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Designing Thought: How Task Commitment Shapes Students' Thinking Structures

Yeni Heryani[1*], Sri Tirto Madawistama[2], Syifa Novianti[3]

Mathematics Education Department, Universitas Siliwangi
Jalan Siliwangi, Tasikmalaya, West Java, Indonesia
[1*]*yeniheryani@unsil.ac.id*; [2]*sritirtomadawistama@unsil.ac.id*; [3]*syifan0301@gmail.com*

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Abstrak

Peserta didik mengalami permasalahan struktur berpikir seperti struktur berpikir yang acak, tidak sistematis, dan tidak logis ketika memecahkan masalah. Salah satu penyebabnya yaitu minimnya komitmen terhadap tugas. Penelitian ini bertujuan mendeskripsikan struktur berpikir peserta didik ditinjau dari tingkat *task commitment* tinggi, sedang dan rendah. Penelitian kualitatif ini menggunakan metode deskriptif. Subjek penelitian sebanyak 3 peserta didik kelas IX SMP Negeri 1 Tambaksari pada Tahun Pelajaran 2022/2023. Instrumen yang digunakan untuk mengumpulkan data terdiri dari penulis, soal tes matematika materi persamaan kuadrat, dan angket task commitment. Analisis data meliputi reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukan peserta didik dengan *task commitment* tinggi yaitu S10T mengalami fragmentasi *mis-analogical thinking*, fragmentasi lubang konstruksi dan fragmentasi lubang koneksi. Peserta didik dengan *task commitment* sedang yaitu S06S mengalami fragmentasi *mis-analogical thinking* dan fragmentasi lubang koneksi. Peserta didik dengan *task commitment* rendah yaitu S01R mengalami fragmentasi *mis-analogical thinking* dan fragmentasi lubang konstruksi.
Kata Kunci: Struktur berpikir; kualitatif; task commitment

Abstract

Students experience problems with thinking structures such as random, unsystematic and illogical thinking structures when solving problems. One of the causes is the lack of commitment to the task. This study aims to describe students' thinking structures in terms of high, medium, and low levels of task commitment. This study is a type of qualitative research with a descriptive method. The subjects of this study were 3 ninth grade students of SMP Negeri 1 Tambaksari in the 2022/2023 Academic Year. The instruments used to collect data consisted of the author, mathematics test questions on quadratic equations, and task commitment questionnaires. Data analysis was carried out by data reduction, data presentation, and drawing conclusions. The conclusion from the results of this study is that students with high task commitment, namely S10T, experience fragmentation of mis-analogical thinking, fragmentation of construction holes, and fragmentation of connection holes. Students with moderate task commitment, namely S06S, experience fragmentation of mis-analogical thinking and fragmentation of connection holes. Students with low task commitment, namely S01R, experience fragmentation of mis-analogical thinking and fragmentation of construction holes.
Keywords: Task commitment; qualitative; thinking structure

I. INTRODUCTION

The interesting thing in the mathematics learning process is how students build mathematical concepts and can build knowledge by connecting one concept with another (Subanji, 2021). In the process of learning mathematics, students experience a thinking process. The term thinking is often used to remember something; in other words, the thinking process is a complex process that occurs in a person's mind when he thinks about something (Paristiowati et al., 2019; Halini et al., 2023) This is in line with the basic objectives of mathematics learning, where students are expected to have the ability to solve problems (National Council of Teachers of Mathematics, 2000; Sinaga, Sitorus, & Situmeang, 2023).

Sukariasih et al. (2020) emphasized that problem-solving skills help students develop the ability to solve real-world problems. They also noted that this process influences the way students construct their thinking and knowledge. Sari and Untarti (2021) also stated that the thinking process in solving mathematical problems is influenced by several factors, both direct and indirect. However, more influential factors are indirect factors such as motivation and personal abilities. This causes differences in points of view or opinions in solving problems. In the thinking process, students will be actively involved with thinking structures that support them in reasoning about the problems given. For this reason, it is important to examine what kind of thinking structures students have.

Based on this, students propose solutions to context-based problems. The thinking process begins with receiving, processing, and storing data in memory to remember it when needed. This process is determined by the capacity of the thinking structure carried out in solving the problems presented (Wulandari & Gusteti, 2021; Artasari et al., 2024). Thus, the thinking structure is a representation of the thinking process, namely, the problem-solving workflow carried out by someone in solving problems. Based on the results of initial interviews conducted by researchers with mathematics teachers at SMP Negeri 1 Tambaksari, information was obtained that several students had symptoms of fragmentation of thinking structures, which were characterized by frequent fragmentation of thinking when solving mathematical problems, and the answers written by students were often still irregular. Fragmentation of students' thinking structures is most visible when students are given practice questions. In completing these tasks, students often experience fragmentation in developing problem-solving strategies. Not only that, the mathematics teacher at SMP Negeri 1 Tambaksari said that the symptoms of fragmentation of thinking structures also occurred due to differences in the level of task commitment possessed by students so that when given practice questions, students felt unfamiliar and under-trained.

This is in line with the results of research conducted by Bahrudin, Indrawatiningsih, and Nazizah (2019) entitled "Defragmenting the Thinking Structure of Middle School Students in Solving Flat Figure Problems". Based on the research results, it was found that the fragmentation of students' concept construction in solving

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problems was fragmentation of logical thinking and construction holes. Defragmentation is carried out by researchers by providing cognitive conflict to repair the fragmentation of logical thinking and bring up schemes that have not yet been built through scaffolding to overcome construction holes that occur in the student's structure. Azizah (2023) analyzed the defragmentation of students' thinking structures in solving geometric mathematical problems on the Pythagorean theorem material. The results showed that students with high Field Independent (FI) cognitive styles experienced fragmentation in the form of hole construction, pseudo construction, and mislogical construction. Defragmentation of the thinking structure is carried out through a deeper understanding of the concept. Research by Rohmah and Rahma (2023) examined the defragmentation of students' thinking structures with high and low Field Independent (FI) cognitive styles in solving geometric mathematics problems. The results showed that high FI students experienced fragmentation in the form of hole constructions, pseudo-constructions, and mislogical constructions. Defragmentation was carried out through interventions such as disequilibration, cognitive conflict, and scaffolding in understanding problems, planning problem-solving strategies, and reviewing problem solving. Meanwhile, low FI students experienced fragmentation in the form of construction holes and pseudo-constructions, with defragmentation through similar but more intensive interventions. Nasrullah (2022) examined the structure of students' mathematical thinking in solving context-based problems. The results showed that students used their mathematical content knowledge to recognize the mathematical nature of a situation, then carried out transformations using mathematical concepts, algorithms, and procedures taught in schools. However, students' reflective thinking skills still need to be improved to support strategic decision making.

Thinking is a mental process where a person uses his mind and brain to gain knowledge (Hasanuddin, 2021). Thinking can be interpreted as a mental activity that can produce knowledge. Simanjuntak et al. (2021) Thinking is a mental activity which involves generating and organizing ideas to understand a problem and develop a solution strategy. According to Prajono et al. (2022), thinking is the ability to remember and stimulate brain activity related to memory and make decisions related to certain problems. Based on the results of the synthesis analysis, it can be concluded that thinking is a mental process where a person uses his mind and brain to reflect, analyze, organize ideas, evaluate information, and solve problems that occur in the surrounding environment.

The thinking activity carried out to be able to solve mathematical problems is a demand for activities or processes, so it can be called a thinking process (Herawati, Hidayati, & Iffah, 2023; Luritawaty & Rahmawati, 2024). The thinking process involves the structure of students' thinking, where the cognitive units of the thinking structure work together with other related

ideas at the same time (Nurmawanti & Sulandra, 2020). This process then forms the structure of students' thinking, where the structure of thinking in solving mathematical problems is a cognitive structure that is formed when students solve problems. Marras (2020) Cognitive structure refers to the internal framework of mental representations and their interconnections. It determines how learners perceive, process, and organize knowledge. Weed emphasizes that analysis of both of these processes is needed to provide an adequate account of stable objects, causes, and how the mind uses mental data. According to Supriyati & Muqorobin (2021), the structure of thinking is an internal picture of students' mental activities that reflect the process of solving mathematical problems. According to Piaget, the structure of thinking is a combination of schemes (cognitive structures) contained in the minds of students (Subanji, 2021). Based on the results of the synthesis analysis, it can be concluded that the structure of thinking refers to the organization or arrangement of schemes or cognitive structures contained in the minds of individuals.

Task commitment or commitment to a task is an important affective characteristic in learning. In mathematics learning, there are several ways to hone students' cognitive abilities, including enriching students with various types of tasks. These tasks can range from simple practice tasks to complex tasks. According to Renzulli in Zay & Kurniasih (2023), Task commitment or commitment to a task is a subtle form of motivation. In line with the opinion put forward by Mufidah et al. (2022) This study found that task commitment is positively related to learning outcomes. Students with high task commitment show resilience and perseverance and do not get bored easily in solving problems, exercises, and assignments. Task commitment is also a form of intrinsic motivation that encourages students to complete school assignments. Therefore, tasks must be made to build understanding, not just to be completed. Measuring success in mathematics learning is not only seen from the results of completing tasks but also needs to reflect the process of self-management and the structure of students' thinking during the completion of the task. Thus, a high task commitment or commitment to tasks is needed in mathematics learning.

According to Renzulli in Zay & Kurniasih (2023), there are three main elements in talent, namely above-average ability, commitment to tasks (task commitment), and creativity. These three elements must be present and interact with each other to achieve a high level of productivity. According to Callahan in Zay & Kurniasih (2023), task commitment is the willingness to focus extraordinary time and energy to solve problems, achieve superior performance, or create unique results. Task commitment, according to Ahmadian (2012), is a trigger factor within oneself that encourages someone to be diligent and persistent in carrying out the tasks that have become their responsibility, even though they face various obstacles. In this case, the expected commitment is not just a promise but a real action in completing the task. The definition of commitment is a promise that sometimes requires self-

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sacrifice and a lot of time to achieve. There are three types of commitment according to Finch et al. (2015), namely affective commitment, continuous commitment, and normative commitment. These three commitments have the same meaning, namely, the desire within oneself to settle on a certain goal.

Task commitment is often associated with strong motivation to achieve goals. According to Renzulli in Kurniasih (2019), motivation is the process of giving strength that triggers a response in an organism, while task commitment is the strength that is brought to a specific task or problem. This opinion is reinforced by Foster in Zay & Kurniasih (2023), who state that motivation can affect student participation in class, task commitment, and the amount of pleasure they get from learning.

From several descriptions, researchers realize that task commitment possessed by students can be one of the factors that support the defragmentation of thinking structures. This is also in line with Hujodo's opinion (Zay & Kurniasih, 2023) that in learning mathematics, there is a thinking process because someone is said to be thinking if he does mental activities. In the learning process, the teacher provides mathematics teaching materials, and then students are asked to do assignments to find out the extent of students' understanding of the material being taught. Wahyuni, Haryaka, & Azainil (2022) found that there was a positive influence of task commitment on problem solving and showed that there were problematic parts of the cognitive structure.

This research aims to describe students' thinking structures in terms of high, medium, and low levels of task commitment. This research has never been carried out by other authors because the review of the thinking structure is also different from previous research, and the review of the affective aspects is also different. Previous studies determined brain dominance. Like Wahyuningsih's research (2023), which analyzed the structure of students' thinking in learning mathematics from the perspective of brain dominance.

II. METHOD

This research uses a qualitative approach with a descriptive analysis method. According to (Sugiyono, 2019) qualitative research is often called naturalistic research because the research is conducted in natural conditions (natural settings) and the research is conducted on natural objects, natural objects are objects that develop as they are, are not manipulated by researchers and the presence of researchers does not affect the dynamics of the object. This study provides an overview of the defragmentation of students' thinking structures in solving problems on quadratic equation material in terms of task commitment. This research was conducted at SMP Negeri 1 Tambaksari, with the research subjects being 3 students from class IX-A of SMP Negeri 1 Tambaksari for the 2022/2023 academic year for two weeks. According to Nurmala (2022), the data collection process in research can use certain techniques, such as distributing

questionnaires, interviews, and observations. Referring to this statement, the researcher determined the data collection process that would be used in this study by providing several instruments such as task commitment questionnaires, quadratic equation material test questions, and interviews. The student assignment commitment questionnaire was prepared based on the concept of a grid-shaped measuring tool from theoretical studies and was developed into 30 questions, which included indicators of perseverance, resilience, self-confidence, dedication to training, and interest, each consisting of 6 statements. The mathematics test questions created were questions on the quadratic equation material, which included HOTS level analysis (C4) indicators as many as 1 question. Improvement of validation results, namely There are slight errors in the questions and the instrument needs to be revised. The language editorial needs to be improved and synchronized between the questions and the results in the answer key. The data collection technique in this study also used the think-aloud technique, which was carried out when the subject was working on the quadratic equation material test questions. Nazari & Hatami (2023) Written Think-Aloud (WTA) strategy inspired by the think-aloud strategy. This strategy involves writing down students' thoughts while solving math problems, which helps reveal their thinking processes and improves math performance. The selection of research subjects was carried out purposively with the consideration that students had a high, medium, or low task commitment category and had worked on the quadratic equation material mathematics test questions, but there were errors in their work. Other considerations were the willingness of students to be research subjects and good communication skills so that researchers could obtain the information needed for the study optimally. After students fill out the task commitment questionnaire, the data results are converted into 3 categories, namely high, medium, and low, using the criteria in Table 1.

Table 1.
Data Conversion Criteria

Interval	*Category*
$X \geq \bar{X} + 0{,}5s$	*High*
$\bar{X} - 0{,}5s \leq X < \bar{X} + 0{,}5s$	*Medium*
$X < \bar{X} - 0{,}5s$	*Low*

(Zay & Kurniasih, 2023)

Students with high task commitment are obtained with subject code S10T, medium S06T and low S01R.The process of analyzing answers was carried out by providing defragmenting, namely scanning, checking some errors, repairing, giving a chance to rework, and certain the result. At the repairing stage, interviews were conducted as a process to rearrange the structure of students' thinking through disequilibration, cognitive conflict, and scaffolding. After that, students were allowed to correct their mistakes until finally it could be ascertained that the corrected answers were correct.

III. RESULT AND DISCUSSION

Based on the results of the answers to the test questions and the task commitment questionnaire worked on by the students, the location of the fragmentation of the thinking structure experienced in working on the

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mathematics test questions was examined. The fragmentation experienced was overcome by 4 types of defragmenting of the thinking structure according to (Wardhani et al., 2016), namely defragmentation of the emergence of schemes, defragmentation of the knitting of schemes, defragmentation of the improvement of analogical thinking structures, and defragmentation of the improvement of logical thinking structures. Before conducting an analysis related to the initial thinking structure of the research subjects, the researcher compiled an ideal thinking structure that was appropriate for answering the given mathematics problems. This ideal thinking structure was then used as a reference when the defragmenting process was carried out and aimed to improve the subject's thinking structure so that it became complete and organized according to the thinking structure for solving the instrument given.

Defragmenting process The thinking structure of students who have high task commitment (S10T) begins with analyzing the results of the answers to the math test questions given. The results of the S10T answers are presented in the Figure 1.

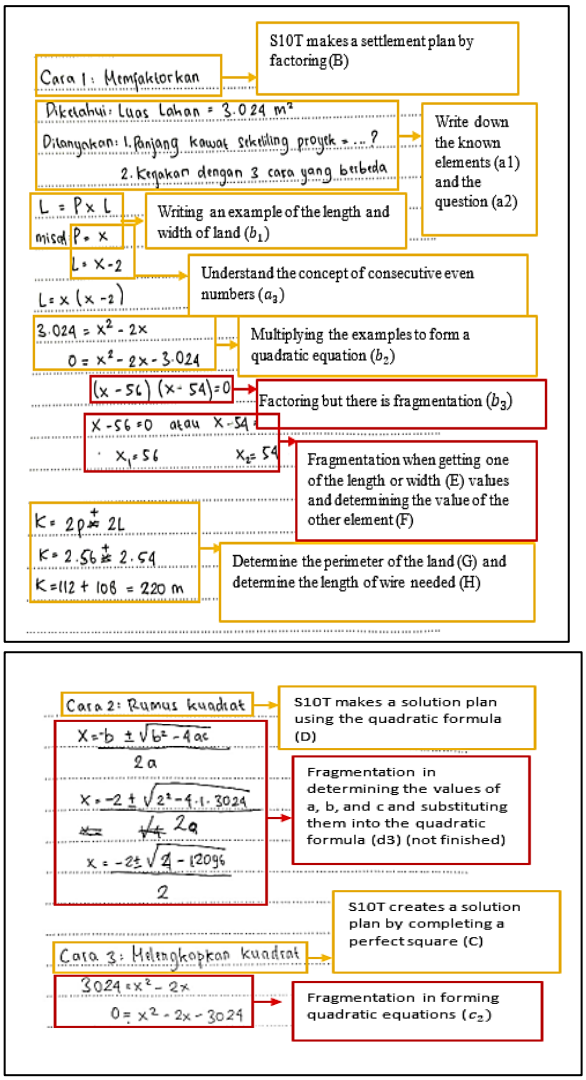

Figure 1. S10T's Answer Results with Fragmentation of Thinking Structure

Based on the analysis of answers to the given mathematical problems and interviews, S10T experienced fragmentation of mis-analogical thinking when determining the roots of the quadratic equation and experienced fragmentation of connection holes because he already knew the final answer to the given question but was not yet able to connect the formulas and known elements to become a well-organized answer. However, S10T still tried to work on the questions according to the instructions by trying various possible ways to get the

answer. This is also in line with the opinion of Papalia et al. (2009) who stated that students who have high task commitment will be encouraged to be diligent and persistent in doing their assignments even though they experience various obstacles or barriers. According to Pratiwi (2022), the higher the task commitment, the higher the learning achievement. The picture of S10T's initial thinking structure is presented in Figure 2.

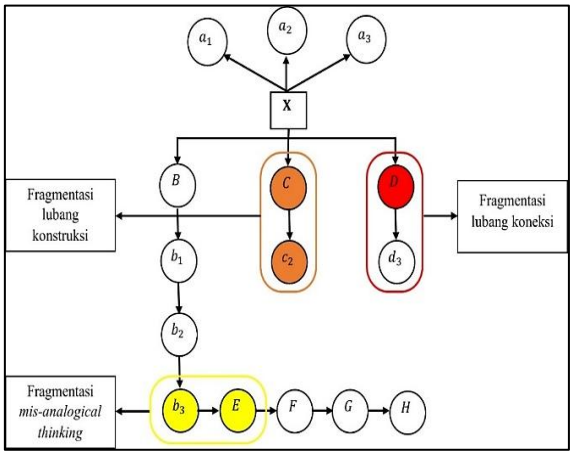

Figure 2. Initial Thinking Structure of S10T

The results of the S06S answers are presented in the Figure 3.

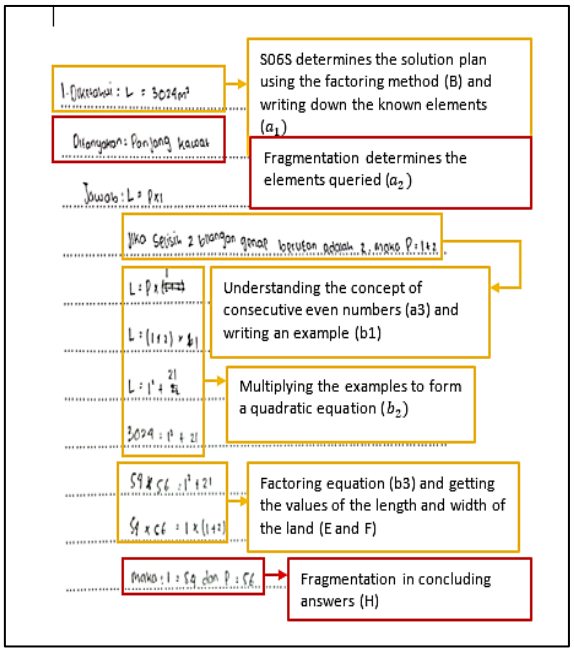

Figure 3. S06S Answer Results with Fragmentation of Thinking Structure

Based on the analysis of answers to the given mathematical problems and interviews, S06S experienced fragmented mis-analogical thinking because S06S considered that his work was finished when the length and width of the land were found, while the final goal asked was the length of the wire needed to surround the land area or more precisely the circumference of the land. In addition to experiencing mis-analogical thinking, S06S also experienced fragmented connection holes because S06S was able to understand the steps to solve the problem using the method of completing perfect squares and quadratic formulas, but S06S was not yet able to link each step and express it in writing. An overview of S06S's initial thinking structure is presented in the Figure 4.

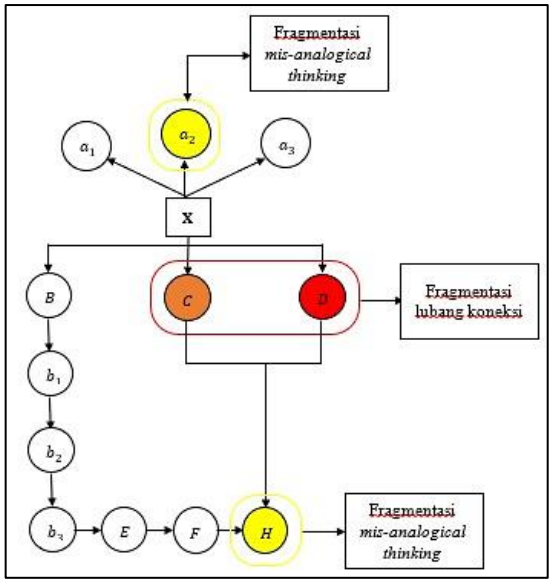

Figure 4. Initial Thinking Structure

To overcome this, 5 defragmentings were carried out. Defragmenting 1 was given as an intervention by directing the subject to a disequilibration condition so that the subject tried to recheck his answers and find the location of the error. Defragmenting 2 was given by providing

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disequilibration to find out the problem-solving plan and scaffolding by asking S06S to draw an illustration of the land. This is following Anghileri (2006) that scaffolding can be done by encouraging students to look at pictures. Defragmenting 3 was given with an intervention in the form of disequilibration so that S06S could reveal the location of the difficulty and dig deeper into his knowledge. Defragmenting 4 was given with an intervention in the form of scaffolding so that S06S was able to link the knowledge he had with the problem to be solved. Defragmenting 5 was done by providing disequilibration so that S06S could compile a solution plan using the quadratic formula method and scaffolding to provide a way for S06S to further explore the knowledge he had. As expressed by Wills (2008) and Derntl (2009), scaffolding is defined as sufficient assistance to students to solve problems themselves. In the process of solving the problem, S06S worked diligently but still often felt difficulty and lacked confidence. However, S06S was finally able to solve the problems given because he had a high interest and dedication to the questions given.

In subjects with low task commitment (S01R), the defragmenting process begins by analyzing the results of the answers to the math test questions given. The results of the S01R answers are presented in the Figure 5.

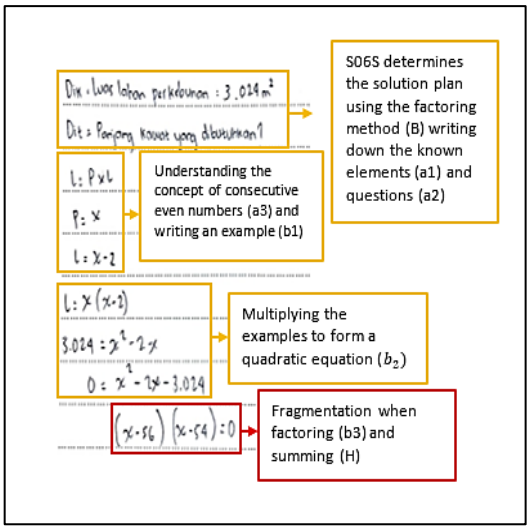

Figure 5. S01S Answer Results with Fragmentation of Thinking Structure

Based on the analysis of answers to the given mathematical problems and interviews, S01R is indicated to have experienced fragmented mis-analogical thinking because he felt that his work was finished when the subject succeeded in finding the length and width of the land while in the question he was instructed to determine the length of the wire to limit the land area (circumference). S01R only used one solution method out of the three alternative solutions requested and was not able to complete his work to find a conclusion. An overview of S01R's initial thinking structure is presented in the Figure 6.

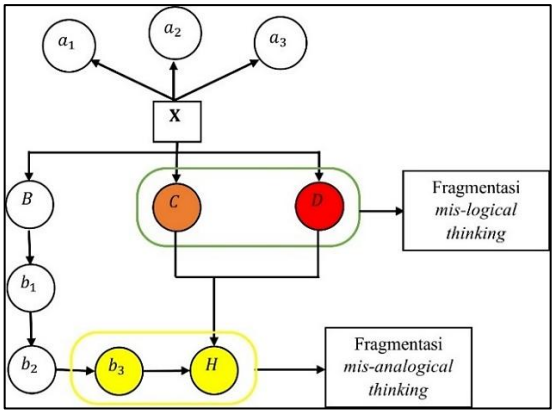

Figure 6. Initial Thinking Structure S01R

To overcome this, a restructuring of the thinking structure was carried out with 4 defragmenting. Defragmenting 1 began with disequilibration to make S01R rethink his answer and was given further intervention in the form of scaffolding to find information in the question and disequilibration related to the stages of working on good math problems. Defragmenting 2 was given with an intervention in the form of scaffolding to overcome problems in compiling a plan to determine the length of the wire using the factoring method. Defragmenting 3 was given with an intervention in the form of disequilibration and scaffolding so that S01R could re-understand the problem given and relate the problem to concepts that had been previously studied. Following Wardhani et al. (2016), scaffolding can be done by asking questions that can cause disequilibration. Defragmenting 4 was given to re-arrange S01R's thinking structure in solving math problems using the quadratic formula method. The intervention given was in the form of disequilibration and provoked cognitive conflict. After that, S01R was given confirmation and sufficient assistance through scaffolding so that S01R could recall the general form of the quadratic equation and relate it to the answers found. In solving the problems given, S01R was able to work on them diligently. S01R was also able to remember the material taught well. However, S01R still often felt insecure and lacked interest in working on math problems. This was evident when solving the problems given S01R paid less attention to the stages of good math work. An interesting finding in this study is that S01R already had good knowledge of the quadratic equation material, but because he had little interest and confidence, it made S01R's thinking structure less well-organized.

A limitation of this research is that it is difficult to isolate variables that specifically contribute to the development of thinking structures. Research conducted in a limited time may not be able to capture changes in students' thinking patterns in the long term. It is not always easy to show a direct relationship between students' thinking structures and their academic outcomes.

IV. CONCLUSION

The results of this research show that students with high task commitment, namely S10T, experience fragmentation of mis-analogical thinking, fragmentation of construction holes, and fragmentation of connection holes. Students with moderate task commitment, namely S06S, experience fragmentation of mis-analogical thinking and fragmentation of connection holes. Students with low task commitment, namely S01R, experience fragmentation of mis-analogical thinking and fragmentation of construction holes. The results of this study can be used as a basis for designing motivation-based and commitment-based learning approaches, such as the application of scaffolding, contextual problem solving, and metacognitive strategies. Teachers can develop approaches that facilitate students to maintain high task commitment, thus having an impact on improving high-level thinking skills.This article shows a significant change in the structure of students' thinking so that this

defragmenting process can be recommended as an alternative solution to overcome students' thinking errors in solving mathematical problems. The process of providing defragmenting can also be studied according to other factors such as cognitive style so that errors in the structure of thinking and the defragmenting process carried out on different cognitive characters can be seen.

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AUTHOR'S BIOGRAPHY

Yeni Heryani, M.Pd.

Born in Kuningan, November 9, 1980. Lecturer in Mathematics Education Study Program, Siliwangi University. Bachelor's degree in Mathematics Education, Siliwangi University, Tasikmalaya, graduated in 2003; Master's degree in Mathematics Education, Universitas Terbuka (UT), Bandung, graduated in 2014.

Dr. Sri Tirto Madawistama,M.Pd.

Born in Tasikmalaya, November 16, 1980. Lecturer in Mathematics Education Study Program, Siliwangi University. Bachelor's degree in Mathematics Education, Siliwangi University, Tasikmalaya, graduated in 2003; Master's degree in Educational Management, Galuh University, Ciamis, graduated in 2011. Doctorate in Mathematics Education, Universitas Pendidikan Indonesia (UPI), Bandung, graduated in 2019.

Syifa Novianti, S.Pd.

Born in Sukabumi, March 25, 2001. Alumni of S1 Mathematics Education, Siliwangi University, Tasikmalaya, graduated in 2024.