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From Individual Reasoning to Collaborative Engagement: Continuity of Student Problematic in Grade 1 Mathematical Problem Solving

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ABSTRACT

This qualitative study examined the continuity of student problematic from individual reasoning to collaborative engagement in a Grade 1 mathematics classroom within the Transformative Lesson Study Incorporating Open Approach (TLSOA) context. Seven Grade 1 students were followed across six lessons on addition and subtraction. Data were collected through video and audio recordings, students' written work, field notes, and photographs, and analyzed using protocol analysis and analytic description. The findings show that student problematic remained observable when students re-engaged with the same mathematical problem in small groups. Student problematic appeared through proposing, questioning, explaining, checking, reconsidering, and coordinating mathematical ideas. The study contributes to understanding how young learners' mathematical engagement continues across changing social contexts.

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1. INTRODUCTION

Mathematics education is expected to prepare learners to think analytically, respond flexibly to unfamiliar situations, and solve mathematical problems through their own reasoning. This expectation requires learning environments that provide students with opportunities to construct, explain, and develop mathematical ideas rather than only follow teacher-directed procedures [1-3]. However, mathematics instruction may still position the teacher as the main source of explanation, which can limit students' opportunities to engage independently with mathematical problems and construct their own solution strategies [4].

Student-centered mathematics instruction offers an alternative by creating opportunities for students to make sense of problems, explore strategies, and express mathematical ideas. Open-ended mathematical tasks provide opportunities for students to develop diverse solution methods and express student-generated reasoning [5]. Lesson study also supports this orientation by enabling teachers to collaboratively design, observe, and reflect on problem situations that promote student learning [6]. In Thailand, the Transformative Lesson Study Incorporating Open Approach (TLSOA) model integrates lesson study and open-ended mathematical problem solving to support classrooms in which students' ideas become central resources for learning [7, 8].

At the primary level, especially in Grade 1, mathematical learning experiences are important for developing early number sense, reasoning, and problem-solving habits. Addition and subtraction provide meaningful contexts for young learners to interpret quantities, examine relationships, and represent mathematical situations in different ways [2]. When mathematical tasks are connected to familiar situations and concrete experiences, young learners can use their existing knowledge to construct their own approaches to problem solving [2]. Therefore, early mathematics classrooms need problem situations that allow students to engage actively with mathematical ideas.

A key concept for understanding such engagement is student problematic. Student problematic refers to a situation in which students appropriate a teacher-assigned mathematical task as an object that requires their own interpretation, reasoning, and resolution [9]. In this sense, students are not merely completing a task or producing an answer. They appropriate the mathematical situation as an object that requires interpretation, strategy selection, checking, and explanation. Therefore, student problematic is not indicated only by answer correctness, but also by students' substantive engagement with mathematical ideas.

Student problematic can be observed in different ways across problem-solving contexts. During individual problem solving, it may appear through students' interpretation of the problem, generation of strategies, use of representations, and monitoring of their own reasoning. During collaborative problem solving, it may appear through proposing, questioning, explaining, checking, reconsidering, or coordinating mathematical ideas with peers. Thus, student problematic may have the same conceptual core across different phases of problem solving, although its observable manifestations may differ according to the social context.

Small-group mathematical activity can create opportunities for learning through dialogue, shared reasoning, and engagement with different mathematical perspectives [10-12]. Collaborative interaction can support the development of mathematical meaning when students do more than share answers and instead explain, question, check, and respond substantively to one another's ideas [13, 14]. However, less attention has been given to how student problematic that becomes visible during individual problem solving continues when students subsequently re-engage with the same mathematical problem in small groups.

This study examines the continuity of student problematic from individual reasoning to collaborative engagement in a Grade 1 mathematics classroom within the TLSOA context. The novelty of this study lies in examining student problematic as a continuous analytical construct across the individual and collaborative phases, rather than treating individual reasoning and group interaction as separate learning events. By focusing on students' re-engagement with the same mathematical problem after individual worksheets were collected, this study provides empirical insight into how Grade 1 students' mathematical engagement remains observable across changing social contexts. In the TLSOA classroom, students first encountered a mathematical problem situation and then worked individually to construct their own solutions. After the individual worksheets were collected, students were given a new group worksheet containing the same mathematical problem and were asked to solve it collaboratively. This classroom arrangement created two connected problem-solving phases: an individual reasoning phase and a collaborative re-engagement phase. This sequence is important because the movement from individual to collaborative problem-solving is not only a change in classroom organization, but also a change in how students engage with the mathematical problem. In the individual phase, students may construct personal strategies and representations. In the collaborative phase, the same problem may become a shared object of discussion, explanation, checking, reconsideration, and coordination. Therefore, it is important to examine whether student problematic remains observable when students re-engage with the same mathematical problem in a different social context.

2. LITERATURE REVIEW

2.1. Student Problematic in Mathematical Problem Solving

Mathematical problem solving is central to early mathematics learning because it allows students to interpret situations, develop strategies, construct representations, and explain mathematical relationships. In Grade 1 classrooms, addition and subtraction provide meaningful contexts for developing number sense, reasoning, and early problem-solving habits. When problem situations are connected to familiar contexts, young learners can use their everyday experiences to construct mathematical ideas [2]. The concept of student problematic provides a useful theoretical lens for examining students' mathematical engagement. Student problematic refers to a state in which students become aware of a problem as their own and develop a desire to engage with and resolve it through their own reasoning, rather than merely responding to a task assigned by the teacher. [9]. From this perspective, students are not only completing a task or producing an answer. They appropriate the mathematical situation as an object that requires interpretation, strategy selection, checking, explanation, and possible revision. Student problematic is therefore different from simple participation, task completion, or answer correctness. A correct answer alone does not necessarily show that students have engaged with the mathematical problem as their own. Similarly, physical participation or answer sharing does not necessarily indicate student problematic. In this study, student problematic is understood as observable when students generate, select, examine, apply, or revise mathematical ideas in response to a problem situation.

2.2. Individual and Collaborative Mathematical Problem Solving

Student problematic can be observed in both individual and collaborative problem-solving contexts. During individual problem solving, it may appear through students' interpretation of the problem, selection of strategies, use of representations, and monitoring of their own reasoning. In this phase, students work with the mathematical situation through their own ideas and attempt to construct a solution independently. During collaborative problem solving, student problematic may appear through interactional processes. Students may propose ideas, question representations, explain strategies, check answers, reconsider approaches, or coordinate different mathematical ideas with peers. These actions show that the mathematical problem becomes a shared object of engagement rather than only an individual task. Previous studies have shown that small-group mathematical activity can create opportunities for learning when students engage with different mathematical perspectives [10, 11]. Collaborative interaction can support the development of mathematical meaning when students explain, question, and respond to one another's ideas [12-14]. However, collaborative work does not automatically indicate deep mathematical engagement. Students may simply share answers, copy solutions, or agree with peers without substantively examining mathematical ideas. Therefore, the analysis of collaborative student problematic must focus on the quality of mathematical engagement, not only on the presence of group work.

2.3. Transformative Lesson Study Incorporating Open Approach

The Open Approach provides an instructional context in which students are encouraged to engage with open-ended problem situations and develop diverse solution methods [5]. This approach positions students' ideas as important resources for classroom learning. Rather than presenting only one fixed procedure, the teacher provides a problem situation that allows students to explore, represent, and explain mathematical relationships in different ways. Lesson study supports this process by enabling teachers to collaboratively design, observe, and reflect on mathematics lessons [6]. In Thailand, the Transformative Lesson Study Incorporating Open Approach (TLSOA) model integrates lesson study and the Open Approach to support student-centered mathematics classrooms [7, 8]. In the TLSOA context, students first encounter a problem situation, develop their own ideas, and then participate in classroom or group-based mathematical activity. This makes TLSOA an appropriate context for examining how student problematic emerges and continues across different phases of problem solving.

2.4. Analytical Framework for Continuity of Student Problematic

This study examines continuity of student problematic across individual and collaborative mathematical problem solving. Continuity does not mean that every student must transfer the same idea from individual work to group work. It also does not mean that the same behavior must appear in both phases. Instead, continuity refers to the continued or renewed treatment of the same mathematical problem as an object of substantive mathematical engagement across changing social contexts.

Table 1 summarizes the conceptual basis used to analyze the continuity of student problematic in this study. The framework connects student problematic with individual reasoning, collaborative engagement, and the TLSOA context. The analytical framework treats student problematic as a construct that can remain observable even when its form changes. During individual problem solving, student problematic is examined through students' strategies, representations, and reasoning. During collaborative problem solving, it is examined through students' interaction with mathematical ideas. This framework allows the study to trace whether the same mathematical problem remains an object of engagement when students move from individual reasoning to collaborative problem solving.

Table 1. Conceptual basis for analyzing continuity of student problematic.

CONCEPTUAL FOCUS	MAIN IDEA	RELEVANCE TO THIS STUDY
Student problematic	Students become aware of a problem as their own and develop a desire to engage with and resolve it through their own reasoning	Explains how students appropriate a mathematical situation as an object of thinking
Individual problem solving	Students interpret the problem, generate strategies, use representations, and monitor reasoning	Supports analysis of student problematic during independent work
Collaborative problem solving	Students propose, question, explain, check, reconsider, and coordinate ideas with peers	Supports analysis of student problematic during small-group interaction
Continuity	The same problem remains an object of substantive engagement across phases	Helps trace whether student problematic remains observable from individual to collaborative work
TLSOA/Open Approach	Open-ended problem situations support diverse student ideas and classroom discussion	Provides the instructional context for observing student problematic

3. METHODS

This study employed a qualitative research design to examine the continuity of student problematic from individual to collaborative mathematical problem solving in a Grade 1 mathematics classroom. The study was conducted within the TLSOA context. The analysis focused on students' verbal expressions, actions, gestures, written representations, and interactions as they engaged with addition and subtraction problem situations. The methodological design of this study was initially informed by the framework of the framework of student problematic described by Isoda and Katagiri in *Mathematical Thinking: How to Develop It in the Classroom* in 2012. Their framework provided an initial conceptual basis for examining how students interpret mathematical situations, construct strategies, and develop their reasoning during problem solving.

The participants were seven Grade 1 students who constituted the entire class taught by the first author as a student teacher during the second semester of the 2025 academic year. The students were followed across six mathematics lesson plans. The classroom was selected purposively because the students had prior experience learning within the TLSOA framework and were familiar with engaging in problem situations independently before participating in collaborative problem solving. Data were collected from multiple sources, including lesson plans, field notes, students' written work, audio recordings, video recordings, and photographs. The six lesson plans were collaboratively designed by the lesson study team and provided the mathematical problem situations used in the classroom. Field notes documented students' actions, verbal expressions, problem-solving approaches, and interactions. Students' written work consisted of individual worksheets and small-group worksheets, which served as separate records of mathematical activity in the two problem-solving phases. Audio and video recordings captured classroom talk, gestures, actions, and interactional details that could not be fully represented in written products or field notes. Photographs provided supplementary visual evidence of students' written work and classroom activity.

Data collection followed the sequence of classroom activity in each lesson. Students first encountered the problem situation and worked individually to construct their own solutions. After the individual worksheets were completed, they were collected by the teacher. Students were then given new group worksheets containing the same mathematical problem and were asked to solve it collaboratively. This arrangement enabled the study to examine whether student problematic remained observable when students re-engaged with the same problem without direct access to their completed individual written solutions.

Data were analyzed using protocol analysis and analytic description. Audio and video recordings were reviewed together with field notes, photographs, and students' written work. Relevant episodes were transcribed and organized chronologically into interaction protocols that linked students' verbal expressions with actions, gestures, and written representations. Student problematic was identified when the available evidence showed that students became personally engaged with the mathematical problem, treated it as a problem of their own, and demonstrated a desire to explore or resolve it through their own reasoning. This engagement was observed through students' generation, selection, examination, application, checking, explanation, or revision of mathematical ideas.

The analysis proceeded in four stages. First, relevant episodes were identified from students' verbal expressions, actions, written work, and interactions. Second, students' mathematical ideas, strategies, and representations during individual problem solving were examined. Third, students' re-engagement with the same problem during small-group work was analyzed by focusing on proposing, questioning, explaining, checking, reconsidering, and coordinating mathematical ideas. Fourth, evidence from the individual and collaborative phases was compared to determine whether student problematic remained observable across the change in social context. Trustworthiness was addressed through triangulation, consistent analytical procedures, and grounding interpretations in observable classroom evidence. Credibility was supported by the use of multiple data sources, including video recordings, audio recordings, field notes, students' written work, and photographs. Dependability was supported by applying the same analytical criteria across the six lessons. Confirmability was strengthened by checking interpretations against interaction protocols and visual records. This study was conducted in accordance with ethical principles for research involving children. Permission was obtained from the school, and informed consent was obtained from students' parents or legal guardians before data collection. Students were informed about the study in an age-appropriate manner, and pseudonyms were used to protect confidentiality. Ethical approval was granted by the Center for Ethics in Human Research, Khon Kaen University, under approval document No. HE673514, Ref. KKU 660201.2.3/5802.

4. RESULTS AND DISCUSSION

The analysis across the six lessons focused on whether and how student problematic that emerged during individual problem solving continued when students subsequently entered small-group problem solving. During the individual phase, students engaged with the problem as their own and constructed mathematical solutions through their own reasoning. After the individual worksheets were collected, students were provided with a new group worksheet presenting the same problem. The analysis then examined whether students continued to engage with the problem through verbal expressions, actions, questioning, explanations, and mathematical reasoning during small-group interaction. The findings show that students' problematic did not disappear when the problem-solving context shifted from individual to collaborative activity. Rather, students continued to engage with the same mathematical problem while proposing, questioning, explaining, checking, and coordinating mathematical ideas with peers. peers. This continuity shows that student problematic remained observable as students moved from individual engagement with the problem to collaborative engagement in jointly solving the same problem.

4.1. Appropriating the Problem as an Object of Thinking

The first pattern concerned how students appropriated the mathematical problem as an object of thinking. In one lesson, the problem situation involved children on a bus. There were six children sitting on the bus, three more children got on at the next stop, and four more children got on at another stop. Students were asked to write a mathematical expression and show how they found the total number of children on the bus.

Problem Situation: There were already 6 children sitting on the bus (Picture 1). When the bus reached the next stop, 3 more children got on (Picture 2). Then, when the bus stopped at another stop, 4 more children got on (Picture 3).

(Picture 1) (Picture 2) (Picture 3)

Instruction: Write a mathematical expression and show how you find the answer to the question, "How many children are there on the bus altogether?" Explain your thinking.

Figure 1. Children on the Bus problem situation.

The problem situation provided students with a familiar context for interpreting quantities and tracking changes. Students' direct speech and actions during this episode were used as evidence of how student problematic began to emerge. As shown in **Table 2**, students first attended to the initial quantity, checked visual information, tracked changes in quantity, and began to propose mathematical actions for solving the problem. Student problematic was observable not only through written answers, but also through students' utterances, gestures, and actions. The students did not merely listen to the problem statement. They attended to quantities, checked visual information, tracked changes across the picture sequence, and began to propose mathematical actions such as counting and adding. Taken together, these responses indicate that the problem situation began to become a problem of the students' own, as they attended to the changing quantities, attempted to make sense of the situation, and began to propose mathematical actions for resolving it. This emerging engagement with the problem provided the basis for the subsequent individual problem-solving phase.

Table 2. Direct speech during initial problem appropriation.

ITEM	DIRECT SPEECH / ACTION	INTERPRETATION OF STUDENT PROBLEMATIC
401	Students: "There are six children already on the bus."	Students attended to the initial quantity presented in the problem situation.
402	Film: "One, two, three. Okay, there are three." Film raised his hand and pointed to the corresponding image on the board.	The student checked the visual information and connected the verbal statement with the picture.
403	Fern: "They sitting inside."	The student attempted to explain the apparent difference between the stated quantity and the visible children in the picture.
407	Grace: "Three more people are getting in." Grace raised her hand and pointed at the picture.	The student recognized the increase in quantity shown in the next picture.
408	Film: "Three more people add on."	The student maintained attention to the changing quantity in the problem situation.
409	Students: "Four more people have been added."	Students identified the next change in quantity across the picture sequence.
410	Film: "One, two, three, four." Film raised his hand while counting each person sequentially.	The student counted the added children and tracked the quantity change visually.
410	Film: "How many children are there now?"	The student began to treat the situation as a mathematical question requiring resolution.
420	Kwan: "Counting."	The student proposed counting as a mathematical action for solving the problem.
420	Cooper: "Adding."	The student proposed addition as a possible mathematical strategy.
421	Grammy: "It equals 10."	The student began to propose a numerical result, although the reasoning still needed further development.

4.2. Student Problematic During Individual Problem Solving

After the initial classroom discussion, students worked individually on the same problem situation. In this phase, student problematic became observable through students' written representations and solution strategies. Students constructed their own ways of representing the quantities and finding the total. For example, some students used a sequential addition strategy, while others reorganized the quantities to make ten before determining the final answer. As shown in **Figure 2**, the students' individual work showed different approaches to the same mathematical problem. One student used a make-ten strategy by reorganizing the quantities to form 10 and then adding the remaining quantity. Another student used a different representation to combine the quantities and obtain the same total. These differences indicate that the students were not simply following one fixed procedure. They were constructing mathematical ideas and representing their reasoning in different ways. However, written products alone were not treated as sufficient evidence of student problematic. They were interpreted together with classroom records, including video-recorded actions, gestures, verbal expressions, and field notes. This was important because student problematic was defined not only by the correctness of a written answer but by students' engagement with the mathematical situation as an object requiring their own reasoning. Therefore, the individual worksheets provided illustrative evidence of students' mathematical thinking, while the interpretation of student problematic depended on multiple sources of classroom evidence.

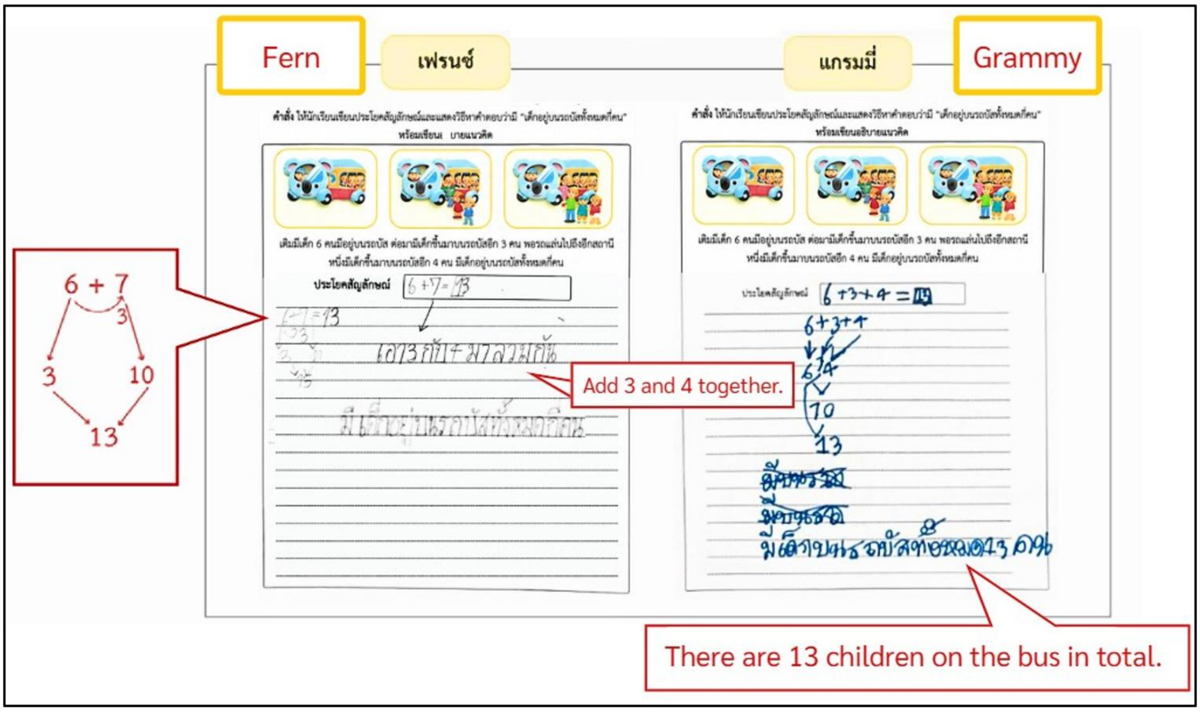

Figure 2. Examples of individual students' thinking processes.

4.3. Collaborative Re-Engagement with the Same Mathematical Problem

After students completed their individual worksheets, the teacher collected them and provided each small group with a new worksheet containing the same mathematical problem. This arrangement meant that students could not directly display, copy, or rely on their completed written solutions during group work. Instead, they had to re-engage with the same problem collaboratively.

In one small-group episode, students reconstructed the solution together after their individual worksheets had been collected. As shown in **Table 3**, the students' direct speech indicates that the mathematical relationship among 6, 4, and 3 became a shared object of examination during collaborative re-engagement.

Table 3. Direct speech during collaborative re-engagement with the same problem.

ITEM	DIRECT SPEECH / ACTION	INTERPRETATION OF STUDENT PROBLEMATIC
448	Fern: "Okay, let's write it first. There are 13 children on the bus altogether."	The student oriented the group toward constructing a shared written solution.
449	Grammy: "Six plus four plus three." Grammy wrote while thinking aloud.	The student represented the problem symbolically using an addition expression.
450	Fern: "Write six plus seven instead, Grammy, because you can combine four and three."	The student proposed an alternative organization of the quantities.
451	Grammy: "Oh!"	The student showed uptake of the peer's suggestion.
452	Fern: "Why did you draw so many lines?" Fern pointed to and traced the connecting lines between numbers.	The student questioned the peer's representation and examined the written strategy.
453	Grammy: "When we write 6 + 4 + 3, we can take 6 and 4 to make 10. Then 3 remains. Ten plus three equals 13."	The student explained the mathematical basis of the make-ten strategy.

Collaborative re-engagement involved more than sharing answers. Students proposed expressions, questioned representations, responded to peer suggestions, and explained the mathematical basis of their strategy. Thus, the same problem became a shared object of mathematical discussion, and student problematic remained observable in the collaborative phase through explanation, questioning, checking, and coordination of ideas.

The small-group written product reflected the mathematical relationships constructed through the group discussion. The representation showed how the quantities were reorganized to make 10 and obtain the total of 13. When considered together with the interaction episode, the written product provides evidence that students jointly proposed, examined, and coordinated mathematical ideas. Therefore, the group product was not simply a combination of individual answers. It represented a collaborative reconstruction of the solution through renewed engagement with the same problem.

4.4. Patterns of Continuity Across the Six Lessons

To examine whether the pattern was limited to one episode or appeared across the broader dataset, evidence from all six lessons was compared (**Figure 3**). The analysis focused on whether mathematical problems addressed during individual work became renewed objects of substantive engagement during subsequent small-group work. Across the six lesson plans, student problematic remained observable at the level of problem-solving activity.

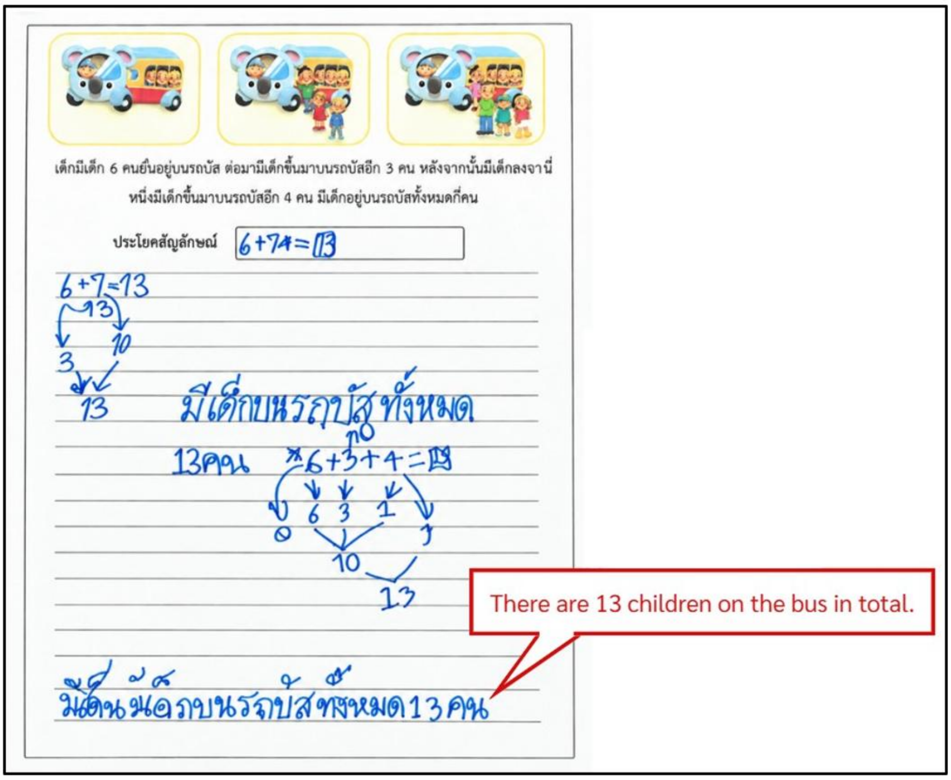

Figure 3. Small-group product constructed through collaborative problem solving.

Table 4 shows that the continuity of student problematic was not defined as the identical transfer of individual solutions into group work. Rather, continuity was identified when the same mathematical problem remained or became an object of substantive engagement again. During the individual phase, student problematic appeared through students' interpretations, strategies, and representations. During the collaborative phase, it appeared through proposing, questioning, explaining, checking, reconsidering, and coordinating mathematical ideas. The evidence was strongest in episodes where students substantively took up one another's ideas rather than merely sharing answers.

4.5. Interpreting the Transition from Individual Reasoning to Collaborative Engagement

The transition from individual to collaborative problem solving was not merely a procedural shift in classroom organization. It also involved a shift in how student problematic became observable. In the individual phase, student problematic was expressed through personal strategies, written representations, and students' attempts to make sense of the problem. In the collaborative phase, student problematic was expressed through interaction with peers, including explanation, questioning, checking, and coordination of mathematical ideas. This finding extends previous research on collaborative mathematical problem solving by showing that small-group interaction can build on prior individual engagement with the same problem. Previous studies have emphasized the value of dialogue, participation, and shared reasoning in mathematical learning [10-14]. The present study adds that collaborative mathematical engagement can be understood as a continuation of students' problematic when students re-engage with the same problem after individual work. Because individual worksheets were collected before group work, the observed collaboration cannot be interpreted simply as copying completed individual solutions. Instead, it shows renewed mathematical engagement with the same problem in a different social context.

From the perspective of student problematic, the same underlying construct can remain observable even when its form changes. During individual problem solving, students' engagement was visible in their own interpretations and representations. During collaborative problem solving, engagement became visible in their interactional work with mathematical ideas. Thus, student problematic should not be understood as fixed behavior. It can be manifested differently according to the structure of the classroom activity.

4.6. Model of Continuity of Student Problematic

The transition of student problematic can be represented as a movement from initial problem appropriation to individual reasoning, collaborative re-engagement, and renewed shared mathematical engagement. **Figure 4** illustrates this process. Student problematic first emerges when students begin to treat the problem situation as an object requiring mathematical resolution. During individual problem solving, this engagement is reflected in students' strategies, representations, and reasoning. When the individual worksheets are collected and students are asked to solve the same problem collaboratively, the problem becomes a renewed object of engagement. In the collaborative phase, student problematic is reflected in proposing, questioning, explaining, checking, reconsidering, and coordinating mathematical ideas. This model does not imply that every student demonstrated the same trajectory across both phases. It also does not imply that identical ideas were transferred unchanged from individual work to group work. Rather, it shows continuity at the level of problem-solving activity. The same mathematical problem remained an object of substantive engagement as the social context changed from individual to collaborative problem solving. Grade 1 students were able to engage with mathematical problems not only individually but also collaboratively. The continuity of student problematic was evident when students re-engaged with the same problem, reconstructed ideas, examined relationships, and coordinated mathematical reasoning with peers. Young learners' mathematical thinking can be supported by classroom arrangements that allow movement between individual reasoning and collaborative engagement within the TLSOA context.

Table 4. Patterns of continuity of student problematic across the six lesson plans.

LESSON PLAN	EVIDENCE DURING THE INDIVIDUAL PHASE	EVIDENCE DURING THE COLLABORATIVE PHASE	ACTIVITY-LEVEL INTERPRETATION
Monkeys at the Zoo	Students constructed different representations of 9 + 6, including symbolic expressions, diagrams, and make-ten strategies.	Students jointly reconsidered the problem by explaining, questioning, and checking mathematical relationships and representations.	The same 9 + 6 problem became a renewed object of substantive engagement during small-group activity.
The Elephant and Apples	Students represented 16 − 7 using symbolic expressions, decomposition, and ten-based strategies.	Students jointly solved the problem by explaining approaches, examining representations, and clarifying or revising reasoning.	The same 16 − 7 problem became a renewed object of engagement as approaches were explained, examined, clarified, or revised.
Tigers and Lions	Students used counting, subtraction, diagrams, and one-to-one correspondence to compare quantities.	Students questioned answers, considered alternative representations, and coordinated different approaches.	The same comparison problem remained an object of engagement as answers and representations were questioned and coordinated.
Children on the Bus	Students represented changing quantities using 6 + 3 + 4, 6 + 7, diagrams, and make-ten strategies.	Students proposed, questioned, and explained different ways of reorganizing the quantities.	The same problem involving 6, 4, and 3 became a shared object of discussion and explanation.
Children in the Sandbox	Students used addition-subtraction expressions, diagrams, and ten-based reasoning to determine the remaining quantity.	Students examined relationships among quantities, explained reasoning, and coordinated representations.	The same problem concerning the remaining quantity became a renewed object of substantive engagement.
Apples in the Basket	Students used sequential subtraction, combined subtraction, diagrams, and ten-based representations.	Students questioned representations, reconsidered conditions, and proposed alternative ways of solving the problem.	The same subtraction problem remained an object of engagement as students reconsidered and coordinated solution approaches.

4.7. Contribution to Mathematics Learning Research

Mathematics learning is closely related to mathematical thinking, differentiated instruction, scaffolding strategies, conceptual understanding, and mathematics proficiency [15-17]. Mathematics learning should not be understood only as answer production, but also as a process in which students develop ideas, use representations, receive instructional support, and engage with mathematical meanings. In relation to these studies, the present research adds new information regarding mathematics learning by showing how student problematic can continue from individual reasoning to collaborative engagement in a Grade 1 classroom. While previous studies have emphasized mathematical thinking, scaffolding, conceptual understanding, and mathematics proficiency, this study specifically explains how young learners re-engage with the same mathematical problem after individual work and continue to treat it as an object of shared mathematical discussion. Therefore, this study contributes to mathematics education by providing empirical evidence of how students' mathematical engagement remains observable across individual and collaborative problem-solving phases.

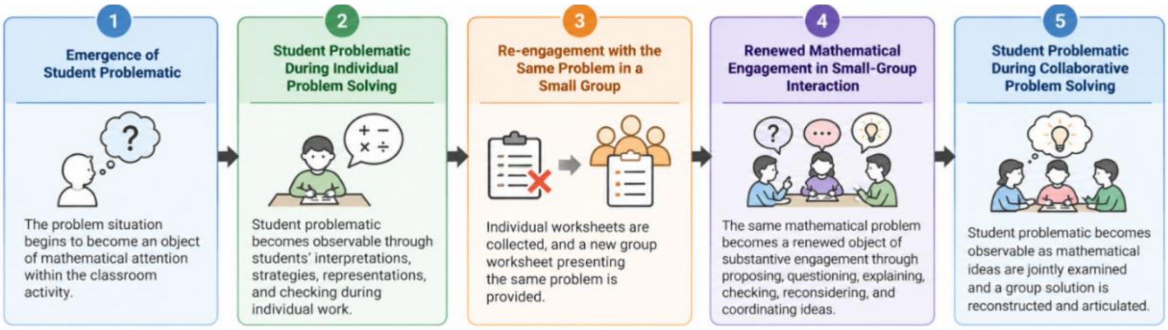

Figure 4. Model of continuity of student problematic from individual reasoning to collaborative mathematical problem solving.

5. CONCLUSION

This study examined the continuity of student problematic from individual reasoning to collaborative engagement in a Grade 1 mathematics classroom within the TLSOA context. Student problematic remained observable when students re-engaged with the same mathematical problem in small groups after completing individual problem solving. During the individual phase, student problematic appeared through students' interpretations, strategies, representations, and reasoning. During the collaborative phase, it appeared through proposing, questioning, explaining, checking, reconsidering, and coordinating mathematical ideas with peers. Student problematic can continue across changing social contexts, although its observable manifestations may differ between individual and collaborative problem-solving phases. This finding contributes to understanding how young learners' mathematical engagement can be supported through classroom arrangements that connect individual reasoning with collaborative mathematical activity. However, the study was limited to seven Grade 1 students in one TLSOA classroom. Future research should examine similar transitions across different grade levels, mathematical topics, and classroom contexts.

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7. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper is free from plagiarism.

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