**Prima: Jurnal Pendidikan Matematika**
Vol. 5, No. 2, July 2021, pp. 40-50
P-ISSN: 2579-9827, E-ISSN: 2580-2216
Web: http://jurnal.umt.ac.id/index.php/prima

# PROFILE OF STUDENTS' COMPUTATIONAL THINKING BASED ON SELF-REGULATED LEARNING IN COMPLETING BEBRAS TASKS

**Diah Nuraisa[1], Hairul Saleh[2], Sigit Raharjo[3]**
Universitas Muhammadiyah Tangerang, Jalan Perintis Kemerdekaan I/33, Indonesia
e-mail: dnuraisa19@gmail.com

**Abstract**

Bebras task is a problem-solving problem that integrates computational thinking in it, which the stages in computational thinking consist of: decomposition, abstraction, algorithm, and pattern recognition. This study aims to describe the profile of students' computational thinking based on the level of self-regulated learning in completing bebras task. This study is a qualitative-descriptive study with three research subjects based on the level of students' self-regulated learning, namely high self-regulated learning, medium self-regulated learning, and low self-regulated learning. The results of this study indicate that students with different levels of self-regulated learning have different computational thinking ability in completing bebras task. Student with high level of self-regulated learning can reach the stages of decomposition, abstraction, algorithm, and pattern recognition. Student with medium level of self-regulated learning can reach the stages of decomposition, absraction, and algorithm. Student with low level of self-regulated learning can reach the stage of decomposition only. Student with low level of self-regulated learning do not yet reflect independence in learning.

**Keywords**: computational thinking, problem solving, self-regulated learning, bebras task

**Abstrak**

*Bebras task* merupakan soal pemecahan masalah yang mengintegrasikan berpikir komputasi ke dalamnya, yang mana tahapan dalam berpikir komputasi terdiri atas: dekomposisi, abstraksi, algoritma, dan pengenalan pola. Penelitian ini bertujuan untuk mendeskripsikan profil berpikir komputasi siswa ditinjau dari tingkat *self-regulated learning* dalam menyelesaikan *bebras task*. Penelitian ini merupakan penelitian deskriptif-kualitatif dengan tiga subjek penelitian berdasarkan tingkat *self-regulated learning* siswa, yaitu *self-regulated learning* tinggi, *self-regulated learning* sedang, dan *self-regulated learning* rendah. Hasil dari penelitian ini menunjukkan bahwa siswa dengan tingkat *self-regulated learning* yang berbeda memiliki kemampuan berpikir komputasi yang berbeda dalam menyelesaikan *bebras task*. Siswa dengan tingkat *self-regulated learning* tinggi dapat mencapai tahapan dekomposisi, abstraksi, algoritma, dan pengenalan pola. Siswa dengan tingkat *self-regulated learning* sedang dapat mencapai tahapan dekomposisi, abstraksi, dan algoritma. Siswa dengan *self-regulated learning* dapat mencapai tahapan dekomposisi. Siswa dengan tingkat *self-regulated learning* rendah belum merefleksikan kemandirian dalam belajar.

**Kata kunci**: berpikir komputasi, pemecahan masalah, kemandirian dalam belajar, bebras task

## INTRODUCTION

The Industrial Revolution 4.0 brings education into The Age of Knowledge, namely the acceleration of increasing knowledge marked by the application of media and technology (Mawardi, 2016: 65). So that requires humans to adapt to a mindset in accordance with the current developments and compete globally. So, ensuring students have the skills to think and innovate in solving problems becomes an urgency for education. As the considerations contained in the Law of the Republic of Indonesia No. 20 of 2003 concerning the National Education System, that education must be able to ensure equal opportunities for education,

*Received: March, 2021; Revised: July, 2021; Accepted: July, 2020*

increase the quality and relevance and efficiency of education management to face challenges in accordance with the changing demands of local, national, and global life. So it is necessary to do educational renewal in a planned, directed and sustainable manner. Based on this, education must be more responsive in developing quality in the midst of the times and preparing an appropriate educational framework.

Problem solving is an important component of the mathematics learning curriculum, both in activities and in the learning process to solve routine and non-routine problems (Telaumbanua, Sinaga, and Surya, 2017: 74). This is because the problem-solving process requires the use of knowledge and skills that are already owned in routine problem-solving processes to be applied in solving non-routine problems. According to Kusumawardani et al., problem solving does not only requires the ability to count for the solutions, but requires more ability such as to reason, so students can find out the meaning of the problem presented (Susanti and Taufik, 2021: 23). In addition, through the process of non-routine problem solving, aspects of mathematics learning can be developed, such as pattern recognition, generalization, and mathematical communication (Kusumaningtyas, 2017). But in fact, based on the value of daily math test, it shows that junior high school students still have difficulty solving non-routine problems, marked by students tend to be reluctant to solve questions that they think are rarely encountered and students have not been able to express creative ideas about the problems presented. In view of the importance of problem-solving abilities in non-routine problems, there are problem-solving techniques whose application is very broad and complex, namely through computational thinking.

Computational thinking is the new literacy of the 21st century. It enables you to bend computation to your needs (Wing, 2010: 3). Computational thinking is closely related to computational theory. According to Simonson, computational theory is an abstraction program about what can be calculated (Alfina, 2017:3) However, computational thinking is not only focused on solving problem, but more focused on how to solve it the problem (Nuraisa et al., 2019: 1). Computational thinking is the thought processes in formulating problems and solutions, so the solutions can be represented in a effectively form (Grover & Pea, 2013: 39). Computational thinking is the ability to think in solving problems with various levels of abstraction and based on indicators of computational thinking, including: decomposition, abstraction, algorithms, and pattern recognition. Although there are four

indicators, computational thinking is synonymous with the use of decomposition and abstraction. In accordance with the characteristics of computational thinking that formulates problems through solving the information presented to be simpler and still structured. This is useful for focusing the algorithm in obtaining a solution. So, complex problems will be solved easily, efficiently, and creatively through computational thinking.

However, in reality the learning process that takes place in Indonesia has not integrated computational thinking (CT) into subjects, such as mathematics. Meanwhile, Indonesia itself already has problem solving problems that include computational thinking, namely Bebras Task. Bebras Task is a problem-solving problem related to informatics that focuses on logic and mathematics. According to Dagiene and Sentance (2016) tasks are the most important component for developing students' computational thinking. Bebras Task questions are presented along with pictures to attract attention and stimulate students to complete them. In addition, Bebras Tasks are used in international standard competitions, namely "Bebras Challenge". The purpose of holding the "Bebras Challenge" is to promote and encourage the development of computational thinking (Tim Olimpiade Komputer Indonesia, 2018).

In addition, one thing that needs to be paid attention to in computational thinking skills is self-regulated learning. Self-regulated learning is an effort to direct self-initiative and motivation in the learning process to achieve optimal learning outcomes. Self-regulated learning has a significant effect on the learning process and learning achievement (Kristiyani, 2016: 11). According to Knain and Turmo, self-regulated learning is a dynamic process of building knowledge, skills, and attitudes when learning a specific context. To build knowledge in the process learning does not only require learning strategies, learning experiences, and applying the knowledge, but must be able to reflect/evaluate learning activities (Amir, Z., 2015: 168-169). Computational thinking is seen as a goal-directed process and uses heuristic reasoning to obtain solutions. Heuristic reasoning includes activities, such as planning, learning, dealing with uncertainty, and the search process (Wing, 2006: 34). Activities in the heuristic reasoning process are consistent with the components in self-regulated learning. This suggests that the relationship between self-regulated learning and computational thinking processes allows the use of concepts, components, and strategies of self-regulated learning as a framework for improving computational thinking skills. This study describes in

detail the relationship between students' self-regulated learning and their computational thinking ability which is shown through problem solving skills in the form of bebras task.

## METHODS

This research is a qualitative-descriptive study. This study aims to describe the profile of the 8th grade students' computational thinking of SMP Negeri 17 Tangerang based on self-regulated learning, from all of the students, there are 3 students only who had met the criteria of subject. The data were collected by self-regulated learning questionnaires, bebras task as a computational thinking test, and unstructured interviews.

Self-regulated learning questionnaires was adopted by Saepulloh (Hendriana, H., Rohaeti, E. E., Sumarmo, 2018: 244-245). The questionnaire was used to obtain scores and determine the categories of students' self-regulated learning. The questionnaire consists of 28 statements with 4 answer choices and using Likert scale. The research subjects can be seen in Table 1 below.

**Table 1. Research Subjects**

| Level of Self-Regulated Learning (based on the results of questionnaire) | Code | Score |
|---|---|---|
| High | $SRL_1$ | 88 |
| Medium | $SRL_2$ | 82 |
| Low | $SRL_3$ | 53 |

Determining the level of self-regulated learning is to get specific difference that will be seen from how students solve problems, including planning to evaluating/re-checking the solution. The number of bebras task questions in this study were 4 and were in the form of essays. Each question contains four indicators of computational thinking, namely decomposition, abstraction, algorithms, and pattern recognition. The indicators of bebras task questions in this study can be seen in Table 2 below.

**Table 2. Indicators of Bebras Task Questions**

| No. | Indicators | Computational Thinking Components | Cognitive Domain | Difficult Level |
|---|---|---|---|---|
| 1 | Students can solve a problem which is one of the problems of cutting stock that contains a pattern. | Decomposition, Abstraction, Algorithm, and Pattern Recognition. | C3 (Application) | Moderate |
| 2 | Students can relate information to one another by making substitutions. | Decomposition, Abstraction, Algorithm, and Pattern Recognition. | C3 (Application) | Moderate |

| | | | | |
|---|---|---|---|---|
| 3 | Students can create and combine information in a structured manner. | Decomposition, Abstraction, Algorithm, and Pattern Recognition. | C5 (Synthesis) | Easy |
| 4 | Students can build and combine information into structured networks. | Decomposition, Abstraction, Algorithm, and Pattern Recognition. | C5 (Synthesis) | Difficult |

In addition, the interview in this study is unstructured interview conducted with the aim of obtain deeper data students' computational thinking ability in completing Bebras Task. The questions in the interview are in the form of questions that clarify the indicators of computational thinking achieved by students that can not be seen from the results of the test they do. So, to find out how students can solve problems, it needs to be found through interviews.

## RESULTS AND DISCUSSION

Based on the results of the self-regulated learning questionnaire, there are 3 levels of self-regulated learning, where students with different levels of self-regulated learning have different computational thinking abilities and have different achievement indicators of computational thinking.

### 1. The Computational Thinking Profile of Student with High Self-Regulated Learning

| Computational Thinking's Indicators | Number of | | | | Conclusions |
|---|---|---|---|---|---|
| | Question-1 | Question-2 | Question-3 | Question-4 | |
| **Decomposition** | 1) $SRL_1$ paying attention to the connection between the sentences of the problem presented.<br>2) $SRL_1$ understands the core of the problem presented in the question.<br>3) $SRL_1$ can describe what is asked. | 1) $SRL_1$ re-explain the problem is a problem of exchanging marbles between colors.<br>2) $SRL_1$ re-explain what is known and what is asked in the question. | 1) $SRL_1$ understands that the problem is a series of rules in making sub-district codes.<br>2) $SRL_1$ explain the problem being asked in a simple way. | 1) $SRL_1$ understands what is known and what is being asked in the question.<br>2) $SRL_1$ paying attention to sentence by sentence on the question properly and carefully, then $SRL_1$ explain the meaning of the sentences which is quite complicated to understand. | 1) $SRL_1$ understands what is known.<br>2) $SRL_1$ paying attention to the sentences and can explain in a simple way.<br>3) $SRL_1$ understands what is being asked. |

| | | | | | |
|---|---|---|---|---|---|
| **Abstraction** | 1) $SRL_1$ makes patterns from the components in the problem as the representation of the solutions.<br>2) $SRL_1$ can explain the representasion of the solutions that he made. | 1) $SRL_1$ determines the number of marbles that can be exchanged with other colored marbles. | 1) $SRL_1$ explained the representation of the solution by changing the name of the sub-district in question into a numeric format (according to the rules in the question). | 1) $SRL_1$ determines the solution by constructing sentences into a circle image and writing the letters according to what is know in the problem. | 1) $SRL_1$ determines the representasion of the solution by many ways, such as making patterns, determining number, changing the name into numeric, and constructing sentences into picture. |
| **Algorithm** | 1) $SRL_1$ automates solutions by making patterns and evaluates the completion process and output.<br>2) $SRL_1$ makes conclusions from the solution. | 1) $SRL_1$ makes 4 equations, which starts from the simplest first equation. After that, the results are substituted for the following equations.<br>2) $SRL_1$ makes conclusions. | 1) $SRL_1$ automates solution precisely.<br>2) $SRL_1$ can make conclusion, both in writing and verbally (when explaining steps for completion). | 1) Problem solving was done twice. On the first settlement, the result found still incorrect. Then, $SRL_1$ completed the second solution according to the sentences and the continuous construction that she made. | 1) $SRL_1$ solves the problems precisely.<br>2) $SRL_1$ evaluates the process and output.<br>3) $SRL_1$ can make conclusions from the automation of the solutions. |
| **Pattern Recognition** | 1) $SRL_1$ understands that there are patterns that are formed on problems that can facilitate problem solving.<br>2) $SRL_1$ makes patterns of 8 tree trunks (10 m/each tree trunk), in which each tree can form a pattern of 2.5 m, 3 m, and 4 m. | 1) $SRL_1$ understands that there is a pattern that is formed, namely the pattern of finding the exchange rate of 1 marble color for other colored marbles, and so on to find the other color exchange rates. | 1) $SRL_1$ understands the patterns in the question and answer.<br>2) $SRL_1$ is able to show patterns that are formed, such as patterns formed between letters and numbers which then generate codes. | 1) The pattern found is a difference in direction. This shows that $SRL_1$ can identify the patterns in the completion step. | 1) $SRL_1$ understands and can find the patterns.<br>2) $SRL_1$ identifies the patterns in the algorithm steps. |

## 2. The Computational Thinking Profile of Student with Medium Self-Regulated Learning

| Computational Thinking's Indicators | Number of | | | | Conclusions |
|---|---|---|---|---|---|
| | Question-1 | Question-2 | Question-3 | Question-4 | |
| **Decomposition** | 1) $SRL_2$ understands what informations are presented.<br>2) $SRL_2$ understands what is being asked and pay attention to an important word in the question, namely minimal. | 1) $SRL_2$ can explain what is known in the problem.<br>2) $SRL_2$ can state what is being asked in the question. | 1) $SRL_2$ re-tell what informations are presented in the question.<br>2) $SRL_2$ understands what is being asked in the question correctly. | 1) $SRL_2$ re-tell what is known in the question.<br>2) $SRL_2$ re-tell what is being asked in the question. | 1) $SRL_2$ uderstands and re-tell what is known in the problem.<br>2) $SRL_2$ understands and re-tell what is being asked in question. |
| **Abstraction** | 1) $SRL_2$ making the patterns of 8 lines labeled 10m/line.<br>2) $SRL_2$ paying attention to information that has different units (cm and m). | 1) $SRL_2$ determines the representation of the solution, but $SRL_2$ difficult to explain it.<br>2) $SRL_2$ changes the information presented into a mathematical format, namely making equations. | 1) $SRL_2$ paying attention to the requirements of coding carefully.<br>2) $SRL_2$ determines the representatio n of the problem solution. | 1) $SRL_2$ making horizontal hierarchies as the representati on of the solution. | 1) $SRL_2$ determines and can explain the representation of the solutions.<br>2) $SRL_2$ paying attention to the informations and convert the informations to the mathematical format. |
| **Algorithm** | 1) Based on the patterns created, $SRL_2$ can automate solutions sequentially.<br>2) $SRL_2$ can make conclusions from the completion steps carried out correctly. | 1) $SRL_2$ can automate solutions.<br>2) $SRL_2$ can make conclusions from the automation carried out. | 1) $SRL_2$ can solve problem appropriately.<br>2) Based on the results of the interview, $SRL_2$ can make conclusion from solving the problems that have been done. | 1) $SRL_2$ perform solutions with the help of precise horizontal hierarchies.<br>2) $SRL_2$ can make conclusion. | 1) $SRL_2$ can automate solutions appropriately.<br>2) $SRL_2$ can make conclusion. |
| **Pattern Recognition** | 1) Based on the results of the interview, $SRL_2$ was unable to identify patterns in the problem solving process that had been carried out. | 1) $SRL_2$ cannot identify patterns in solving problem. | 1) $SRL_2$ cannot identify the pattern that is formed correctly. | 1) $SRL_2$ cannot identify any patterns from the patterns that have been made. | 1) $SRL_2$ cannot identify the patterns that have been made. |

## 3. The Computational Thinking Profile of Student with Low Self-Regulated Learning

| Computational Thinking's Indicators | Number of | | | | Conclusions |
|---|---|---|---|---|---|
| | Question-1 | Question-2 | Question-3 | Question-4 | |
| **Decomposition** | 1) $SRL_3$ re-tell what is known in the problem.<br>2) $SRL_3$ understands what is being asked in the question. | 1) $SRL_3$ understands the informations are presented in the question.<br>2) $SRL_3$ knows what is being asked in the question. | 1) $SRL_3$ understands the problem correctly.<br>2) $SRL_3$ knows what is known.<br>3) $SRL_3$ understands what is being asked. | 1) $SRL_3$ knows what is known in the question, but $SRL_3$ do not show an understanding of the problem.<br>2) $SRL_3$ knows what is being asked in the question. | 1) $SRL_3$ knows and can re-tell the informations are presented.<br>2) $SRL_3$ knows what is being asked. |
| **Abstraction** | 1) $SRL_3$ cannot determine the representation of the solution in solving the problem. | 1) $SRL_3$ cannot determine the representation of the solution correctly. | 1) $SRL_3$ writes a name of the sub-district first, then $SRL_3$ changes the letter rules according to the number rules according to the coding rules. | 1) $SRL_3$ cannot determine the representation of the solution in any form. | 1) $SRL_3$ cannot determine the representation of the solution in any form. |
| **Algorithm** | 1) $SRL_3$ multiply the information in the question, such as multiplying the size of wood by the number of pieces of wood needed, then add and divide by 10.<br>2) $SRL_3$ makes conclusion by rounding off. | 1) $SRL_3$ is unable to automate solution properly.<br>2) Based on improper solution, affect the conclusion made. | 1) $SRL_3$ can complete sequentially.<br>2) $SRL_3$ cannot make conclusion. | 1) $SRL_3$ creates hierarchies horizontally, but $SRL_3$ do not understand why the problem is solved by this step.<br>2) $SRL_3$ cannot make conclusion. | 1) $SRL_3$ can complete the problem, but do not understand why the problem solved by this step.<br>2) $SRL_3$ cannot make conclusion. |
| **Pattern Recognition** | 1) $SRL_3$ do not make patterns in the completion step, but perform basic arithmetic operations.<br>2) $SRL_3$ cannot identify patterns in | 1) $SRL_3$ cannot identify patterns, both in problem and in the process of solving problem. | 1) Based on the patterns that were successfully made, $SRL_3$ could not find differences or similarities in the patterns that were formed. | 1) $SRL_3$ cannot identify the patterns in the problem. | 1) $SRL_3$ cannot identify the patterns, both in problem and in the process of solving problem. |

| | |
|---|---|
| | solving problems. |

Based on the results of the test and interview, $SRL_1$ have good planning, implementation, and evaluation/reflection skills in the learning process. Planning in the form of determining the representation of the solution by identifying the information and problem presented. Implementation is in the form of implementing organizing representations into an automation solution. Meanwhile, the evaluation is in the form of re-checking whether the automation of the solutions carried out is in accordance with the plan and whether the results of the solutions obtained are in accordance with the problems asked in the questions. $SRL_1$ represent the process of regulating their learning by demonstrating their ability to diagnose needs (referring to students understanding what is needed in solving problems), have persistance, and performing cognitive strategies, especially rehearsal and elaboration in the completion process, so as to create and identify patterns. It is following the results of research by Yanti and Surya (2017) which states that self-regulated learning (independent learning) affects the quality of learning itself, which is shown at the level of achievement/student learning outcomes. The better process of regulating the learning process, the better the learning outcomes obtained.

$SRL_2$ can do planning and implementation quite well in the completion process. However, the behavior is not careful, both in the process and in make conclusions (evaluation/reflection phase). Lack of activities to evaluate the process affects the making of conclusion and the results obtained by the settlement. It is following the results of research by Yanti and Surya (2017) which states that self-regulated learning (independent learning) affects the quality of learning itself, which is shown at the level of achievement/student learning outcomes. $SRL_2$ shows that the lack of evaluation activities carried out also affects the learning outcomes that are owned.

$SRL_3$ achieved the decomposition indicator only. At the abstraction, $SRL_3$ cannot determine the correct representation of the solution (planning phase), this is because $SRL_3$ is unable to diagnose what informations are needed in completing bebras task. This affects the automation of the solution that is carried out is also incorrect. $SRL_3$ do a solution based on trial and error, but only once, then do not re-checking. So that if the answer is not found, $SRL_3$ think the problem solving has been completed. This shows that $SRL_3$ do not see learning

difficulties as challenges, so they can easily give up when they experience difficulties in learning. It is following the results of research by Hamundu, Sudia, and Samparadja (2017: 157) which states that students with low self-regulated learning have a feeling of boredom, give up easily, prefer to choose a more instant way and use less careful thinking, take a long time, lack willingness to examine problems and feel complicated to identify. $SRL_3$ do not yet reflect independence in learning.

## CONCLUSION

Besides being applicable to various problem contexts, computational thinking is useful for practice logic and pattern recognition for students in solve non-routine problems that require deeper analysis and thinking. Computational thinking is important to be included in mathematics learning. The recommendations for further research are the need for research in the form of appropriate learning methods to teach computational thinking to students and the development of computational learning instruments, especially in mathematics subject and learning.

## ACKNOWLEDGMENTS

I would like to express my special thank of gratitude to my lecturers who gave me the opportunity to explore the topics and helped me in doing this research. Secondly, I also would like to thank my parents and brother who helped me a lot in finishing this research. I am really thankful to them.

## REFERENCES

Alfina, Azza. 2017. "Berpikir Komputasional Siswa Dalam Menyelesaikan Masalah Yang Berkaitan Dengan Aritmetika Sosial Ditinjau Dari Gender." *Simki-Techsain* 01(04).

Amir, Z., Risnawati. 2015. *Psikologi Pembelajaran Matematika*. Yogyakarta: Aswaja Pressindo.

Dagiene, Valentina, and Sue Sentance. 2016. "It ' s Computational Thinking ! Bebras Tasks in the Curriculum." (October). doi: 10.1007/978-3-319-46747-4.

Grover, S., and Pea, R. 2013. "Computational Thinking in K-12: A Review of the State of the Field." *Educational Researcher* 42(1):38–43. doi: 10.3102/0013189X12463051.

Hamundu, A., Sudia, M., Samparadja, H. 2017. "Profil Pemecahan Masalah Terbuka Yang Ditinjau Dari Self Regulated Learning Siswa SMP." *Jurnal Pendidikan Matematika*

8(2):157. doi: http://dx.doi.org/10.36709/jpm.v8i2.5983.

Hendriana, H., Rohaeti, E. E., Sumarmo, U. 2018. *Hard Skills Dan Soft Skills Matematik Siswa*. edited by N. F. Atif. Bandung: Refika Aditama.

Indonesia, Tim Olimpiade Komputer. 2018. *Tantangan Bebras Indonesia 2018 Bahan Belajar Computational Thinking Tingkat SMP*. NBO Bebras Indonesia.

Kristiyani, Titik. 2016. *Self-Regulated Learning (Konsep, Implikasi, Dan Tantangannya Bagi Siswa Di Indonesia)*. Yogyakarta: Sanata Dharma University Press.

Kusumaningtyas, Y. A. W. 2017. "Peningkatan Kemampuan Pemecahan Masalah Dan Hasil Belajar Matematika Dengan Metode Problem Solving (PTK Siswa Kelas IX F SMP Negeri 1 Colomadu Tahun Ajaran 2016/2017)." Universitas Muhammadiyah Surakarta.

Mawardi. 2016. *Ilmu Pendidikan*. Jakarta: Yayasan Mirqot Ilmiah Al-Itqon.

Nasional, Departemen Pendidikan. 2003. *Undang-Undang RI No. 20 Tahun 2003 Tentang Sistem Pendidikan Nasional*.

Nuraisa, D., Azizah, A. N., Nopitasari, D., and 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. doi: 10.25273/jipm.v8i1.4871.

Telaumbanua, Y. N., Sinaga, B., and Edy, S. 2017. "Development of Mathematics Module Based on Metacognitive Strategy in Improving Students' Mathematical Problem Solving Ability at High School." *Journal of Education and Practice* 8(19):74.

Wing, J. M. 2006. "Computational Thinking." 49(3):33–35.

Wing, J. M. 2010. *Computational Thinking: What and Why?*

Yanti, S., and Surya, E. 2017. "Kemandirian Belajar Dalam Memaksimalkan Kualitas Pembelajaran." *Artikel Penelitian* (December):1–10