The Application of Thematic-Scientific Learning In Elementary Schools By Distance Learning To Build Higher Order Thinking Skills

Theresia Kriswianti Nugrahaningsih¹*, Ummu Hanny Almasitoh², M. Pujo Darmo³, Iswan Riyadi⁴.

¹ Departement of Mathematics Education, Universitas Widya Dharma Klaten
² Department of Primary Teacher Education, Universitas Widya Dharma Klaten
³ Departemen of Pancasila and Civics Education, Universitas Widya Dharma Klaten
⁴ Department of Geography Education, Universitas Widya Dharmo Klaten

Email: ¹* kriswianti.th@gmail.com, ² ummuhany@unwidha.ac.id, ³ pujodarmo@unwidha.ac.id, ⁴ iswanriyadi@gmail.com

Abstract: In entering the era of the industrial revolution 4.0 which is also known as the phenomenon of disruptive innovation, a learning process is needed that leads to the formation of high-order thinking skills (HOTS). Elementary school is the earliest formal education to provide a foundation for the next education. For this reason, HOTS-based learning is also needed in elementary schools. Following the demands of the refined 2013 curriculum, learning is given in a thematic form. This study is combining thematic learning with scientific learning to build higher-order thinking skills. Because currently it is still in a pandemic period, so the learning is carried out by distance learning. To support the learning, the communicative learning media are made that can be accessed by zoom meeting and lead to higher-order thinking. The media is made using power points, which be arranged according to sub-themes, that have been determined according to the curriculum based on the stages of scientific learning by paying attention to higher-order thinking processes. Also, an evaluation tool that leads to higher-order thinking is developed. From the trial results, scientific thematic learning can be carried out online with the help of power point media, with the result that more than 70% of students get a score of more than 70. By using the mean difference test, it is evident that there is a significant increase in the average value between pretest and posttest for 4 (four) subjects. The limitation of this learning is that not all students can actively participate in online discussions.

1. Introduction

Primary school education is the initial level for every human being to become the foundation for further education. At the elementary school education, it is expected to be able to shape the character of students. The government mandates the 2013 Curriculum for Elementary Schools by applying a thematic approach and scientific-based learning approach that leads to attitudes, skills, and knowledge by emphasizing that students 'know why', 'know how', and 'know what' [1]. The thematic approach presents learning with one specific theme for several subjects at once. The thematic approach is an integrated learning model that uses one particular theme to associate several subjects so that it can be an interesting learning and can provide meaningful experiences for students. Learning begins by presenting a more actual and contextual learning theme in everyday life, by connecting various ideas, concepts, skills,
attitudes, and values, both between subjects and within one subject. The choice of themes is tailored to the subject matter, to teach one or more concepts that combine various information. This is in accordance with Smalldine's opinion, that thematic learning allows teachers to organize learning in several topics by integrating content and skills from several subjects [2]. Meanwhile, Kovalik argues that thematic learning is a model of curriculum and learning model that facilitates the achievement of goals more easily [3]. The thematic approach guides students to be able to better analyze topics thoroughly, be able to understand basic concepts, and find value in problems.

While the scientific-based learning approach includes observing, asking, reasoning, trying, forming networks for all subjects. Learning with a scientific approach is learning that consists of observing activities (to identify things you want to know), formulating questions (and formulating hypotheses), trying/collecting data (information) with various techniques, associating/analyzing/processing data (information) and draw conclusions and communicate the results which consist of conclusions to obtain knowledge, skills, and attitudes. These steps can be continued by creating activities [4].

According to the objectives in formulating the 2013 curriculum, thematic approaches and scientific approaches are expected to be able to form complete knowledge for students and be able to build higher-order thinking skills for students [5].

Higher-order thinking skills are skills that include thinking critically, logically, reflective, metacognitive, and thinking creatively. According to King et al, higher-order thinking skills are activated when individuals experience unknown problems, uncertainty, questions, or dilemmas [6]. Chamot and Kupper stated that metacognitive strategies are considered as high-level executive skills that utilize the cognitive process and involve thinking about the learning process, planning learning, monitoring learning tasks, and evaluating how well someone has learned [7].

To build high-order thinking skills, it cannot be separated from the dimension of metacognitive knowledge. High-level thinking skills include critical, logical, reflective, metacognitive, and creative thinking. They are activated when individuals face unknown problems, uncertainties, questions, or dilemmas. Successful application of skills produces valid explanations, decisions, performance, and products in the context of available knowledge and experience and that promotes sustainable growth and other intellectual skills [8].

Blakey introduced metacognitive strategies, namely by linking new information with previous knowledge, selecting strategies to monitor, and evaluating his thought processes [9]. In learning with a thematic approach, to reveal initial knowledge, it is necessary to open the lesson by showing a video sub-theme that contains contextual problems that are familiar to students. Thus, the teacher can make students think actively to ask questions, express opinions, and reflect on the truth of their opinions along with other students. Metacognitive strategies ensure effective teaching and help students learn mathematics effectively [10]. Aydin concluded that metacognitive skills develop thinking skills, provide active learning, develop general abilities and intelligence, develop problem-solving skills [11].

Anderson and Krathwohl revised Bloom's Taxonomy into six thinking skills, namely, remembering, understanding, application, analyzing, evaluating, and creating. Of the six thinking skills grouped into two thinking abilities, namely higher-order thinking, which includes analyzing, evaluating, and creating, and low order thinking skills which include remembering, understanding, and application [12]. Fostering students' higher-order thinking skills are considered an important educational goal. To hone students to build higher-order thinking skills, many experts have conducted research. Barak introduced elements of constructivist pedagogy combined with specific measures aimed at encouraging the higher-order thinking in science classrooms necessary to make the development of higher-order thinking a regular ingredient in current school science teaching [13]. Madhuri et al promoted students' higher-order thinking skills in chemistry by using inquiry-based learning by designing laboratory exercises based on Bloom's taxonomy, using the just-in-time facilitation approach. A pre-laboratory discussion that described the experimental theory and its relevance is carried out to enable the students to analyze real-life problems. Students' performance is assessed based on their ability to conduct experiments, design new experiments, and relate the practical utility of the subject modules to real-life [14].
While Anat Zohar in his research divided the objects into 4 (four) programs. They concluded that by involving higher thinking skills, students with high academic achievement obtained higher thinking scores than their peers with low academic achievement, but both groups showed significant progress, even students with low achievement made greater progress. They showed a higher increase in thinking skills than students with high achievement. From the results of his research, Zohar strongly suggested that teachers should encourage students of all academic levels to engage in tasks that involve higher-order thinking [15]. In the next studies, Anat Zohar and Schwartz enhanced the assignment of higher-order thinking tasks by providing a variety of thinking strategies; increasing student involvement in metacognitive thinking; and using "language thinking" in the classroom [16]. Meanwhile, Barnett's tips for improving critical thinking are to give higher-order thinking questions [17]. So, to practice high-level thinking skills students have developed evaluation tools by tackling high-order thinking skills.

This paper is the second year of research to develop learning models and media by combining thematic approaches, scientific approaches, and involving metacognition to build higher-order thinking skills in elementary students. Research takes learning in elementary school, so that high-level thinking skills of students can be formed early. The 2013 curriculum has been launched since 2013, but in its implementation, there are many obstacles, so that until now it has not been implemented perfectly. From the results from the first stage of research, information was obtained that in the 2018/2019 academic year, learning was still using the old curriculum, namely KTSP, because only grade I and grade IV was required to use the 2013 curriculum with a thematic approach. So, for grades II, III, V, and VI not all teachers have implemented the 2013 Curriculum. More teachers use KTSP than those who use the 2013 Curriculum. In the 2019/2020 school year all classes are required to use the revised 2013 Curriculum, with a thematic approach. From the survey results, only 24% have used the thematic approach for more than 4 years. The remaining 25% have just started in the 2019 school year, and 50% have only used a thematic approach for 2-4 years. In teaching with a thematic approach, there are still many shortcomings, especially in presenting the theme at the beginning of the lesson. The teachers did not use the PowerPoint media in learning. Besides, learning for each subject becomes less focused, because the teacher only focuses on how to change subjects so that they appear coherent according to the theme. Teachers have not been able to condition students to be able to "ask questions", one of the stages in the scientific approach. In terms of communicating learning outcomes, students have not been able to communicate coherently. This will affect the high-order thinking skills of students, it appears that the results of student learning evaluations related to high order thinking are still low.

To support learning, learning media were developed that combined a thematic approach and a scientific approach, with attention to metacognition for elementary students. The evaluation tool developed is also made regarding higher-order thinking skills. The results of this study will produce research products in the form of data on the effectiveness of learning models and descriptions of learning in elementary schools, with a thematic and scientific approach as mandated in the 2013 curriculum in elementary schools.

2. Method
This paper is part of a multiyear competitive grant research, conducted in the second year. This part of the research is a classroom action research, carried out in third grade SD Kristen 2 Klaten in the 2020/2021 school year. SD Kristen 2 Klaten is located in Sumberejo Klaten Selatan. This research was conducted for 1 month in August 2020. The subjects of this study were all third-grade students of the odd semester of the 2020/2021 school year, which may be 15 students. Consisting of 12 male students and 3 female students.

This study revealed the implementation of learning in elementary school related to the implementation of the 2013 curriculum and the results of student evaluations related to higher-order thinking skills of students.
2.1. Data Collection Techniques

In this study, the data were collected by (1) observation and (2) tests. Observation is an evaluation of non-test techniques that take inventory of student and teacher activities, student personality in learning, methods used, and class conditions in a learning process. To monitors the implementation of learning and student activity, we used an observation sheet. Student activity that was observed was activeness in the following lessons, asking questions, or submitting opinions. Tests are questions or exercises or tools used to measure skills, intelligence knowledge, abilities, or talents possessed by individuals or groups. The test to be given in this research is a written test in the google form. The completeness of learning outcomes is as follows (a) a student is said to be complete if he/she has reached more than 70% absorption, (b) a class is said to have completed learning if there are 70% of the total students who reach more than 70% absorption.

2.2. Research Procedures

This classroom action research was carried out in several cycles. Each cycle consists of three meetings. At the end of each cycle, it is evaluated whether there is an increase in student learning outcomes or not. Each cycle starts with planning, acting, observing, and reflecting. The cycle will stop when the indicators of success have been reached.

2.3. Data Analysis Techniques

The data collected are in the form of quantitative and qualitative data. Quantitative data in the form of pretest and posttest scores. To test the effectiveness of the model, the average of pretest and posttest scores will be compared. To test the significance of the increase in the mean value, the mean difference test was used with the help of the Minitab program.

Qualitative data is in the form of notes about the activities of students and teacher during learning. The student activities that were observed were the student's activity in participating in the lesson, how the students expressing their opinions, and how the students raised questions. The teacher's activities that were observed were how the teacher carried out thematic-scientific learning, how the teacher could activate students to be able and dare to express their opinions.

3. Result and Discussion

3.1. Result

From the results of a survey of 149 teachers in SD Klaten, it was found that there are 25% of teachers have just started teaching by thematic learning, 1% have never taught by thematic learning. The rest have 2 years or more using thematic learning. Of the 149 teachers, there were 8% of teachers who never made questions referring to HOTS, 48% only occasionally made questions referring to HOTS. About using aids for teaching, there were only 5% of teachers always use learning aids, 42% often use learning aids, 50% of respondents only occasionally use learning aids, the rest never use learning aids. Teachers who never used power points in teaching were 43% and who sometimes used power points as much as 47%, who often used power points as much as 8%, and who always used power points only 2%.

So it is necessary to develop a thematic-scientific learning model that can improve the higher-order thinking skills of elementary school students. In the second stage, a thematic-scientific learning model based on metacognition was developed to build higher-order thinking skills (PTSBM) of elementary school students. The next step is to improve the draft prototype I of the scientific thematic learning model based on metacognition to build high-level thinking skills of elementary school students adapted to the 2020 pandemic. The stages of preparing a learning model by improving the model that has been planned. After the model is validated by the validator, the prototype model draft is refined. The foundation for improvement used is the philosophical basis of the model, pedagogical, theoretical, and empirical or the feasibility of its application. The five learning components proposed by Joyce [18] are used as a reference in developing the initial model, namely; 1) Syntax 2) Social System 3) Principle Reaction 4) Support System 5) Instructional Effect and Nurturant Effect.
In the first cycle, the teacher did not use web meetings such as zoom or google meet to teach but used WhatsApp media. This is because many students do not have their cellphones or laptops. They have to use their parent's cellphone. While their parents have to work in the morning. So students can only use it in the afternoon. Previously, the PowerPoint media was sent via WhatsApp, students were asked to pay attention, then take questions and give their opinions. Because of the implementation of learning only using WhatsApp media, not all activities at each stage can be carried out properly, especially for teamwork. Because the students in grade 3 of elementary school are not very good at writing on their cellphones yet, it is possible that the parents who answer and give their opinions. To overcome this, the opinions of students on WhatsApp are in the form of voice recordings.

From the results of the reflection, it was found that the implementation of learning still has many shortcomings. The obstacle faced is the time that becomes very long because many students are not fluent in typing on their cellphones, considering that they are still in grade 3 SD. There are even students who open their cellphones in the afternoon when their parents come home from work because their parents bring their cellphones. At the group discussion stage using video call on WhatsApp, in this case, the teacher can invite students to have a direct discussion. The teacher also tries to be more cooperative in paying attention to the students' questions, although they must patiently look at their cellphones. If the information is long, it can be done by audio call or video call, which is a facility from WhatsApp. However, this activity also takes a lot of time because not all students can participate, so for each group, the teacher has to agree with the parents of students so that they can hold discussions via video call. The advantage is that students are motivated to learn independently, so they can follow the lessons well. To overcome these limitations, assignments are made that can make students happy to learn independently. Efforts are made to use other media, namely using google meet, so that students can communicate directly with the teacher. By using google meet, teachers can present learning media in the form of power points that have been designed using thematic and scientific approaches. By communicating audio-visual, the teacher can ask questions that can make students think at higher levels. Also, students being given a youtube link according to the related topic, and students being asked to provide comments.

In the second cycle to anticipate the obstacles that occur, google meet is used to present the enhanced PowerPoint media. Learning is carried out in the afternoon when the parents of students have returned from their work so that all students are expected to be able to take part in the learning. The teacher also tries to be more cooperative in presenting PowerPoint media. In the first phase of the activity, namely the preliminary phase, the teacher presents the sub-themes to be studied, invites students to think and express their opinions. In the second phase, namely the knowledge construction phase, starting to enter each subject according to the web of themes. In this case, using the stages in the scientific approach, namely: 1) observing; 2) asking; 3) Trying/gathering information; 4) Associating processing information; 5) communicating. In the third phase, students are asked to answer a quiz, with questions that lead to higher-order thinking. In the fourth phase, the closing phase, students are invited to make conclusions together.

The final results after the third experiment for 5 (five) subjects are as follows:
The minimum completeness criteria limit (KKM) is more than 70. Only 2 students did not reach the KKM, namely for SBdP subjects. So that the research was stopped in cycle II

To see if there is a significant increase between the pre-test and post-test mean of 5 (five) subjects, the Minitab help is used with the following results:

| Subject                        | Pre-Test | Post-Test | T-test | P-value | Conclusion                      |
|--------------------------------|----------|-----------|--------|---------|---------------------------------|
| Mathematics                    | 91       | 96,33     | 2.20   | 0.018   | There is a significant increase in value |
| Indonesian Language            | 90.33    | 96,67     | 2.29   | 0.015   | There is a significant increase in value |
| Pancasila and Civil Education  | 92       | 98,33     | 3.54   | 0.0007  | There is a significant increase in value |
| Cultural Arts and Crafts (SBdP)| 88,67    | 92,33     | 1.75   | 0.045   | There is a significant increase in value |
| Sports Education and health (PJOK) | 90.69 | 93       | 0.64   | 0.26    | There is no difference in average |

By looking at the table, it appears that 4 (four) of 5 (five) subjects, namely Mathematics, Indonesian Language, Pancasila and Civics Education (PPKN), Cultural Arts and Craft (SBdP) have a significant increase in value. There was no significant increase in Sports Education and Health (PJOK), although some students showed an increase in grades.

The results of the classroom action research that was carried out on a limited basis in SD Kristen 2 Klaten are as follows:

3.1.1. Syntax:

a. Phase I: Introduction and Sub-theme delivery
   1) Opening lessons and holding apperception through questions and answers.
2) Motivating students by suggesting the benefits of studying this material and expressing expectations
3) Delivering the sub-themes to be taught, which are presented with the media
4) Exploring students' opinions regarding the themes presented
5) Provide responses to students' opinions / questions

b. Phase II: Knowledge Construction.
Enter each subject by starting from the theme that has been presented in the PowerPoint media
1). Observing:
   a) The teacher provides an introduction, then asks students to read the text, then together with the students summarizes the important things contained in the reading.
   b) Presenting declarative and procedural knowledge, especially concepts, principles, and skills, by always asking for students' opinions, inviting students to think.
2) Asking:
   a) Checking student understanding through questions and answers. Questions refer to higher-order thinking skills.
   b) Ask students to make questions related to learning material
3) Trying / collecting data (information):
   a) Forming small groups and distribute Student Worksheets (LKS), asking students to immediately work on and discuss
   b) Students observe and recheck what has been done. The teacher assists as needed to students who are experiencing difficulties
4) Associating/processing information:
   a) students process the information that has been collected
5) Communicating:
   a) The teacher asks students to present the results of their group work
   b) The teacher provides feedback and together with the students makes conclusions

c. Phase III: Assessment
1) The teacher asks students to work on quizzes on the LKS individually
2) The teacher collects the results of the quiz to be checked

d. Phase IV: Closing.
In closing activities:
1) The teacher together with students summarize what they have learned
2) The teacher gives independent assignments/homework (PR) and asking for an agreement on the deposit time
3) The teacher closes the lesson and reminds students to keep studying hard and conveying things that are considered important for the next meeting.

3.1.2. Social system
Students work together with friends in a team or group to discuss problems via video calls on WhatsApp. They can come up with ideas to solve problems. The teacher seeks to select a process of activity that allows teachers and students to collaborate. The atmosphere tends to be democratic. In online learning, this is done by using video calls or discussions on WhatsApp.

3. Principle of Reaction
The principle of reaction describes how the teacher should view, treat, and respond to students. The principle of reaction that develops in this learning model positions the teacher as a facilitator when students carry out problem-solving activities. Students are stimulated by challenging questions to be able to solve problems collaboratively.
3.1.3. Support System

Support systems are all means of materials, tools, or learning environments that support learning. The support system in this learning model is in addition to lesson plans, teacher's book, student's book, HOTs-based evaluation tools, as well as learning media in the form of power points that display contextual problems as sub-themes. It will create a confrontational atmosphere and can generate metacognition processes, critical thinking, and solving problem abilities.

3.1.4. Instructional and Nurturant effects

The instructional effects of this learning model is an increased understanding of knowledge and problem-solving skills, indicated by an increase in the value of each subject. While the nurturant effects include opportunities for students to improve problem-solving skills, build their knowledge, foster motivation in learning, improve students' higher-order thinking skills, improve communication, and work together in groups.

Strengths and Limitations of the PTSBM Learning Model.

Although efforts have been made to continuously improve the PTSBM model during the development stage, as something new, this model still has limitations, in addition to its strengths.

The strengths of the PTSBM Model are as follows:

a. The students become more active, more critical, and have high motivation because learning becomes more colorful
b. By the learning that started from the same theme for various subjects, students' knowledge becomes intact and connected. It will make an interconnected network of knowledge in the brain, so this will make the knowledge more durable.
c. By the theme with the contextual thing, the students can be trained to construct their knowledge with the support of the teacher.
d. By often guiding students with questions at cognitive levels C4 to C6, it can train students to think critically and improve students' mastery of the material.
e. Student understanding increases, it marked by increased student learning outcomes

While the limitations of this model are as follows:

a. There are students' limited abilities, for example in mastering initial knowledge, it needed hard work from both teachers and students
b. It needed hard work of teachers to practice students' metacognitive thinking and higher-order thinking skill.
c. Due to online implementation, there are many shortcomings, among others, because some students do not have the facilities to take part in online learning. Besides, students are also less able to focus on learning online. Of course, the role of parents is very necessary. Because there are various backgrounds of parents, there are also various forms of parental support. Some actively participate in learning and guide their children, even asking questions that are not clear through the WhatsApp group. However, some parents do not want to know about their child's education.

3.2. Discussion

The effectiveness of the five components of learning as proposed by Joyce [18] has been tested. The five components developed in this model are; 1) Syntax 2) Social System 3) Principle Reaction 4) Support System 5) Instructional effects and nurturant effects. The instructional impact is that there is an increase in the value of 4 (four) subjects, namely Mathematics, Indonesian Language, Pancasila and Citizenship Education (PPKN), Cultural Arts and Crafts (SBdP). While the nurturant effects are starting to form students' higher-order thinking skills.

Following Zohar's suggestion that teachers should encourage students of all academic levels to engage in tasks involving higher-order thinking [15], this study was carried out in primary schools. This study proved that learning with a thematic-scientific approach based on metacognition can build
students' higher-order thinking skills. Starting with contextual problems, students are asked to identify problems that arise, students are invited to express their opinions regarding the problems that arise. This will motivate students to think in higher order. This will be realized if there is two-way communication between teachers and students.

By the theme with the contextual thing, the students can be trained to construct their knowledge with the support of the teacher. By the learning that started from the same theme for various subjects, students' knowledge becomes intact and connected. By often guiding students with questions at cognitive levels C4 to C6, it can train students to think critically and improve students' mastery of the material. As F.J. King and friends wrote that higher-order thinking includes critical, logical, reflective, metacognitive, and creative thinking. these skills are activated when students of any age encounter unfamiliar problems, uncertainties, questions, or dilemmas. successful applications of these skills result in explanations, decisions, performances, and products that are valid within the context of available knowledge and experience, and promote continued growth in higher-order thinking, as well as other intellectual skills [19].

According to some researchers, proved that HOTs can be improved through learning, such as Purnamawati’s research proves that the use of metacognition-based learning tools in the field of Industrial Electronics Expertise was effective for growing HOTS capabilities [20]. HOT skills acquisition can also be enhanced through science teacher in-service professional development programs on how to use the curriculum to impart an understanding of scientific concepts and their applications in daily life [21]. The study about Teaching Science through Inquiry contributes to the body of knowledge on the development of higher-order thinking skills in general, and inquiry skills development in particular [22].

4. Conclusion

4.1. Conclusion

This online scientific thematic learning, despite facing many obstacles, can improve students' higher-order thinking skills. To overcome the obstacles that exist in online learning, learning begins by presenting contextual problems as the main theme, then students are asked to identify problems that arise, students are invited to express their opinions about problems that arise. This can be done using video conference media such as google meet. By using video conference media, teachers can provide opportunities for students to express their opinions directly, so two-way communication between teachers and students can take place. The teacher always needs to stimulate students with questions that lead to cognitive levels 4 to level 6 in the revised Bloom's Taxonomy. The assignment that is given can make students able to analyze existing problems, students can express their opinions to solve problems. The problems that are given are problems that are often faced by students daily. This makes students more excited about doing their assignments. Also, students can be given youtube links according to related topics and students provide comments.

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