and restate the conclusion during the interview. This detailed procedural account supports elaboration and is consistent with the written and interview evidence across the two equivalent tasks. Earlier studies have reported that FD students may rely more strongly on familiar structures or require clearer external organization when solving mathematical problems (Badjeber & Mailili, 2018; Napfiah, 2018; Siahaan et al., 2018). In the present case, that tendency appears as dependence on one known method rather than as failure to understand the chosen method.

The fact that both participants reached correct answers but differed in creative-thinking indicators has an important assessment implication. Correctness captures whether the final numerical outcome is acceptable, but it does not reveal how many relevant ideas a student can generate, whether the student can shift procedures, or how fully the reasoning can be explained. Research on problem solving and creative thinking likewise emphasizes the value of examining solution processes in addition to final responses (Huda et al., 2017; Risani & Nuriyatin, 2021; Siki et al., 2023). For the two cases here, AAR and AKW would look similar if evaluation stopped at the answer 24, yet the interview and written evidence show different strategic repertoires. This difference supports the use of indicator-based analysis when teachers want to understand how students approach a mathematical task rather than merely whether they complete it. It also suggests that classroom assessment can include prompts asking students to explain, compare, or generate another method after a correct solution has been obtained.

The results also have a practical implication for the design of LCM instruction. Tasks that explicitly ask for more than one solution route may create opportunities for students to practice fluency and flexibility, particularly when familiar procedures such as listing multiples and prime factorization are compared side by side. Collaborative and open forms of mathematical activity have been used in previous studies to encourage the production and communication of alternative ideas (Kadir et al., 2017; Salsabila & Delyana, 2023; Widyastuti et al., 2021). For students who initially rely on one procedure, teachers can use structured prompts such as identifying known information, explaining why a method works, and asking whether the problem can be solved

another way. Such support should be used as scaffolding rather than as a fixed response to an FD label, because the present study does not establish that cognitive style determines a student's future performance. The pedagogical goal is to expand students' strategic repertoire while preserving the detailed reasoning that participants such as AKW were already able to provide.

Within the mathematics-education literature cited here, this study adds a narrower conceptual distinction to previous work on creative thinking and cognitive style. Earlier studies commonly compared overall creative-thinking levels or problem-solving profiles across FI and FD students (Napfiah, 2018; Risani & Nuriyatin, 2021), whereas the present analysis separates the four indicators within a single LCM problem structure. That separation shows that an FD case can display elaboration even when fluency, flexibility, and originality are not observed, and that an FI case can display fluency and flexibility without originality. This finding refines the interpretation of creative-thinking profiles by showing that the indicators can combine in different ways within correct solutions. It also prevents overgeneralization because the evidence is tied to two purposively selected fifth-grade students in one school and one mathematical topic. The contribution is therefore best understood as a context-specific account that can inform further comparative or intervention research rather than as a universal hierarchy between FI and FD learners.

Limitations and Directions for Future Research

This study is limited by its case-based design, the use of two purposively selected participants from one fifth-grade class, and the focus on a single mathematical topic. The findings therefore cannot be generalized statistically to all FI and FD students. Instrument quality was addressed through the validation and credibility procedures described above; no additional psychometric evidence was available. Future research could examine more participants within each cognitive-style category, use additional mathematical topics, and investigate whether instructional tasks that require multiple solution routes are associated with changes in fluency, flexibility, originality, and elaboration over time. Such work would help determine which patterns observed in these two cases remain stable across settings and which are specific to the LCM context.

CONCLUSIONS

The study identified different creative-thinking profiles for the two focal students when solving LCM word problems. AAR, classified as field independent, used listing multiples and prime factorization, explained the reasoning in detail, and therefore met fluency, flexibility, and elaboration but not originality, corresponding to Level 3 (creative) in the classification used by this study. AKW, classified as field dependent, used one conventional listing-multiples strategy and explained it in detail, meeting elaboration only and corresponding to Level 1 (less creative). The comparison shows that correct answers can mask meaningful differences in strategy breadth, procedural variation, and explanatory detail. Within the limits of this two-case qualitative design, the results support mathematics instruction that asks students to explain and compare solution methods while providing structured prompts for students who have not yet developed alternative strategies.

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