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Students' Computational Thinking Process in Solving PISA Problems of Change and Relationship Content Reviewed from Students' Self Efficacy

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abstract

This research focuses on the stages of students' computational thinking processes in solving PISA questions about change and relationship content in terms of self-efficacy. The subjects of this study were 15-year-old students of class X MIPA 3 MAN 1 Semarang City, totaling 22 students and selected 2 students who had high self-efficacy, 2 students who had moderate self-efficacy and 2 students who had low self-efficacy. This research method uses a qualitative descriptive approach. Data collection using questionnaires, test instruments and interviews. Data analysis in this study included data collection, data reduction presented in text form and drawing conclusions or verification. The results of the study show that students' computational thinking processes in solving PISA questions about change and relationship content that have high self-efficacy can reach the stages of decomposition, pattern recognition, abstraction and algorithmic thinking as well as students' thought processes in carrying out plans can link real problems into mathematical problems. Whereas students who have self-efficacy are reaching the stages of decomposition, pattern recognition, abstraction and algorithmic thinking and in carrying out plans do not connect real problems to mathematical problems but use logic. Whereas students who have low self-efficacy only reach the stages of decomposition and pattern recognition have not done abstraction and algorithmic thinking because students' thinking processes in carrying out plans use logic and in solving these problems do not provide conclusions of answers and logical steps.

Keywords:
Computational thinking, PISA, Change and Relationship, Self Efficacy

INTRODUCTION

The Industrial Revolution 4.0 has had a huge impact on the human economy, both in the industrial sector and the education system in Indonesia. This progress is supported by advances in technology, especially communication science which has spawned various innovations (Nuraisa et al. 2019). To welcome the industrial revolution 4.0, education as the front guard must be able to contribute to changes in human civilization. Therefore, education must be able to develop the skills needed by society in the era of the industrial revolution 4.0. One of the skills that must be developed is computational thinking skills (Veronica et al., 2022).

Computational thinking is a series of abstract mental activities that include reasoning processes, such as abstraction, decomposition, pattern mapping, pattern recognition, algorithmic thinking, automation, modeling, simulation, evaluation, testing, and generalization (Città et al. 2019). In mathematics, computational thinking is a type of high order thinking skill (HOTS) that helps facilitate problem solving and improves students' mathematical performance (OECD, 2013). One of the ways to develop computational thinking is by providing non-routine questions. By giving non-routine questions, it aims to train students to get used to solving problems using computational thinking skills. In terms of mathematical content, computational thinking is included in the 2021 PISA assessment. In the discussion of all sub-content of mathematics (quantity, uncertainty and data, change and relationships, as well as space and shape) (OECD, 2018). Computational thinking is expected to be applied in the education curriculum to improve science and mathematics skills in PISA (Program for International Student Assessment).

PISA organized by the Organization for Economic Co-operation and Development (OECD) is a study to evaluate the education system followed by more than 70 countries around the world including Indonesia. The general objective of PISA is to assess the extent to which students of participating countries have attained a level of proficiency appropriate to make major contributions in reading, mathematics, and science to their society (Rahmatia, 2021). Indonesia is one of the countries that has participated since the beginning of the implementation of PISA. However, the PISA results achieved by Indonesian students are still not satisfactory.

Indonesia's gains in PISA are still not satisfactory. This can be seen from the PISA results from 2000 to 2018 showing that Indonesia in the field of mathematics, the score obtained is below the average score of OECD countries, namely 500. The PISA results show that Indonesian student achievement is always ranked quite low. The low results of PISA Indonesia identify that Indonesian students are not yet able to understand concepts and apply knowledge to solve problems in real life contexts (Amalia et al. 2018).

The PISA math questions to be used in this study are change and relationship content. This part of the problem focuses on the mathematical content contained in the applicable curriculum, namely functions and algebra (OECD dalam Rahmatia, 2021). Fadillah & Ni'mah (2019) stated problems in the PISA questions about change and relationship content, students who could not solve the problem as much as 55.50% of the total research subjects. The results of the 2018 PISA study questions that are difficult for students to understand in Indonesia are the content of change and relationship compared to quantity, space and shape, and uncertainty (Fadillah & Ni'mah, 2019). The difficulties experienced by students are in the form of difficulties in understanding problems, linking real-life aspects to mathematical models, performing mathematical operations, and interpreting the results of solving mathematics to real world problems (Nuryanti et al. 2018). The difficulties students face in solving complex math problems or questions that are not routine in order to be able to solve them require self-efficacy (Sumliyah et al., 2020). This is in line with Samsuddin (2019) which states that what influences students in solving PISA questions is self-confidence in their abilities or self-efficacy.

Self-efficacy is a belief in one's abilities, factors that influence one's performance in achieving a goal, and one's actions in dealing with a problem (Novianti et al., 2018). Thus self-efficacy becomes an important prerequisite for students in working on PISA. Self efficacy serves as a predictor in the success of solving mathematical problems. Therefore, students' lack of confidence in their own abilities results in their inability to solve problems or solve them correctly (Kusmaryono, 2018). Based on data from 40 countries in PISA 2003, showing the strongest correlation with consistent test performance is self-efficacy. The above problems are the main attraction for researchers to conduct research that aims to describe students' computational thinking processes in solving PISA content change and relationship questions in terms of self-efficacy.

Previous research related to computational thinking processes has been investigated by several researchers. First, research conducted by Supiarmo et al. (2021) showed that in solving PISA questions about change and relationship content, there was no significant difference in the computational thinking abilities of students who had high and moderate levels of self-regular learning, because students' computational thinking skills were limited to the pattern recognition stage. The problem solving steps applied by students are less coherent because abstraction and thinking algorithms have not been carried out in solving the PISA questions. This is caused by errors and incomplete and systematic settlement steps.

Second, research conducted by Lestari & Annizar (2020) shows that in the process of working on a test instrument in the form of PISA questions, based on the informational aspects of subjects who have high computational thinking skills, the indicators are clear, precise, and relevant. In addition, the subject fulfills appropriate and relevant indicators based on aspects of concepts and ideas. Whereas the point of view aspect fulfills clear and broad indicators, but in the inference aspect the subject only fulfills logical indicators.

Third, research conducted by Rahmadhani & Mariani (2021) shows that Digital PjBL is effective on students' computational abilities in solving junior high school mathematics problems. The description of students' computational abilities in solving junior high school mathematics problems through Digital PjBL in terms of self-efficacy, namely students' computational abilities in solving mathematical problems with high self-efficacy fulfills the four computational indicators of students in solving mathematical problems. Students' computational abilities in solving mathematical problems with moderate self-efficacy fulfill the three indicators of students' computational abilities in solving mathematical problems. Students' computational abilities in solving mathematical problems with low self-efficacy meet the two indicators of students' computational abilities in solving mathematical problems.

The difference between the previous research and the research that will be carried out lies in the objects and subjects studied which will affect the results of the research. This study aims to analyze students' computational thinking processes in solving PISA questions about change and relationship content in terms of self-efficacy. It is hoped that this research can provide reinforcement of the weaknesses of previous studies.

LITERATURE REVIEW

Computational Thingking

Computational thinking is a thinking process that involves solving problems based on known data so that the solution can be represented as a logical, efficient and effective step. Wing (in Supiarmo et al., 2021) states that there are four indicators of computational thinking, including decomposition, pattern recognition, abstraction and algorithmic thinking which are described as follows

Tabel 1
Characteristics of Computational Thinking Students

No.	Computational Thinking Indicator	Indicator Characteristics
1.	Decomposition	Students are able to identify the information needed/what is known from the problems given.
		Students are able to identify what is being asked based on information from the problems given.
2.	Pattern recognition	Students are able to recognize patterns or characteristics that are the same/different in the problems given to build solutions.
3.	Abstraction	Students can determine conclusions by eliminating elements that are not needed when implementing a problem solving plan.
4.	Algorithmic thinking	Students are able to mention the logical steps used to compile a solution to a given problem.

Source: (Supiarmo et atl., 2021)

Self efficacy

Self-efficacy is a belief in one's self in the ability one has in carrying out an action to achieve a predetermined goal, being able to influence situations well, and being able to overcome an obstacle. The dimensions of self-efficacy according to Bandura (in Hasanah et al. 2019) namely the level of difficulty (level), generality (generality), strength (strength). The dimension of level of difficulty (level) relates to the degree of difficulty of the task at which a person feels able or unable to deal with problems, then the dimension of generality relates to one's belief in one's ability to perform actions in various fields, while the dimension of strength (strength) related to the level of strength of a person's belief about the ability possessed when facing difficulties experienced.

METHODS

This research is a qualitative research using descriptive analysis. The main focus of this research is to describe students' computational thinking processes in solving PISA questions about change and relationship content in terms of self-efficacy. This research was conducted in one of the Aliyah madrasas in Semarang City, Central Java. This research was conducted on students who have the age criteria of 15 years according to the OECD criteria. The research subjects were selected using purposive sampling technique.

Data collection techniques in this study include questionnaires, tests, and interviews. The self-efficacy questionnaire contains 15 statement items consisting of positive statements and negative statements with details of 8 positive items and 7 negative items and includes indicators of self-efficacy namely level, strength, and generality. In the self-efficacy questionnaire instrument, there are 9 indicators that become components of student self-efficacy to categorize student self-efficacy into 3 categories, namely high, medium and low self-efficacy. The following self-efficacy grid is shown in table 2 below.

Tabel 2.
Student Self Efficacy Questionnaire Grid

Dimension	Indicator	Positive	Negative	Number of Items
Level	1. Do math tasks from easy to difficult	1	-	1
	2. Able to complete tasks even though they have not been taught or have not been understood.	-	3	1
	3. Viewing a difficult task as a challenge	2,6	4,5	4
Strength	4. Commitment in completing the assigned tasks	7	8,10	3
	5. Have good motivation towards himself	9	-	1
	6. Respond to different situations well and be positive	-	11	1
Generality	7. Consistent in tasks and activities	12	-	1
	8. Making experience to increase confidence in achieving success	14	13	2
	9. Be prepared to deal effectively with situations	15	-	1
Total item	8	7	15	

The next instrument is the Computational Thinking test. The test in this study used PISA questions with change and relationship content to describe students' computational thinking processes. The questions consisted of 4 2012 PISA questions with change and relationship content. Students are expected to be able to solve open-ended problems using logical and systematic computational thinking processes in solving these problems.

Table 3.
Computational thinking questions grid

Subject	PISA level	Question indicator	Computational Thinking Indicator	Question Number	Question Form
Conten *change and relationship*	3	Determine the height of the third tower from the problem of 3 towers with different heights.	Decomposition, pattern recognition, abstraction, algorithmic thinking	Descri ption	1
	2	Identify relevant information for simple mathematical models to calculate numbers.	Decomposition, pattern recognition, abstraction, algorithmic thinking	Descri ption	2
	5	Calculates start time for a trip given two	Decomposition, pattern recognition,	Descri ption	3

		different speeds, total distance to travel and finish time	abstraction, algorithm thinking		
	4	Solve real-world situations involving cost savings and fuel consumption.	Decomposition, pattern recognition, abstraction, algorithmic thinking	Description	4

The next data collection technique is interviews. The interviews conducted by the researchers were structured in a semi-structured manner. If during the interview there are conditions beyond those that have been procedured, the researcher can develop interview questions. Research subjects were asked questions to describe computational thinking processes. Subjects can give their opinions and ideas related to the problems given to get more in-depth information. Computational thinking indicators contained in the questions asked. In the informant selection technique, the researcher chooses to interview someone who is the key to the research and related stakeholders.

The data analysis technique in this study refers to Miles and Huberman, where activities in qualitative data analysis are carried out interactively and continuously until completion, so that the data is saturated. Activities in data analysis include data collection, data reduction, data presentation, and drawing conclusions. First, data collection begins with self-efficacy questionnaires, computational thinking tests, and interviews. All these types of data have one key aspect in common, the analysis mainly depends on the integrative and interpretive skills of the researcher. Second, data reduction. The procedure of selecting, streamlining, abstracting, and changing the raw data recorded by the researcher is called data reduction. The data reduction stage is processing the self-efficacy questionnaire data, which is then divided into 3 groups. The results of the assessment of computational thinking processes to classify students who will be used as research subjects, the findings of the assessment of students' computational thinking processes and self-efficacy questionnaires will be used as research objects converted into notes as interview material. The results of the interviews were compiled and clarified in clear and easy-to-understand language before being processed into ready-to-use data. Third, the presentation of data. Presentation of data is done when researchers compile information, then researchers can draw conclusions based on the appearance of the data. The data presented in this study are the results of self-efficacy questionnaires and computational thinking tests using PISA content change and relationship questions. Fourth, drawing conclusions. At this stage the researcher draws conclusions from the data that has been obtained. The results obtained in the entire analysis process were then concluded in an analytical descriptive manner by looking at the data obtained during the research process.

RESULT AND DISCUSSION

This research was conducted on 11-13 February 2023 at an Aliyah madrasah in Semarang, Central Java. The initial step of this research was conducted on 22 students and then selected by purposive sampling. The categories of student self-efficacy are presented in table 4.

Table 4
Student Self Efficacy Category

Category	High Self Efficacy	Moderate Self Efficacy	Low Self Efficacy
The number of students	2	16	4

Then, based on filling out the self-efficacy questionnaire, 6 students were obtained who fulfilled the research subject. The subjects of this study were 3 students consisting of 1 subject with high self-efficacy, 1 subject with moderate self-efficacy and 1 subject with low self-efficacy, coded as follows.

Table 5
Results of Selection of Research Subjects

No	**Student code**	**amount**	**Self Efficacy Category**	**Subject**
1	S21	55	High	S01
2	S08	46	Moderate	S03
3	S16	37	Low	S05

The data in this study were in the form of questionnaires, answers and interview results. Through these three data, the subject's computational thinking process will be seen based on indicators of computational thinking processes, namely decomposition, pattern recognition, abstraction, and algorithmic thinking. Then the results of the analysis of the data are used to determine the subject's computational thinking process.

The following is the result of S01's computational thinking processes with high self efficacy S01answer in solving question number one, namely the 2012 PISA question, change and relationship content at level 3.

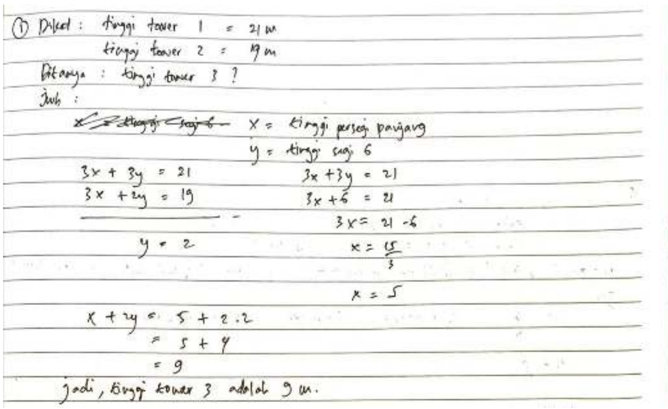
① Diket : tinggi tower 1 = 21 m
tinggi tower 2 = 19 m
Ditanya : tinggi tower 3 ?
Jwb :
~~x = tinggi segi 6~~ x = tinggi persegi panjang
y = tinggi segi 6
3x + 3y = 21
3x + 2y = 19
y = 2
3x + 3y = 21
3x + 6 = 21
3x = 21 - 6
x = 15/3
x = 5
x + 2y = 5 + 2.2
= 5 + 4
= 9
jadi, tinggi tower 3 adalah 9 m.

Figure 1
Answer S01 number 1

Based on Figure 1 it shows that S01 in solving questions can give the right answer. Subject S01 can mention the information that is known and asked in the questions and then can answer correctly using the concepts that have been studied before. this explains that S01 can do the decomposition in the given problem. Then in developing a strategy S01 can connect problems with SPLDV material, to find value and can be solved using the elimination-substitution method. S01 assumes a hexagon with the symbol , and a rectangle with the symbol . S01 derives the equation and writes the mathematical model $3x + 3y = 21$ as the equation on the first tower as well as for the equation on the second tower namely $3x + 2y = 19$. As for those asked, S01 wrote down the mathematical model equation namely $x + 2y$. And make a conclusion that the tower height is 9 m. So that S01 can be said to perform pattern recognition on a given problem based on computational thinking indicators. S01 also provides conclusions and can mention logical steps. So that S01 also fulfills the indicators of abstraction and algorithmic thinking in computational thinking.

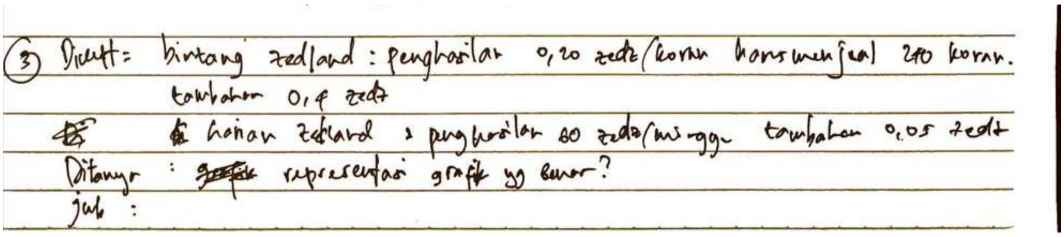
(3) Dikt: bintang zedland : penghasilan 0,20 zeds/koran konsumen jual 240 koran.
tambahan 0,4 zeds
harian zedland : penghasilan 60 zeds/minggu tambahan 0,05 zeds
Ditanya : ~~grafik~~ representasi grafik yg benar?
Jwb :

Figure 2
Answer S01 number 2

The following is the result of S01's answer in solving question number two, namely the 2012 PISA question, change and relationship content at level 2

Based on Figure 2 it shows that S01 in solving questions can give the right answer. S01 can mention information that is known and asked in questions and then can answer correctly. this explains that S01 can do the decomposition in the given problem. Then in developing the S01 strategy, it can connect the problem with the mathematical material that has been previously obtained, namely SPLDV. S01 uses the strategy of looking for bonuses for newspapers that are sold by reducing the income received that week, namely 76 zeds with the income determined by the daily zedland, which is 60 zeds, so that you get a bonus of 14 zeds. Then S01 for example the number of newspapers sold with x then dividing the bonus obtained 14 zeds by 0.05, namely the bonus for each newspaper sold that exceeds the target so that 280 newspapers are sold. Subject S01 can determine the conclusion that the number of newspapers sold is 280 newspapers. So that S01 can be said to perform pattern recognition on a given problem based on computational thinking indicators. Then S01 can provide conclusions and mention logical steps so that they can find the right solution. So S01 fulfills the indicators of abstraction and algorithmic thinking in computational thinking.

The following is the result of S01's answer in solving question number three, namely the 2012 PISA question, change and relationship content at level 5

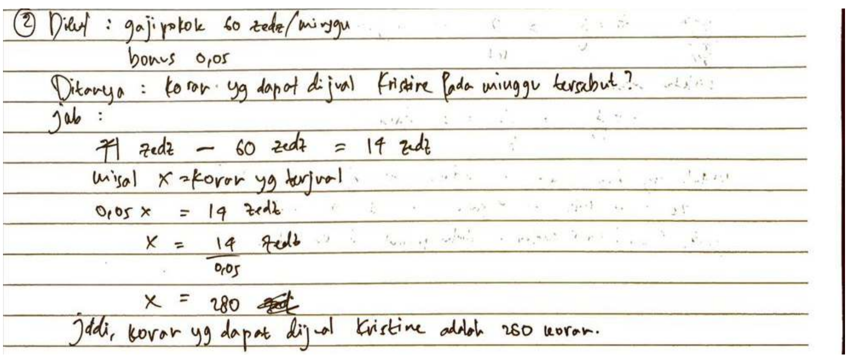
(2) Dikt : gaji pokok 60 zeds/minggu
bonus 0,05
Ditanya : koran yg dapat dijual Kristine pada minggu tersebut?
Jwb :
74 zeds − 60 zeds = 14 zeds
misal x = koran yg terjual
0,05 x = 14 zeds
x = 14/0,05 zeds
x = 280
Jadi, koran yg dapat dijual Kristine adalah 280 koran.

Figure 3
Answer S01 number 3

Based on Figure 3 it shows that S01 in solving the questions did not give an answer. S01 had difficulty understanding the problem so it did not find the right solution. Subject S01 can only mention information that is known and asked in the problem. S01 can only find out a little information based on the problem presented, this explains that S01 can perform computational thinking indicators, namely decomposition, but has not done pattern recognition, abstraction and algorithmic thinking in a given problem..

The following is the result of S01's answer in solving question number four, namely the 2012 PISA question, change and relationship content at level 4.

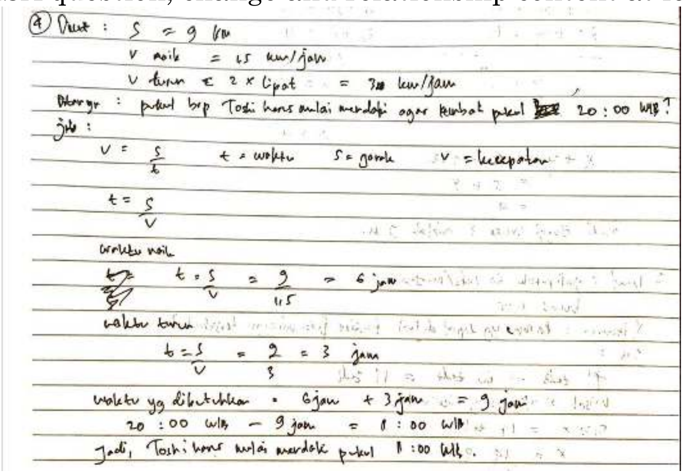

Figure 4
Answer S01 number 4

Based on Figure 4 it shows that S01 in solving questions can give the right answer. Subject S01 can mention information that is known and asked in the questions and then can answer correctly with the concepts used. This explains that S01 can decompose in the given problem. Subject S01 uses the velocity formula to find the climber's time. Then in developing strategies S01 can connect problems with mathematical material that has been obtained previously, so that S1 can be said to perform pattern recognition on given problems based on computational thinking indicators. S01 translates the problem language into mathematical language with formulas $t = \frac{s}{v}$. Using this formula, S01 finds the climber's time needed when going up and down, then adds up the time needed to return at 20:00 WIB. Thus, S01 also fulfills the indicators of abstraction and algorithmic thinking in computational thinking.

The following is a presentation of computational thinking process data in solving PISA content change and relationship questions based on self-efficacy.

Table 6 Presentation of Computational Thinking Process Data in Solving PISA Questions Content Change and Relationship Based on Self Efficacy

PISA Level	Computational thinking indicator	High self efficacy	Medium self efficacy	Low self efficacy
2	Decomposition	▪ Can understand the problem well. ▪ Can provide known and asked information on the problems given	▪ Can understand the problem well. ▪ Can provide known and asked information on the problems given	▪ Can provide information that is known and asked about the problems given but lacks detail

	Pattern recognition	▪ Can formulate real problems to mathematical problems ▪ Can solve problems using mathematical solutions	▪ Can find patterns by formulating real problems using logic ▪ Solving problems using logic	▪ Can find patterns by formulating real problems using logic ▪ Solving problems using logic
	Abstraction	▪ Can interpret conclusions from mathematical solutions to real solutions.	▪ Can provide conclusions on the problems given	▪ Can't provide conclusions on the problems given
	Algorithmic thinking	▪ Can mention logical steps in solving a given problem	▪ Can mention the steps in solving the problem given	▪ Can't mention the steps in solving the given problem
3	Decomposition	▪ Can understand the problem well. ▪ Can provide known and asked information on the problems given	▪ Can understand the problem well. ▪ Can provide known and asked information on the problems given	▪ Can provide information that is known and asked about the problems given but lacks detail
	Pattern recognition	▪ Can formulate real problems to mathematical problems ▪ Can solve problems using mathematical solutions	▪ Can find patterns by formulating real problems using logic ▪ Solving problems using logic	▪ Can find patterns by formulating real problems using logic ▪ Solving problems using logic
	Abstraction	▪ Can interpret conclusions from mathematical solutions to real solutions.	▪ Can provide conclusions on the problems given	▪ Can't provide conclusions on the problems given
	Algorithmic thinking	▪ Can mention logical steps in solving a given problem	▪ Can mention the steps in solving the problem given	▪ Can't mention the steps in solving the given problem
4	Decomposition	▪ Can understand the problem well. ▪ Can provide known and asked information on the problems given	▪ Can understand the problem well. ▪ Can provide known and asked information on the problems given	▪ Can provide information that is known and asked about the problems given but lacks detail
	Pattern recognition	▪ Can formulate real problems into mathematical	▪ Can find patterns but do not solve the	▪ Cannot find patterns in solving given

		problems ▪ Can solve problems using mathematical solutions	given problems	problems
	Abstraction	▪ Can interpret conclusions from mathematical solutions to real solutions.	▪ Can provide conclusions on the problems given	▪ Can't provide conclusions on the problems given
	Algorithmic thinking	▪ Can mention logical steps in solving a given problem	▪ Can mention the steps in solving the problem given	▪ Can't mention the steps in solving the given problem
5	Decomposition	▪ Can understand the problem well. ▪ Can provide known and asked information on the problems given	▪ Can provide known and asked information but lacks detail.	▪ Can provide known and asked information on the problems given but lack detail

Based on table 6 the researchers found that at level 5 students with high, medium and low self-efficacy could not solve the problems given, which were limited to decomposition, due to a lack of understanding of the questions and conceptual knowledge of the students.

The explanation above regarding students' computational thinking processes in solving PISA questions about change and relationship content can be influenced by self-efficacy. Self-efficacy is related to the confidence in students to solve a problem related to answers in solving problems. Especially in learning mathematics which looks more difficult and requires strategies in solving open problems. Self-efficacy can be in the form of attitudes or personality of students who can build students' thinking processes in solving a problem. Thus Self-efficacy has an influence on behavior selection, amount of effort and persistence, as well as thinking patterns and emotional reactions. Self-efficacy assessment encourages individuals to avoid situations that are believed to be beyond their abilities or to carry out activities that are thought to be able to overcome them.

Students who have high self-efficacy in solving PISA questions with change and relationship content can collect important information in questions that are useful for finding complete solutions along with what is asked in the questions correctly, changing problems into appropriate mathematical language in the form of variables and models, designing and use strategies to get solutions to problems by using the required mathematical concepts, applying facts, rules, and algorithms during the process of finding the right solution, explaining the meaning of the solution results correctly, correcting the completion steps again, and revealing that the results obtained makes sense. In accordance with the results of research conducted by Amelina (2020), that students with high self-efficacy in solving PISA questions can say what is known correctly, implement plans correctly, devise steps for completion, re-examine, write conclusions correctly and are confident in their abilities and the method of solving problems used. This is also supported by research conducted by Purwanti & Mujiasih (2021), that mathematical literacy students with high self-efficacy in solving HOTS-oriented questions can make questions, transform problems into mathematical models, obtain appropriate answers according to understanding, and provide conclusions.

Low self-efficacy in general indicates that students can collect important information in questions that are useful for finding complete solutions along with what is asked in the questions correctly, do not change problems into appropriate mathematical language, do not devise strategies to get solutions when encountering difficulties, do not uses appropriate mathematical concepts, does not apply facts, rules, and algorithms during the process of finding solutions, is not thorough in the calculation process, cannot interpret the solution results because they do not find the correct solution, does not re-correct the solution steps, and is unsure of the results which is obtained. This is also in accordance with the results of research conducted by Amelina (2020), that if students with low self-efficacy find difficulties in solving PISA questions, then they become less interested in working on the PISA questions.

CONCLUSION AND IMPLICATION

Conclusion

Students' computational thinking processes in solving PISA questions about change and relationship content that have high self-efficacy can reach the stages of decomposition, pattern recognition, abstraction and algorithmic thinking as well as students' thought processes in carrying out plans can link real problems into mathematical problems. Whereas students who have self-efficacy are reaching the stages of decomposition, pattern recognition, abstraction and algorithmic thinking and in carrying out plans do not connect real problems to mathematical problems but use logic. Whereas students who have low self-efficacy only reach the stages of decomposition and pattern recognition have not done abstraction and algorithmic thinking because students' thinking processes in carrying out plans use logic and in solving these problems do not provide conclusions of answers and logical steps.

Implication

Researchers provide recommendations to several parties based on research findings. For students who have high self-efficacy to further deepen the material to solve non-routine questions to train their computational thinking skills. Students who have moderate self-efficacy should try to understand ways to solve algebraic problems, namely by practicing non-routine math questions, one of which is the PISA question with the content of change and relationship. Students who have low self-efficacy should practice solving math problems so they know the principles of solving problems. Teachers can increase student self-efficacy by acting as a companion, guide, director and motivator in learning. To improve computational thinking processes through giving non-routine questions to students, one of which is PISA questions. For other researchers, they can deepen it by conducting further research related to other thought processes in solving PISA questions on change and relationship content.

REFERENCES

Amalia, W., Mulyono, & Napitupulu, E. (2018). Pengembangan Soal Matematika PISA-LIKE Pada Konten Change And Relationship Untuk Mengukur Kemampuan Pemecahan Masalah. *Paradikma Jurnal Pendidikan Matematika*, 11(2), 1–8. https://doi.org/10.24114/paradikma.v11i3.22925

Amelina. (2020). *Analisis Kemampuan Siswa dalam Menyelesaikan Soal Matematika Model PISA pada Konten Perubahan dan Hubungan Ditinjau dari Self Efficacy*. Skripsi pada Institut Agama Islam Negeri Tulungagung: diterbitkan.

Città, G., Gentile, M., Allegra, M., Arrigo, M., Conti, D., Ottaviano, S., Reale, F., & Sciortino, M. (2019). The Effects Of Mental Rotation On Computational Thinking. *Computers and Education*, *141*. https://doi.org/10.1016/j.compedu.2019.103613

Fadillah, A., & Ni'mah. (2019). Analisis Literasi Matematika Siswa Dalam Memecahkan Soal Matematika PISA Konten Change and Relationship. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *3*(2), 127–131. https://doi.org/10.31764/jtam.v3i2.1035

Hasanah, U., Dewi, N. R., & Rosyida, I. (2019). Self Efficacy Siswa SMP Pada Pembelajaran Model Learning Cycle 7E (Elicit, Engange, Explore, Explain, Elaborat, Evaluate, and Extend). *PRISMA, Prosiding Seminar Nasional Matematika*, *2*, 551–555. https://journal.unnes.ac.id/sju/index.php/prisma/

Kusmaryono, I. (2018). Analysis Of Students' Incorrect Answers In A Mathematical Test: An Insight On Students' Learning Based On Solo Taxonomy And Error Analysis. *Jurnal Pengajaran MIPA*, *23*(1), 1–8. https://doi.org/10.18269/jpmipa.v23i1.9517

Lestari, A. C., & Annizar, A. M. R. (2020). Proses berpikir kritis siswa dalam menyelesaikan masalah PISA ditinjau dari kemampuan berpikir komputasi. *Jurnal Kiprah*, *8*(1), 46-55. https://doi.org/10.31629/kiprah.v8i1.2063

Martalyna, W., Isnarto, I., & Asikin, M. (2018). Students Mathematical Literacy Based on Self-Efficacy By Discovery Learning With Higher Order Thinking Skills-Oriented. *Unnes Journal of Mathematics Education Research*, *7*(1), 54–60. https://journal.unnes.ac.id/sju/index.php/ujmer/article/view/23988

Novianti, I., Darminto, B. P., & Purwoko, R. Y. (2018). Penerapan model snowball throwing terhadap pemecahan masalah ditinjau dari self efficacy. In *Seminar Nasional Pendidikan Matematika Ahmad Dahlan* (Vol. 6, pp. 295-300)

Nuraisa, D., Azizah, A. N., Nopitasari, D., & Maharani, S. (2019). Exploring Students Computational Thinking based on Self-Regulated Learning in the Solution of Linear Program Problem. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *8*(1), 30-36. https://doi.org/10.25273/jipm.v8i1.4871

Nuryanti, L., Zubaidah, S., & Diantoro, M. (2018). Analisis Kemampuan Berpikir Kritis Siswa SMP. *Junal Pendidikan : Teori, Penelitian, Dan Pengembangan*, *3*(2), 155–158. http://journal.um.ac.id/index.php/jptpp/

OECD. (2013). *PISA 2012 : Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy*. OECD Publishing. https://doi.org/10.1787/9789264190511-en

Purwanti, K. L., & Mujiasih, M. (2021). Kemampuan Literasi Matematika Siswa Madrasah Ibtidaiyah Ditinjau Dari Self-Efficacy. *Journal of Integrated Elementary Education*, *1*(1), 59-74. https://doi.org/10.21580/jieed.v1i1.6975

Rahmadhani, L. I. P., & Mariani, S. (2021, February). Kemampuan Komputasional Siswa Dalam Memecahkan Masalah Matematika SMP Melalui Digital Project Based Learning Ditinjau Dari Self Efficacy. In *PRISMA, Prosiding Seminar Nasional Matematika* (Vol. 4, pp. 289-297).

Rahmatia. (2021). *Analisis Kesalahan Dalam Menyelesaikan Soal PISA Konten Change And Relationship Pada Siswa Kelas VIII MTs Darul Iman Palu Menggunakan Teori*

Rokhmatillah, I. N. F., Manoy, J. T., & Fardah, D. K. (2019). Profil Pemecahan Masalah Matematika Siswa pada Soal PISA Konten Quantity Ditinjau dari Self-Efficacy. *Jurnal Penelitian Pendidikan Matematika dan Sains*, *3*(2), 75-88. https://doi.org/10.26740/jppms.v3n2.p75-88

Samsuddin, A. (2019). *Kemampuan Literasi Matematika Dan Self - Efficacy Siswa SMP Negeri Di Kota Makassar*. Tesis pada Universitas Negeri Yogyakarta: diterbitkan

Sumliyah, S., Rustika, P., & Firmansyah, A. L. (2020). Efforts to Improve The Ability of Self Efficacy Students with The AIR Learning Model. *Eduma : Mathematics Education Learning and Teaching*, *9*(1), 48–60. https://doi.org/10.24235/eduma.v9i1.5621

Supiarmo, M. G., & Susanti, E. (2021). Proses Berpikir Komputasional Siswa dalam Menyelesaikan Soal Pisa Konten Change and Relationship Berdasarkan Self-Regulated Learning. *Numeracy*, *8*(1), 58-72. https://doi.org/10.46244/numeracy.v8i1.1378

Veronica, A. R., Siswono, T. Y. E., & Wiryanto. (2022). Primary School Students' Computational Thinking in Solving Mathematics Problems Based on Learning Style. *Eduma : Mathematics Education Learning And Teaching*, *11*(1), 84–96. https://doi.org/10.24235/eduma.v8i2.10378