ACQUIRING MATHEMATICAL KNOWLEDGE AND PROCESS SKILLS IN MATHEMATICS REMEDIAL INTERVENTION BASED ON INSTRUCTIONAL MODEL

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Abstract: Remediation for students with learning difficulties in mathematics is commonly based on a behaviourist framework of learning. As a result, these students might acquire procedural knowledge but are weak in process skills and without sufficient conceptual understanding. This study was embarked on investigating teaching and learning process of a mathematics remediation classroom in which a teacher helped his five students to improve mathematical knowledge and process skills through a concrete-representation-abstract sequence. Using a case study research design, qualitative data was collected through observation, interview and students’ work, at a suburban primary school. The teacher encouraged his students to explore mathematical ideas through problem-solving and modelling. Throughout the activities, he used explicit instruction a student who often showed learning difficulties. He also used explicit instruction for other students but he gradually provided prompts to other students to think actively while they were engaged in hands-on activities. Initially, these students had difficulties manipulating objects and drawing due to lacking of conceptual understanding. An indirect approach to instruction motivated them to learn simple reasoning, making connections and representations. However, they did not show any improvement in communication. Hence, a mixed instructional approach might facilitate students in acquiring mathematical knowledge and process skills.

Keywords: Conceptual Understanding, Concrete-Representation-Abstract, Mathematics Remediation, Procedural Knowledge, Process Skills

Introduction

Remediation for students with learning difficulties in mathematics is commonly based on a behaviourist framework of learning. Generally, teachers over-emphasize the mastery of mathematics automacy in solving arithmetic problems. Students are helped to understand mathematical concepts and procedures using a concrete-representation-abstract (CRA) sequence which is based on a teacher-centred approach (Moscardini, 2009; Gurganus, 2007; Fuchs & Fuchs, 2001; Mercer & Miller, 1992) such as drill-and-practice, and demonstration-prompt-practice. As a result, these students might acquire procedural knowledge but are weak in process skills and without sufficient conceptual understanding. The students might have problems applying what was learned in a variety of contexts and learning mathematics at the higher level (Moscardini, 2009; Ketterlin-Geller, Chard, & Fien, 2008; Cawley & Parmar, 1992)

Mathematics Remedial Interventions for Knowledge and Process Skills Acquisition

The aim of mathematics remediation is to help students to master skills of arithmetic and reasoning (Ministry of Education, 2010). Merely gaining arithmetic skills is not sufficient for these students. Students with mathematics learning difficulties should be helped to master procedural knowledge with conceptual understanding and learn mathematical process skills. To help them gaining mathematical knowledge and process skills, we proposed an instructional model as shown in Figure 1 which is focused on the content, a mixed
Mathematical Knowledge

Knowledge should be constructed through active participation in learning activities (Slavin, 2009; O’Donnell, Reeve & Smith, 2007). According to the view of constructivist advocates, students should develop their conceptual understanding so that they have more cognitive resources to improve procedural proficiency. However, teachers tend to downplay the development of procedural knowledge when they over-emphasize the learning of mathematical concepts (Evans, 2007). Rittle-Johnson, Siegler & Alibali (2001) suggested an iterative model which enables students to develop their conceptual understanding and procedurally proficiency. Evans (2007) also recommended that teachers should make links between these two types of knowledge explicit during instruction. Thus, we suggest that both conceptual understanding and procedural knowledge should be emphasized and developed simultaneously during remedial interventions.

Mathematical Process Skills

National Council of Teachers of Mathematics (2000) identifies five process standards for learning and doing mathematics actively, including problem-solving, reasoning, representation, making connections, and communication. Problem-solving is recommended to enable students improve their conceptual and procedural knowledge. Through active and guided participation in problem-solving activities, students could be engaged in mathematical processes and thus improve their process skills (Reys, Lindquist, Lambdin & Smith, 2007; Van de Walle, 2001). NCTM (2000) and MOE (2010) highlight the importance of mathematical reasoning. Students should be able to understand mathematics and make justification towards mathematical theories (Reys et al., 2007). In the view of constructivist advocates, inductive reasoning is emphasized rather than deductive reasoning. Hence, students are required to solve mathematical problems to develop their knowledge using an inductive method during instruction. Reys et al. (2007) and Van de Walle (2001) suggested five ways of representing mathematical ideas which include written symbol, picture, manipulative, real-world situation, and spoken language. Students should be encouraged to
create their own ways of representing ideas and transform it from one form to another. Through problem-solving and modelling, students could learn to make connections between mathematics and real-world situations (Confrey, 2007; Usiskin, 2007, Niss, Blum & Galbraith, 2007). They also could learn to identify connections among mathematical ideas, and relations among mathematical symbols and procedures, and conceptual ideas related to the symbol (Reys et al., 2007). In mastering communication skills, students are expected to communicate their mathematical ideas orally, using symbols or visual representations (MOE, 2010). The purpose is to help students understand and apply mathematics effectively. From the perspective of social constructivism, language is a tool which can be used for organizing mathematical ideas (Slavin, 2009). According to Usiskin (2007), language is also important in helping students identify and apply a correct number operation in a real-world context. Hence, Reys et al. (2007) suggested experiences with a variety of concrete situations, problem-solving contexts, and communicating mathematical ideas as prerequisites in planning instruction for number operations.

**Instructional Strategy**

Remediation program for students with learning difficulties should be developmental (Hallahan, Lloyd, Kauffman, Weiss & Martinez, 2005). Researchers found that a concrete-representation-abstract sequence is effective for improving students’ arithmetic as it could help the students to understand mathematical concepts before they master the skills. According to the diagnostic and remedial approaches which are proposed by Mercer and Miller (1992), teachers carry out demonstration using manipulative to help students understand a concept. Next, students are guided to manipulate concrete objects and practice until they understand the concept. At the next phase, manipulative are replaced by the use of drawings in order to help students master a skill based on their conceptual understanding that is gained in the previous phase. During this phase, a mnemonic strategy is also taught to help them remember the procedures, and thus apply that during the abstract phase. This strategy is applied based on a teacher-directed approach to instruction in every phase to guide students master the concepts and skills in mathematics during mathematics remediation. However, a teacher-directed approach might foster an over-reliance on concrete materials and drawings rather than mental strategies to solve problems (Moscardini, 2009). They might face difficulties to discard these strategies when they are required to use mental strategies and make progress onto more efficient strategies in mathematical processes.

**Instructional Approach**

Direct and explicit instruction is commonly used and found effective in helping students with learning difficulties in learning arithmetic skills (Gurganus, 2007; Joyce, Weil & Calhoun, 2009). This model of teaching is based on the behaviourist framework of learning. Reinforcement, such as incentives, prompts and positive reinforcers, is used to elicit intended behaviours of students, maintain those behaviours, and encourage students to perform that again in future (O’Donnell et al., 2007). Generally, teachers with this disposition use drill-and-practice and demonstration-prompt-practice approaches to help students with learning difficulties.

Yet, students might still face difficulties in retention of mathematical knowledge over time and failure in performing steps because of misconceptions (Ketterlin-Geller et al., 2008). Hence, they need to develop their basic arithmetic skills as they are involved in sense-making and mathematical processes. Teachers with traditional disposition tend to demonstrate
procedures for their students to re-enact and thus hamper them from making sense of mathematics. Instead of encouraging our participating students to learn procedures without active thinking, we planned the instructional activities and encouraged our participating teacher to gradually incorporating the constructivist approach during the teaching and learning process of mathematics remediation. Slavin (2009) recommended a few suggestions for mathematics instruction in the primary school. Apart from working together in small groups to solve problems, real-life problems, reflections, scaffolding and a favourable environment are suggested by Slavin (2009).

**Instructional Technique**

Van de Walle (2001) suggested a developmental approach based on the constructivist view of learning. Students should participate in problem-solving activities to help them develop mathematical ideas. According to Slavin (2009), teachers should use a problem-context which is related to students’ experiences to motivate their participation. They also should represent their ideas physically, using drawings, verbally, or using symbols, in solving problems. The concrete experiences of students should be supported by the use of scaffolding by teachers so that students can learn mathematics through their cognitive function when they are required to do reasoning and making connections. Slavin (2009) suggested that this activity should be carried out using cooperative learning method so that students can understand concepts through their discussions with peers.

Modelling could be used as a tool for students to make sense and generalizations (Usiskin, 2007). In mathematics learning, modelling also enables students to use their knowledge in a variety of contexts if teachers could establish a clear reference for students to make sense (Niss et al., 2007). In problem-solving activities, teachers should provide word problems that describe real-life situations as exercises in modelling (Greer, Verschaffel & Mukhopadhyay, 2007). According to Greer et al. (2007), students at the primary level could be involved in the process of modelling that includes understanding a situation, translating the situation into mathematics, working it out mathematically, translating the mathematics back to real-world situation, evaluation, and communication.

**Research Method**

**Research Design**

Using a case study research design, qualitative data was collected through observation, interview and students’ work, at a suburban primary school. According to Creswell (2008) and Merriam (1998), case study is used to gain an in-depth understanding and to reflect on that process.

**Participants**

To understand the teaching and learning process during the implementation of the instructional model as shown in Figure 1, a remediation class teacher and his four students were selected through purposeful sampling (Creswell, 2008). The teacher was officially assigned to the Special Remediation Program. Nazrah, Faith, Farib and Hafiz were selected after administration of a screening test and followed by a diagnostic test. All of them needed remediation as they had not mastered basic skills in addition.
Research Instruments

For qualitative research, observational data, interview data and documents are frequently used to understand a process (Creswell, 2008; Merriam, 1998). In our research, we collected open-ended information as these authentic experiences would enable us to record information as it occurs in a setting and study the actual behaviours of research participants. Open-ended interview with teacher and students to enable us further understand the thinking and behaviours of participants during the teaching and learning process. Apart from understanding the observational data, we used the interview data to find out the difficulties faced by the participating teacher and students, and to improve planning of the instruction. Work of students including worksheets, drawings, problem-solving solutions, and school documents was also used to understand the central phenomena in our study. These documents helped us to support or contrast the information we obtained from observations and interviews.

Data Analysis

Generally, we applied the analysis strategy suggested by Creswell (2008) and Merriam (1998) to analyze all our observational and interview raw data. After it was transcribed, a preliminary exploratory analysis was carried out to identify the focus of our research. Next, segmenting was used to identify units of information which were then became the basis for defining categories. The codes were categorized into themes and descriptions of the participants. For additional insight, the themes were layered and inter-related.

Validity and Reliability

Qualitative research is interpretative in nature. To determine the credibility of our research findings, we used triangulation and member checking as suggested by Creswell (2008). We also applied strategies such as audit trails, member checks, and memos as suggested by Morse, Barrett, Mayan, Olson & Spiers (2002) to support the rigor in our evidence.

Remedial Intervention for Addition without Regrouping through Concrete-Representation-Abstract Sequence

The teacher was expected to employ the constructivist instructional approach. As the students were used to explicit instruction and drill-and-practice, he should adjust his instruction according to the responses of his students. Instructional activities were planned for addition without regrouping at three levels according to the concrete, representation, and abstract sequence.

The ideas of place-value were revised using concrete objects. Students should represent a number using place-value cards and straws in units and bundles of ten. For example, the students could combine cards of ’2 tens’ and ’3 ones’ to represent the number ’23’ that was read by their teacher. After that, they should prepare two bundles and three units of straws.

After the teacher explained a problem context related to addition, students should represent the problem in both concrete and abstract forms. After modelling the straws to show the process of addition based on the join model, the students should represent it in a math sentence and its standard written form. He also should encourage them to explain the process of making representation and connection.
The students should use pictorial representation to illustrate the process of addition apart from the abstract representations which included math sentence and standard written form. They should identify the connection between the representations.

At the abstract level, the students were expected to read a problem context and solve the related problems which were printed in English in a worksheet.

Findings

Difficulty in Connecting Mathematics to Manipulative and Drawing

During revision of place-value concept using straws, Faith had difficulties in recognizing numbers such as thirteen and thirty. When Mr. Harris said “tiga belas”, she showed a ‘3 tens’ card. Initially, Mr. Harris suspected that she was confused with the number names. Thus, Mr. Harris put two bundles of straws on the table in which each bundle consisted of ten straws. Faith showed a ‘1 ten’ and ‘2 ones’ cards which represented the value of twelve straws. During interview, she explained that she thought of ‘30’ when she heard “tiga belas” but ‘12’ when she saw the two bundles. Obviously, she could make connection between a numeral and the place-value concept. Yet, she represented a set of objects and a number she heard with the wrong numeral in her mind. Mr. Harris explained the correct answer to her directly using straws and the ‘2 tens’ cards as follow-up action. In another case, Faith wrote a two-digit number in standard written form correctly after she saw straws in bundles and units that were shown by her teacher. However, she was often not sure whether she should write a single-digit number at the ones or tens place. Despite given repeated and explicit explanation from Mr. Harris, she still had misconceptions with place-value.

When Mr. Harris asked Faith to write two addends in standard written form and modelled straws to show the process of addition, Faith did the computation before she prepared the straws for the sum. Hence, Mr. Harris asked her to prepare straws for each addend in the next question, and asked her to find the number of straws if she combined the two groups of straws. Without saying anything, she put the two groups of straws together and counted all of them one-by-one. She did not explain the model. When she was asked to write the process in standard written form, she wrote the addends and did the computation one more time. Mr. Harris asked her to explain the process and the abstract representation but she kept quiet. When she was asked whether the straws were the same as what she had written, she gestured to show that she did not know.

Faith also failed to explain the process of addition using drawing when Mr. Harris asked the students to draw a ‘H’ shape to represent a ten and a segment to represent one unit. As she often showed difficulties in performing a task given to her, Mr. Harris gave her explicit and one-to-one instruction in the subsequent tasks. Faith told us that it was difficult to use straws or drawing to model a number and process of addition but simply doing the computation was “easier”. Hence, learning at the concrete and representation levels was not a pleasant experience for her.

Understanding Addition through Concrete Objects and Mathematical Processes

If Faith encountered difficulties in performing a task, Mr. Harris tended to guide her individually through explicit instruction. On the other hand, Mr. Harris always prompted Farib, Nazrah and Hafiz to work out the solution although he also used explicit instruction for
them initially. As he had more confidence for these three students, he supported them to make sense of mathematics. Mr. Harris explained that Faith was not confident and could not perform active thinking. Based on past experiences, if she was required to make sense of a problem, he believed that she would not do anything and thus waste her time of learning. He found that the other students had higher motivation to learn as long as they were supported.

Nazrah and Hafiz encountered difficulties in understanding place-value. When Mr. Harris said “lapan belas”, Nazrah showed a ‘18 ones’ card and eighteen units of straws while her teacher expected her to show ‘1 ten’ and ‘8 ones’ cards, and a bundle plus eight units of straws. To help her understand that, Mr. Harris asked her “Eight plus what equal eighteen?” but she could not recall this basic fact. Hafiz put ‘1’ and ‘9’ cards together instead of overlapping ‘10’ and ‘9’ cards to show ‘19’. Initially, Mr. Harris explained their mistakes explicitly. After these two students made mistakes repeatedly, Mr. Harris changed his instructional technique. He posed the question “How many tens?” to encourage his students reflect on their mistake and thus make correction. This question had brought intended outcome in remediating weakness of Nazrah and Hafiz. According to the students, they tried to work out the number of bundles in every number when they were making sense in finding the solution.

In subsequent task, Mr. Harris expected his students to represent two numbers he read in standard written form, and model the straws to show the process of addition. We observed that Nazrah, Farib and Hafiz prepared the straws based on the answer they had computed on paper. According to Hafiz, his purpose is to ensure that his modelling was done correctly and he did not know how to perform the process. Hence, Mr. Harris insisted that their modelling should demonstrate the process rather than simply the answer of addition. With prompts from Mr. Harris, all the three students were able to prepare two groups of straws in bundles and units, and then combine the straws to show the sum. They also could represent the process in math sentence and standard written form.

Nazrah had shown her ability to make simple connection between ideas of addition and subtraction. To represent ‘12’, Faith took twelve straws but Nazrah took away two and tied the remaining straws as a bundle. Her action showed that she understood the basic fact of ‘12 – 2 = 10’. In another case, Nazrah prepared straws for second addend first before she prepared for the first addend. Mr. Harris insisted that she should prepare straws for the first addend before the second one. Without saying anything, Nazrah continued her modelling and told her teacher the correct answer. Obviously, she understood the commutative property of addition and thus applied it in the activity.

**Difficulty in Representing Addition through Drawing**

Mr. Harris demonstrated an example before his students represented addition by drawing a segment for a straw, and a ‘H’ shape for a bundle of tens straws. He also instructed them to draw a simple place-value box with two columns and two rows. The first column was the tens place for drawing the ‘H’ shapes while the second column was ones place for the segments. The students were required to represent the first addend at the first row and the second addend at the second row. It was difficult for them to represent a number and process of addition by drawing pictures. Nazrah drew five segments while Nasir drew four ‘H’ shapes to represent ‘14’. Mr. Harris asked them to identify the number of ten in a given number. This question stimulated the students to think and thus represent the number correctly using ‘H’ shapes and segments. Successes in engaging students to make sense of mathematics
encouraged Mr. Harris to use prompts in facilitating his students during the activity of drawing and sense-making. Farib, Nazrah and Hafiz could represent processes of addition using drawing and abstract form. Hence, activity at the representation level had helped these students in making connection, transforming representations, and understanding.

**Problem-solving at the Abstract Level**

As all the students were having learning difficulties in Malay language and English, Mr. Harris read and explained the problem context and problems to them. He guided Faith step-by-step explicitly while other students were encouraged to solve the problems themselves. Hence, Farib, Nazrah and Hafiz were busy searching for information from the problem context.

Farib took initiative in the problem-solving process such as noting the Malay Language word for English words that he did not understand. Yet, he often made mistakes as a result of using wrong information. His good mastery of basic addition facts with the sum up to 10 enabled him to find the answer quickly for every math sentence, and also in strengthening his confidence of solving problems. When Mr. Harris asked him to identify and correct his mistakes, he was motivated to perform the task. Strength in his procedural knowledge had helped him in the problem-solving process.

Hafiz always listened attentively to explanation of Mr. Harris and jotted down the meaning of words that he did not understand. Hence, he managed to solve all the problems correctly by his own initiative. During the teaching and learning process, he was usually quiet and did his work individually. Although he disliked talking to his teacher and peers when he was doing mathematics, he would help his peers after he had completed his work. Hence, Mr. Harris allowed his students to participate in an instructional activity following their preferred learning style.

**Discussion**

**Decision Making of Teacher**

Our participating teacher had used a mixed instructional approach during mathematics remediation. An explicit instructional approach was often used to start the remedial intervention activities. It enabled him to give clear instructions as suggested by Joyce et al. (2009). Thus, he reduced misunderstanding and increased motivation of students to carry out their learning tasks. After a simple explanation, he challenged his students to solve problems. Initially, whenever any of the students encountered difficulty, Mr. Harris tended to explicitly re-teach his students steps to correct their mistakes. Yet, after realizing that this approach did not work for his students, he changed to a more indirect approach and offered prompts to support his students. Three of the students obviously showed that they could actually perform simple mathematical process skills. Active learning occurred when an indirect approach was applied in teaching and learning.

However, the indirect instructional approach was not suitable for Faith. According to Gurganus (2007), teachers should identify the individual needs of each student and thus employ an instructional approach which could help the student in learning. Hence, Mr. Harris used one-to-one and explicit instruction for Faith based on his observations on Faith during previous lessons. When she was required to carry out a task, she showed her fear and
reluctance to work. Even if prompts were given, she also failed to relate those prompts with her work and thus did not take any action. Mr. Harris understood that this student was having problem in understanding instruction due to weakness in Malay language, and her character which was more dependent. Hence, he often guided her closely to motivate her in participation.

As a result, the teacher often used two different instructional approaches during the activities based on the responses of his students. A teacher should be clear with the purpose and reason an approach to instruction was chosen when students were required to perform the task themselves. Our participating teacher made his decisions based on an individual student’s characters, cultural background, and past experiences in learning.

Problem-solving and Modelling

When a passive mode of learning occurred, we found that Faith carried out the any task by following instruction given by her teacher. She was not encouraged to make sense of what she was doing. Thus, she was unable to apply the procedures in using manipulative or drawing in another similar situation. Mr. Harris only expected mastery of arithmetic skill and ability to follow his instruction from Faith. As a result of always following instruction and lacking experiences to think actively, Faith became unconfident whenever she was challenged with a new learning task. It also caused her failure in using cognitive strategies to carry out the task. Although there might be concepts and procedures in her mental networks, the two different types of knowledge were not linked through sufficient concrete experiences. Hence, this practice was not supported by Van de Walle (2001) who suggested that students must be helped to build a meaningful link between their procedural knowledge and conceptual understanding.

There was no sufficient evidence that Faith could perform reasoning and transform representations during the problem-solving and modelling activities. As suggested by Slavin (2009), students should be guided rather than directed in hands-on activities. We observed that Faith often sought help from her teacher or simply kept quiet. If she had made a mistake, she would not check and make correction proactively. Based on these observations, we concluded that explicit instruction which is often used in the traditional remedial approach was not suitable for engaging students in active sense-making. Findings of Moscardini (2009) and Ketterlin-Geller et al. (2008) also supported our conclusion.

On the other hand, Nazrah, Hafiz, and Farib were required to work out the learning task during the problem-solving and modelling activities. Mr. Harris justified these students that they had the potential to perform active thinking and become independent learners. Hence, they were often given prompts from their teacher to facilitate their sense-making processes. Their performance during their learning processes suggested that an indirect approach with sufficient questions and prompts (Slavin, 2009; Gurganus, 2007) that could stimulate active thinking was crucial. For example, Nazrah and Hafiz used concrete objects to show connection between a number and the objects, and thus the meaning of that number. All the three students also managed to show the process of addition using manipulative and drawings with prompts from their teacher. At the abstract level, they also initiated the problem-solving process and learning of language although it was limited to listening and recognizing a few words. According to Usiskin (2007), language should be considered by teachers in helping their students recognize the correct model that should be used in a problem-context. During hands-on activities, the students also proved that they could apply their knowledge and
understanding in performing a task. The concrete experiences during the activities at the three different levels helped them to gain sufficient understanding and knowledge to complete their tasks. Apparently, the concepts and procedures were linked up meaningfully because of the meaningful contexts used in problem-solving and modelling activities. The students had improved some of the process skills but there was no sufficient evidence that they had improved their communication skill.

Therefore, problem-solving and modelling could be carried out using either behaviourist or constructivist approach in the mathematics remediation classroom. However, to enable active sense-making process, constructivist approach which emphasized guided participation of students could be more suitable if compared to the behaviourist approach. In the case of Faith, the teacher could slowly motivate her to make sense of mathematics through careful scaffolding rather than explicit instruction. Generally, teachers could gradually employ guided participation rather than rely on explicit instruction to help students make sense of mathematics.

Roles of Concrete-Representation-Abstract Sequence

Concrete objects and drawing were used tools for making explanation and demonstration of mathematical ideas by Mr. Harris. Giving clear instruction using manipulative or drawing could help students to understand expectation from their teacher. Depending on the instructional approach and technique chosen by the teacher, concrete objects and drawing could be used for various purposes during student learning.

Faith used objects and drawing as a tool for counting and representing a number. These tools had helped her to identify her misunderstanding and thus used by Mr. Harris to help her construct a link between the number and concrete objects as recommended by Reys et al. (2009) and Cathcart, Pothier, Vance & Bezuk (2011). After the effort to correct her misunderstanding with numbers, Faith was found lacking sufficient understanding of the process of addition. She could only show the final answer using objects and drawing. To help her understand the process, Mr. Harris gave her explicit instruction to represent addition using objects and drawing. However, she was not required to think actively any strategy to use her cognitive resources in solving problems or modelling. As a result, those objects and drawing were simply tools used by the teacher to explain mathematical ideas.

Initially, Nazrah, Hafiz and Farib also used objects to a number after they had computed the answer. Through guidance from their teacher, they showed the process of addition based on the join model of addition (Reys et al., 2009; Cathcart et al., 2011). If the connection between computation and modelling of the process of addition was not made explicit, the students might not learn meaning and skill of addition as two unrelated components. After these students had built the connection, they were able to justify their answer, and thus translate the answer back to the problem-context.

All the activities in the CRA sequence were related to a problem-context. According to Thompson (1991), students must be given sufficient experiences in manipulating objects before they can use that to build understanding. Mayer and Wittrock (2006) also emphasized that manipulative might increase cognitive load of students if they were not familiar with the manipulative. Apart from sufficient experiences with manipulative and drawing, we found that a meaningful problem-context was helpful in facilitating students to build understanding of the problems. Hence, our findings support the suggestion of Cathcart et al. (2011) and
Reys et al. (2007) that concrete objects and drawing should be used based on a model to stimulate students’ active thinking. Nazrah, Hafiz and Farib had shown the potential of the CRA sequence to be used as tools for sense-making when a problem-context was used in each activity.

**Conclusion**

Students could acquire mathematical knowledge and process skills if their teacher applies an indirect approach to instruction. Prompts and motivation are crucial in supporting them to actively make sense of mathematics. Using CRA sequence in problem-solving and modelling activities could engage students in acquiring mathematical knowledge and process skills if their teacher employs the constructivist approach with prompts and motivation. As students might be used to explicit instruction from their previous experiences, this instructional approach should be incorporated gradually and teachers should be tactful and flexible in selecting a suitable approach for their students. In our research, explicit instruction was unable to involve our participating student in active thinking and mathematical processes. There was no sufficient evidence that she could gain conceptual understanding during the remedial interventions. Hence, her teacher should provide prompts and supports rather than direct instruction on carrying out a task.

In short, to help students with learning difficulties acquire mathematical knowledge and process skills, emphasis on both conceptual and procedural knowledge could be supported by a mixed instructional approach, the CRA sequence, and a meaningful problem-context through problem-solving and modelling activities.

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