Math Journaling in Inductive Thinking Learning Models to Enhance Students Self-Regulated Learning (Theoretical concepts)

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Abstract

The quality of educational outcomes in Indonesia so far has not shown satisfactory results. Besides, the government’s very low graduation standard does not require students to work hard and does not foster students to have self-regulation in learning. This article aims to explain math journaling as an inductive thinking learning model to improve the skills of self-regulated learning (SRL). This article followed the systematic literature review (SLR) method. The researcher collected the data from books and scientific articles that discuss math journaling, inductive thinking learning models, and self-regulated learning. The collected data is then analyzed qualitatively. The analysis results indicate that math journaling is under the concept of inductive thinking learning models and a good model to improve students’ self-regulated learning abilities. Based on these findings, the use of math journaling as an inductive thinking learning model is suggested as an alternative learning model to improve students’ SRL abilities so that students become independent learners.

Keywords: Self-Regulated Learning, Math Journaling, Inductive Thinking Learning Model

1. Introduction

Education for human life means something important and a problem to be considered (Akrim & Sulasmi, 2020). Its contribution to the quality of life for human resources is enormous. A country and a nation will become developed if its people have a high-quality education. On the contrary, a country will be left behind from others if its people’s education is low with poor quality. Without qualified human resources, a nation will not be able to compete with other nations in this competitive global competition of life. It is evident in China that qualified human resources have succeeded in increasing the country’s economic growth from 1978-2008 and became one of the nations with the largest economy in the world (Whalley & Zhao, 2013).

Bearing this in mind, improving the quality of education cannot be negotiated in the context of improving the quality of the nation’s resources in Indonesia (Widodo, 2015). Until now, education in Indonesia does not seem to show a satisfactory indicator for contributing to the quality of human resources of its citizens. The Human Development Index (HDI) of the UNDP report as the initiator and organizer of the HDI survey in the "Human Development Report 2001" turns out that Indonesia has only managed to rank 102 out of 162 countries. In 2007 out of 177 countries published by HDI, Indonesia ranked 107th with an index of 0.728, ranked 7th out of nine ASEAN countries under Vietnam, and above Cambodia and Myanmar. Because HDI covers several indicators like economic, education, health, and population, it means that Indonesian economy, education, health, and human population are below Malaysia, Singapore, Brunei Darussalam, Philippines, and Australia.
The low quality of education in Indonesia is certainly influenced by several factors that cause it. Kurniawan (2016) concluded that the education problem in Indonesia is the distribution of education, issues of quality of education, issues of efficiency, and issues of relevance. Furthermore, almost all input components and process components in the administration of education in Indonesia do not support the creation of quality education, which happens in most schools in Indonesia. Educators or teachers, as input components of a learning process, cannot carry out their duties optimally and professionally even though they play a very important role in the quality of education being carried out (Rohman, 2016). The assumption that the teacher is a source of knowledge, and students are vessels that must be filled, creates a passive tendency in student learning. The learning method that is generally used by teachers in schools is the lecture method. This method, which is characterized by the concept of one-way information, makes teachers the primary source of knowledge and positions them passive recipients of the information. The facts show that learning has only been limited to teaching, not yet aimed at improvement, enrichment activities, increase motivation to learn, and the development of effective attitudes and learning habits. This kind of condition needs improvement, and educators have a significant role in the problem of behavior change. (Handarini, 2000) said that the context of education today prioritizes intellectual development. Other intelligence, such as spiritual intelligence, also needs to be developed to counteract the negative effects of globalization (Bl‘ah, 2014).

Education in Indonesia only pursues the formalities of degrees and diplomas; the educational process is done by students by memorizing the material provided by the teacher, not practicing, or jumping directly into real things. This is compounded by the tightness of the curriculum so that the teacher in implementing the learning process is more oriented to the achievement of the material according to the syllabus and less attention to the quality of the learner. Too much material makes students overwhelmed in learning it (Mililiyati, 2016). The national final evaluation and examination system used has not been effective in boosting the quality of graduates, coupled with graduation standards set by the government far below what it should be. The absence of synchronization between the curriculum, the learning process, with evaluations and the UN is a separate obstacle (Sari, 2012).

The conditions illustrated above have an unfavourable effect on students as candidates of the nation’s generation. Many students cannot manage themselves in learning, so they do not have optimistic results in learning. Self-regulated learning is a process of self-direction done by students to change their mental and physical abilities into skills related to the task (Zimmerman, 2001). SRL is very helpful for students in the learning process (Yang, Chen, & Chen, 2018), and is considered one of the effective learning strategies used in the education process (Fettahlioglu, 2011). SRL will appear in the context of assignments where the assignment can be given by the teacher, from a textbook, or colleagues in collaborative workgroups; or, assignments that may be self-generated, such as when a scales participant is pursuing knowledge and skills related to a hobby (Winne & Hadwin, 2010). Alsa (2005) said that self-regulated learning awareness for Indonesian students was low. The low level of SRL was due to the environment, and the learning settings did not provide many challenges to students. Individuals with strong self-regulated learning (SRL) skills are exemplified by the ability to plan, manage, and control their learning processes, as well as learn faster and achieve higher grades than those who have weaker SRL skills (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017).

Getting instant material is preferred by students. Even the reading culture of students is still defeated by their culture of receiving instant material given by the teacher so that students’ desire to learn independently is low. Procrastination often occurs. For instance, delaying doing the assignments given at school will make the students careless in resolving it. As a result, the outcomes obtained are not optimal. The system of speed learning on the last night when dealing with the exam shows the lack of students’ skills in managing themselves to learn. The low SRL in students, even college students, makes them not optimally conducting learning activities based on self-regulation (Alsa, 2005). Learning based on self-regulation has not been done optimally by many students. Graduation standards set by the government are very low. Thus, it does not require students to work hard in learning. Students who do not study well, as long as they meet the participation and attendance requirements in class, can still move up the class or pass the test no matter how low the test scores are. The community rarely heard of students who do not graduate or failed the exam. No more pressure is intended for students to study diligently and actively because schools are more focused on the number of graduates. It is also one of the factors contributing to the development of learning based on the self-regulation of students.
Self-regulated learning could also influence students’ success in achieving optimal performance. SRL interventions in student learning processes have been proven to improve students’ performance and achievement (Jansen, Van Leeuwen, Janssen, Jak, & Kester, 2019; Wang, 2011). High SRL skills are also able to generate high-performance efficiency and high self-satisfaction, which can produce good learning outcomes (Artino, 2008). Students with high SRL skills will have a greater chance of success in the classroom (Pintrich, 2000) and online learning (Broadbent, 2017). Susanto declares (2006) that although a student has a good level of intelligence, personality, home environment, and a school environment that supports it, the student will still not be able to achieve it without the support of self-regulation ability optimal performance. Based on research at Harvard University in the United States (Achmad, 2010), it turns out that a person’s success is not determined solely by knowledge and technical ability (hard skills), but rather by the ability to manage themselves and others (soft skills). This research revealed success is only determined around 20 percent by hard skills and the remaining 80 percent by soft skills. Even the most successful people in the world can succeed because they are supported more by soft skills than hard skills. Self-regulated learning is one of the skills included in soft skills because self-regulated learning itself is self-direction, self-regulation in behavior as the ability to control one’s behavior, and one of the main drives of human personality. Furthermore, self-regulated learning that leads to student active learning is highly possible to do in this digital era. All information can be easily accessed from anywhere and at any time (Baharuddin & Dalle, 2019).

On the other hand, with the increasing challenges of life in the current era of globalization, education must be able to provide provisions for students to be able to independently add knowledge and insight, augmenting their knowledge, update their knowledge, and adapt their knowledge according to the demands of life. Therefore, making students have the ability to learn based on self-regulation becomes a goal that must be achieved by as many students as possible. By learning based on self-regulation, metacognitively, students actively plan, coordinate, organize themselves, monitor themselves, and evaluate themselves at various stages in the learning process. Motivative students who regulate themselves in learning show high self-efficacy and self-attribution, have a genuine interest in learning and show high effort and persistence in learning. Behaviorally, students who learn based on self-regulation will actively choose, structure, and create an environment that can optimize learning, seek advice, find information, put themselves in situations that allow them to learn, govern themselves, and reward their learning success.

Zimmerman (1989) said that learning based on self-regulation could develop in education or learning special. Besides, Pintrich, Smith, & Mckeachie (1993) said that students should indeed develop learning based on self-regulation when facing new educational or curriculum challenges. Self-regulation can build competencies as anticipated at school age, so it takes children to manage themselves without relying on the help of others, which is often referred to as self-regulation. This SRL can improve and develop optimal results (Zimmerman, 1989). Susanto (2006) states that the development of self-regulation has begun to occur in children starting to enter the school environment. In the school environment, children are required to be able to follow the teaching-learning process; for example, learning to focus attention. In line with Susanto, Santrock (2008) also states that middle and late childhood is a period where achievement becomes the main theme, and self-control becomes better.

For these reasons, self-regulated learning will be more optimal if developed since children are already in elementary school. Moreover, the ability to self-regulate cannot develop by itself. Its development needs to be sought from an early age. Besides, it also requires a conducive environment so that children can develop self-regulation. One of the representative environments to develop is in the school environment. Elementary school, an initial environment for children to organize themselves and complete their tasks, is an effective place to develop self-regulated learning from an early age. What learning model is appropriate to be applied to develop students’ abilities in organizing themselves in learning? What learning media should be sought to develop the SRL? These two questions need answers. So, this paper was written to try the question.

Based on the background description above, the problem is formulated in the following questions:

1) What is Self-Regulated Learning?
2) How is Inductive Thinking Learning Models?
3) How is Math Journaling in Inductive Thinking Learning Models?
4) How is Math Journaling in Inductive Thinking Learning Models Could Enhance Self-Regulated Learning of elementary students?
2. Research Methodology

This article was written using the systematic literature review (SLR) method. The SLR method was chosen because the purpose of this article is to explain theoretically and empirically about the inductive thinking learning model and Math Journaling in improving students’ Self-Regulated Learning. This objective follows the SLR approach’s objectives, which is to look for empirical evidence that meets certain criteria to solve research problems (Snyder, 2019). According to Tranfield, Denyer, dan Smart (2003), the SLR stages include planning the review, conducting the review, reporting, and dissemination. The data used in this article are sourced from books and scientific articles that explain the learning model of inductive thinking, Math Journaling, and Self Regulated Learning. The data are then analyzed qualitatively following an interactive data analysis model consisting of three stages: data reduction, data display, conclusion drawing/and verification (Miles, Huberman, & Saldana, 2014).

3. Result

Self-Regulated Learning

Self-regulation is an important component in social cognitive theory (social cognitive theory). Social cognitive theory is a continuation of social learning theory (social learning theory) with a long and rich historical background. Albert Bandura was the first person to publish social learning theory in the early 1960s, which was later renamed to social cognitive theory in 1986 in his book entitled Social Foundations of Thought and Action: A Social Cognitive Theory (Brown, 1999).

Social cognitive theory has three basic principles (Brown, 1999). The first principle that the consequences caused by a response (such as rewards and punishments) allow a person to carry out certain similar behaviors in similar situations. The second principle is that humans can learn by observing others rather than through individual participation in an activity. Learning by observing the successes and failures of other people’s behavior is called vicarious learning. The concept of vicarious learning is not shared by behavioral learning groups (Brown, 1999). The third principle is that the individual is very likely to imitate the behavior he observes from others. Identifying others’ behavior is a function of the extent to which a person perceives others like themselves and the degree of emotional attachment he feels to others (Brown, 1999). The social cognitive theory defines human behavior as a triadic, dynamic, and reciprocal interaction between individual, behavioral, and environmental factors (Brown, 1999; Bandura, 1986). In the view of social cognitive theory, humans are not driven by internal forces or formed by external stimuli automatically. Functions in humans are explained through the triadic reciprocal model, which states that behavior, cognition, and other individual factors, as well as events that occur in the environment, all operate as determinants as a whole (integrating determinants) (Bandura, 1986).

Bandura in (Brown, 1999) said that the system of self-regulation bridges external influences with the capabilities or capital of humans as a basis for engaging in purposeful behavior, thus enabling humans to have individual control over their thoughts, feelings, motivations, and behavior. Based on this understanding, self-regulation has an important role in human behavior. Self-regulation (self-regulation) can be interpreted as self-direction or self-regulation in behavior. Self-regulated learning can be interpreted as "organizing or directing themselves in learning" or "learning by directing or regulating themselves." Researchers use the term "learning based on self-regulation" to replace the term self-regulated learning, a more efficient term without reducing its meaning. Bandura’s social cognitive theory states that self-regulation in learning is determined not only by personal factors but also by behavioral factors and environmental factors/external factors, which are mutually related (Alwisol, 2004). The results showed that the SRL process occurred in three stages: first, students analyzed the assignment by setting goals and making strategic plans. Students tried to motivate themselves, and the last stage was self-reflection of the activities they had done.

The term self-regulation can be identified with the term self-control, self-discipline, and self-directed (Cobb, 2003). Like self-regulation, which has several terms, self-regulated learning also has several definitions, including those defined by Zimmerman (1989) as the active ability of learners metacognitively, motivational, and behavioral in the learning process. Students coordinate themselves to plan, organize, self-teaching, self-monitor, and evaluate themselves at different learning stages. In Motivational terms, they consider themselves to be competent, have self-efficacy, and be autonomous. While behaviorally, they can choose, shape, and create an environment for optimal learning. Students who have self-regulated learning respond to the tasks given to them with confidence, perseverance, and logic. They realize when they have to master certain skills and even a set of other skills and use appropriate strategies for achieving their goals.

Aside from being a skill or ability, as described above, Zimmerman also mentioned that self-regulated learning (SRL) is learning that focuses on
how students move, change, and maintain learning activities both on their own and in their social environment, in informal instructional contexts or formal (Zimmerman, 1989). SRL is not a permanent trait, but rather a skill that can be developed and honed through personal experience and practice in implementing SRL strategies (Schunk, 2005; Zimmerman, 2015). Students who make self-regulation are aware of their emotions and have strategies to manage emotions (Winne & Butler, 1995). Equally important, students who conduct self-regulation can evaluate the obstacles that may arise and make the necessary adaptations. It can be concluded that students who make self-adjustments are certainly able to control themselves in carrying out activities in harmony with the norms surrounding their lives, including social norms and religious norms where the inculcation of the values of character expected by these norms.

Self-regulated learning is also defined as a self-initiated action that includes a setting of goals (goal setting) and arrangements for achieving goals, time management, and setting the physical and social environment (Zimmerman & Risemberg, 1997). Self-regulation, or self-direction, self-regulation in behavior, is the ability to control one's behavior and one of the main drivers of human personality. Self-regulation is one of the important concepts in social cognitive theory; it is the key to understanding the theory. For more than two decades, social learning theory researchers have researched self-regulation, such as giving gifts or rewards to oneself, setting standards, delaying pleasure, setting goals, perceptions of self-efficacy, self-governance, and self-evaluation. Students who manage their learning (self-regulated learning) are metacognitive, behavioral, and motivated to be active in learning, so they will continue through three phases: the preparation phase, the performance phase, and the assessment phase (Zimmerman, 2002). Components that can be measured to determine self-regulated learning that has implications for student performance in school are cognitive management, metacognitive management, motivational arrangements, and emotional regulation.

**Learning Models of Inductive Thinking**

The inductive thinking learning model explores inductive processes in students who are relatively rigid and flexible. This inductive thinking learning model is designed to train students to make concepts and, at the same time, work on the concepts and how they are applied (generalized). This is following the principle of inductive thought, where the thought that starts from a certain number of cases becomes a general thing or generalization (Hamad, 2007; Krawczyk, 2018). The main features of this induction generally depend on the accumulation of positive examples to verify a theory into truth (Page, 2014). Next Stenberg and Stenberg put forward two reasons why people need to do inductive reasoning, namely 1) Help to become more proficient in understanding the correct variability in the environment, 2) help predict events in the environment so the uncertainty of prediction of a minimized event (As’ri, 2016).

This research model also has an accompanying awareness that is aware of the nature of knowledge and logical thinking. Besides, the model also raises awareness of the importance of science (Joyce & Weil, Model of teaching, 1996). Inductive thinking learning models are included in the group of information processing learning models (Joyce, Weil, & Calhoun, 2011), which are useful for developing students' thinking abilities (Nurlia, 2014; Billing, 2013). Through the inductive thinking learning model, a teacher must be able to provide questions so that students can arrange subject matter by thinking and building ideas (Hidayah & Harini, 2014). This learning model is proven to have a positive effect on student learning outcomes (Putri, Ardana, & Ganing, 2014; Arwira, Ramadhani, & Nasution, 2017; Sitorus & Siregar, 2018), conceptual knowledge (Respioka & Simamora, 2018), generic skills and students' responses (Warimun & Murwaningsih, 2015). Inductive thinking learning models are also proven to improve the quality of learning, including the use of learning facilities, teacher performance, class climate, scientific attitudes, and student achievement motivation (Listyaningrum, Sajidan, & Suciati, 2012). This model can also increase students' interest in reading (Susmitahati, 2015; Saadati, Sari, & Sadli, 2019).

Those impacts, both instructional and accompaniment, can be described as shown below:
This inductive thinking learning model is a character whose developer is Hilda Taba, later developed by Bruce Joyce. This model is based on three assumptions, namely: thinking can be taught; thinking is an active transaction between individuals and data, and the thought process follows certain laws (by a lawful sequence).

This model includes three strategies, namely:
- Basic strategy: concept formation, data interpretation, and application concepts. The first strategy is pursued through 3 phases, namely, Phase 1: enumeration and making a list, Phase 2: grouping and Phase 3: labeling and categorizing. These phases can be described in Table 1:

**Table 1 Inductive Thinking Learning Model Phases: Basic Strategy**

<table>
<thead>
<tr>
<th>Over activity</th>
<th>Covert mental operations</th>
<th>Eliciting questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Enumeration, listing</td>
<td>Differentiation</td>
<td>What do you see? Nothing?</td>
</tr>
<tr>
<td></td>
<td>(identification of separate item)</td>
<td>Listen? Note?</td>
</tr>
<tr>
<td>2. Grouping</td>
<td>Identification of similar features, abstraction</td>
<td>What do you have in common? What is the criteria?</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Labeling, categorizing</td>
<td>Define the hierarchical order of items (super and</td>
<td>What is this group called? What belongs to what?</td>
</tr>
<tr>
<td></td>
<td>subordinate)</td>
<td></td>
</tr>
</tbody>
</table>

The second strategy, data interpretation, is pursued through 3 phases. Namely, phase 1: Identify important relationships; phase 2: examine the relationship; 3rd phase: making conclusions. These phases can be described in Table 2.

**Table 2 Inductive Thinking Learning Model Phases: Data Interpretation**

<table>
<thead>
<tr>
<th>Over activity</th>
<th>Covert mental operations</th>
<th>Eliciting questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify Important Relationships</td>
<td>Differentiation</td>
<td>What do you see? Nothing?</td>
</tr>
<tr>
<td></td>
<td>(identification of separate item)</td>
<td>Listen? Note?</td>
</tr>
<tr>
<td>2. Researching Relationships</td>
<td>Linking categories to each other</td>
<td>How could this happen?</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Make Conclusions</td>
<td>Beyond what is given</td>
<td>What does this mean?</td>
</tr>
<tr>
<td></td>
<td>Find implications, extrapolate</td>
<td>What picture is created in your mind? What is your conclusion?</td>
</tr>
</tbody>
</table>

The third strategy, application of concepts, is pursued through 3 phases, namely, phase 1: predicting consequences, explaining unknown phenomena, making hypotheses; phase 2: explain and/or support predictions and hypotheses; 3rd phase: verify the prediction. These phases can be described in Table 3.

**Table 3 Inductive Thinking Learning Model Phases: Concept Application Strategy**

<table>
<thead>
<tr>
<th>Over activity</th>
<th>Covert mental operations</th>
<th>Eliciting questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Predict consequences, explain</td>
<td>Analyses the characteristic</td>
<td>What will happen if ...?</td>
</tr>
<tr>
<td>phenomena, make hypotheses</td>
<td>nature of the problem or situation, releasing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>relevant knowledge</td>
<td></td>
</tr>
<tr>
<td>2. Explain and/or support predictions</td>
<td>Determine causal relationships that lead to</td>
<td>Why do you think this will happen?</td>
</tr>
<tr>
<td>and hypotheses</td>
<td>predictions or hypotheses</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Verify predictions</td>
<td>Use logical principles or factual knowledge to</td>
<td>What does this mean?</td>
</tr>
<tr>
<td></td>
<td>determine the conditions that are necessary and</td>
<td>What picture is created in your mind? What is your mind?</td>
</tr>
<tr>
<td></td>
<td>enough</td>
<td></td>
</tr>
</tbody>
</table>

Socially, this model has a high to a moderate structure. It is also cooperative, but the teacher is the initiator and controller of the activity. The teacher adjusts the task according to the level of the students’ cognitive activity and determines students’ readiness. In this model, students need raw data to be analyzed and organized. From the characteristics of the inductive thinking learning model that has an instructional impact on fostering awareness of the importance of science, this model can be very effective if applied to develop self-regulated learning.

**Math Journaling**

One subject that has a low National Final Examination result in mathematics. It was reported that the average score of students’ mathematics had not yet reached the national exam graduation standard. Compared to other subjects, mathematics is always far behind. So far, mathematics is considered a difficult subject for most students. This assumption is inseparable from the perceptions that develop in society about mathematics. The assumption of many people that mathematics is a difficult subject unwittingly has co-opted students’ minds. So students also think so, when dealing with mathematics. The view that mathematical science is dry, abstract, theoretical, full of symbols and formulas that are difficult and baffling. This assumption helps shape students’ negative perceptions of mathematics. As a result, mathematics is no longer objectively viewed.

The traditional paradigm of learning mathematics in schools tends to be dominated by the transfer of knowledge. The material is ample and difficult, and the demands to complete the learning
material have made the teacher teach mathematics quickly but not deeply. Mathematical learning is carried out with instruction patterns, not the construction and reconstruction of knowledge, even without allowing students to determine for themselves which direction students want to explore in finding knowledge that is meaningful to themselves. As a result, learning mathematics in schools is only rote and not a train mindset. Journaling is a media that is considered as a fairly simple media, where students are trained to be able to record their activities in mathematics learning, math journaling conceptualized from a writing prompt that can allow students to think about solving problems, formulate explanations, try vocabulary or spelling, experience in forming arguments, evaluating uses, criticizing judgments and reflecting on their understanding and ideas of others (Walz & Lincoln, 2008)). Journal writing in mathematics refers to structured writing assignments with specific questions to gain students' conceptual understanding of the given topic (Chai, 2004).

Math journaling has also been shown to have a positive impact on understanding rational number operations, especially students of class VIII (Smoak, 2017), as well as the attitudes and dispositions of gifted students towards learning mathematics (Tan & Garces-Bacsal, 2013). Journal writing also positively influences student communication in mathematical reasoning and the use of mathematical vocabulary (Kostos & Shin, 2010). This journal can also be used as a scaffold for students to become independent learners because they can monitor and take responsibility for their learning outcomes (Suhaimi et al., 2017). Mathematics is a very important subject and must be mastered by students because mathematics is a science that includes other sciences. Although not fully mastered, understanding the concept alone is enough. So Self-regulated learning in mathematics learning is possible to apply. From the characteristics of math journaling mentioned above, as well as by using the learning model of inductive thinking through mathematics learning in elementary schools, it is predicted that math journaling will be effective if applied in learning to improve self-regulated learning of elementary students. Math journaling is a treatment designed as a metacognitive activity aiming to help them uncover how they learn mathematics well (Tanler, 2006). Math Journaling is practiced by (Walz & Lincoln, 2008) to assist students in solving mathematics learning problems, where students are trained to create and use abilities in organizing, recording, and combining their ideas in mathematics.

Math journaling itself is a form of learning technique, which is one of the journaling techniques in general, which among other things, is to collaborate journals, bring to the journal's home and collect assignments and assessments into the journal as a portfolio. Journaling itself by Paris is stated as provoking. However, with a specific activity like journaling, it gives students opportunities for self-evaluation and independent problem solving; important skills for self-regulated learners (Paris & Paris in (Tanler, 2006). By using the math journaling model, teachers can set several learning goals and facilitate learners in the classroom. This is because, in the math journaling model, the teacher will see how students collaborate and discuss what must be addressed in their journals. Besides, with math journaling, teachers will witness students' willingness to bring their journals home to help complete homework. In this way, parents who are not familiar with topics in mathematics can also help their children (Walz & Lincoln, 2008). Students are instructed to do their cutting and pasting assignments in journals both individually and in groups so that they become a kind of portfolio. With this journal, students can use it as a source of their learning materials and self-evaluation tools for their work performance.

Math Journaling in the Inductive Thinking Learning Model Can Improve Self-Regulated Learning

The inductive thinking learning model explores inductive processes in relatively rigid and flexible way. This inductive thinking learning model is designed to train students to make concepts and, at the same time, work on the concepts and how they are applied (generalized). This model teaches students' interest in logic, interest in language, meaning of words, and interest like knowledge. This model contributes instructional impact in the form of students' ability to obtain information, form the formation of a concept, and apply it. Besides, the model also raises awareness of the importance of science. This model also has an impact accompanying the spirit of research, awareness of the nature of knowledge, and logical thinking (Joyce & Weil, Model of teaching, 1996).

This model can be very effective if applied to develop self-regulated learning from the characteristics of the inductive thinking learning model that has an instructional impact on fostering awareness of the importance of science. One of the subjects that have low National Final Examination results is mathematics. It was reported that the average math grade of students has not yet reached the National Exam graduation standard. Compared to other subjects, mathematics is always far behind.
Mathematics is considered difficult by most students because of the assumption inseparable from the perception in society. This has co-opted students’ minds when dealing with the mathematics that mathematical science is dry, abstract, theoretical, full of symbols and formulas that are difficult and baffling. This shapes students’ negative perceptions of mathematics. As a result, mathematics is no longer objectively viewed. The traditional paradigm of learning mathematics in schools tends to be dominated by the transfer of knowledge. The material is ample and difficult, and the demands to complete the learning material have made the teacher teach mathematics quickly but not deeply. Mathematical learning is carried out with instruction patterns, not the construction and reconstruction of knowledge, even without allowing students to determine for themselves which direction students want to explore in finding knowledge that is meaningful to themselves. As a result, learning mathematics in schools is only rote and not a train mindset.

Math journaling is a medium that is considered quite simple, where students are trained to be able to record their activities in learning mathematics, math journaling conceptualized from a writing prompt that can allow students to think about solving problems, formulate explanations, try vocabulary or spelling, experience in forming arguments, evaluating the usefulness, criticizing judgment and reflecting on their understanding and ideas of others (Walz & Lincoln, 2008). Math journaling model not only makes students get a richer and deeper understanding of the lesson but can also provide opportunities for students to reflect and measure their learning process. Math Journaling is defined as a reflection that can truly function as a set of measurements for self-evaluation (Walz & Lincoln, 2008). Mathematics is a very important subject that students must master for mathematics, which includes other sciences. Although not fully mastered, understanding the concept alone is enough. So Self-regulated learning in mathematics learning is possible to apply. From the characteristics of math journaling mentioned above, as well as by using inductive thinking learning models through mathematics learning in elementary schools, it is predicted that math journaling will be effective if applied in learning to improve self-regulated learning of elementary students. In the math journaling model, students are required to organize their activities related to mathematics learning, both at school and home. By learning based on self-regulation metacognitively, students actively plan, coordinate, organize themselves, monitor themselves, and evaluate themselves at various stages in the learning process.

4. Discussion

Self-Regulated Learning

Self-regulated learning refers to learning that occurs largely from the thoughts, feelings, strategies, and behaviors produced by students themselves aimed at achieving goals (Zimmerman, 1989). Self-regulated learners not only need to have cognition (knowledge building or knowledge to build upon), and metacognition (knowledge and monitoring learning strategies), but they must also be motivated to use their metacognition strategies to build their understanding of learning materials (Pintrich & De Groot, 1990). A study shows that personal abilities that enable students to become independent learners and develop a core of excitement (resilience) are closely related to achievement (Zimmerman & Martinez-Pons, 1988).

Learning Models of Inductive Thinking

The inductive thinking learning model teaches students to have an interest in logic, interest in language, and the meaning of words, and interest like knowledge. This model contributes instructional impact in the form of students’ ability to gather information, practice it carefully, process information with concepts, and learn to manipulate them (Anggraini, 2017). In this model, students have to observe, measure, collect data, and assess the assumptions to get conclusions (Barra, Wilujeng, & Kusanto, 2019).

Math Journaling

Math journaling makes students have richer and deeper understanding of the lesson and can provide opportunities for students to reflect and measure their learning process. Math Journaling is defined as a reflection that can truly function as a set of measurements for self-evaluation (Walz & Lincoln, 2008). Writing a journal gives the teacher a complete picture of the students’ depth of understanding and thinking (Baxter, Woodward, & Olson, 2005). Journaling can also minimize the phenomenon of "dumbing down," where gifted children deliberately score below their potential in math exams and other evaluative steps to better suit their less talented classmates (O’Boyle, 2008). Journal writing also provides a way for students to express their doubts and frustrations about learning (Towndrow, Tan, & Vethan, 2008).

Math journaling can be implemented in the curriculum without disrupting the methods used by the teacher in the classroom (Walz & Lincoln, 2008). This math journaling not only changes the way of learning and teaching but also improve the way that can lead to self-regulated learning in students. It is
because this math journaling can also be used as a strategy in self-regulated learning (Tanler, 2006).

Math Journaling in the Inductive Thinking Learning Model Can Improve Self-Regulated Learning

Math journaling is a medium that is considered quite simple, where students are trained to be able to record their activities in learning mathematics, math journaling conceptualized from a writing prompt that can allow students to think about solving problems, formulate explanations, try vocabulary or spelling, experience in forming arguments, evaluating the usefulness, criticizing judgment and reflecting on their understanding and ideas of others (Walz & Lincoln, 2008). Math journaling model not only makes students get a richer and deeper understanding of the lesson but can also provide opportunities for students to reflect and measure their learning process. Math Journaling is defined as a reflection that can truly function as a set of measurements for self-evaluation (Walz & Lincoln, 2008).

5. Conclusion & Recommendations

Math journaling in the inductive thinking learning model is a learning medium applied in the learning process at the elementary level, as a strong foundation for developing self-regulated learning in elementary students. With this flow, as presented in this paper, is expected to make a meaningful contribution to the implementation of teaching and learning activities in this country. The contribution is then expected to improve the education system in Indonesia. Teachers can apply this concept to foster self-regulated learning of their students.

6 References:


