Mathematical Module Based on CTL Approach to Increase Learning Motivation and 4C Skills

Athifah Rahmi, Suparman

Abstract: This study aims to analyze the application of ADDIE learning design models learning models to improve learning motivation and 4C students in Indonesia. 4C skills are important skills students have in 21st century learning and the industrial revolution 4.0. Meanwhile, student motivation is low impact on learning outcomes are low. So to improve motivation to learn and 4C skills the need for providing teaching materials in accordance with the characteristics of students. The subjects of the study were students of class VIII at a junior high school in Yogyakarta. Research objects include 4C skills, learning motivation, CTL approach, mathematics learning modules, ADDIE learning design models and Numbers Pattern material. This study used qualitative research methods. The instruments used include observation and study of literature. Data analysis using Miles-Huberman consisting of data reduction, data presentation and drawing conclusions. This study provides results in the form of making a mathematics learning module by applying the ADDIE learning design model, CTL approach to the Numbers Pattern material to increase students' motivation and 4C learning skills.

Key Words : ADDIE, CTL, 4C Skills, Modules, and Learning Motivation

1 INTRODUCTION

IN the era of learning in the 21st century and in the 4.0 industrial revolution, it is known that the development of science and technology is so rapid that this has also influenced the world of education. Students are expected to not only be able to master the theory of learning and get satisfying learning achievements, but now students are also expected to be able to master certain skills. These skills include critical thinking, communication, collaboration and creative skills. First, critical thinking is one of the cognitive strategies used by students to gain additional knowledge through thinking of alternative solutions, developing and playing with ideas, questioning and providing evidence to support ideas. In addition, critical thinking is one of the cognitive processes that helps in self-regulation systems and is also related to motivational factors such as self-efficacy, expected outcomes, task value, and goal orientation [1]. The development of the definition of critical thinking is the process of examining internally and exploring issues of concern, triggered by certain experiences, which creates and clarifies meaning in terms of oneself and others, and which results in changes in perspective and conceptual relationships [2]. Critical thinking skills consist of sub skills such as analyzing, evaluating and concluding so that it is a metacognitive process [3]. Second, students are expected to be fluent and able to communicate effectively and they must be able to convey their thoughts with clarity and confidence both in written and oral form [4]. Third, Collaboration has become an important characteristic of science today and can offer great benefits, for example that joint scientific work and scientific collaboration have a higher potential for solving complex scientific problems [5]. Fourth, creativity is defined as the skills to produce original and meaningful solutions for new situations [6]. This ability is one of the important abilities in everyday life because every one will face various problems with demands to have creative thoughts to find solutions to face problems [7]. This is the reason why these skills are considered important to have because of the many benefits or benefits obtained if you can apply them in life. This is considered important because the application of 4C skills is very large influence the benefits for students in their daily lives, so students are expected to be able to grow and develop properly [8]. But the reality found today is the lack of student motivation. Meanwhile, learning motivation plays an important role in the learning process in order to achieve the expected learning achievements or results. Motivation is a core concept of educational psychology with a long history and different theoretical paradigms [9]. The ways that can be strived to improve student motivation include learning by providing an approach or learning model and providing appropriate and interesting learning tools. Exactly what is meant here is what is in accordance with the characteristics of the student. Factors that influence students 'motivation in learning science are students' interpretations about the nature of the task, success or failure of students to make progress in scientific understanding, students 'goals in class, and students' affective orientation towards science [10]. In this study, researchers took the subject of research that is around the scope of mathematics learning. Here the researcher will design a learning tool in the form of a mathematics learning module with a learning design model, learning model or approach and certain learning material to increase student motivation and 4C learning skills in Indonesia. The reason why taking a learning tool in the form of a mathematics learning module is because the use of this mathematics module is one of the methods used so that students are active and motivated in the implementation of mathematics learning [8]. Modules are independent teaching materials that contain a series of learning experiences and are arranged systematically in order to help students achieve learning goals [8]. The right approach or learning model can encourage or provoke students to follow the learning process in class. Here the researcher takes an approach or model of CTL learning to be applied to students. Based on the results of literature studies, it was found that CTL is a comprehensive approach that resembles the workings of nature and can unite concepts and practices [11]. CTL is also an innovative instructional tool whose work can build contractibility of students in critical thinking, inquiry learning, problem solving related to the actual, intellectual and relevant social context [11]. Then why the chosen learning design model is ADDIE learning design model. The answer is because the ADDIE

- ***Athifah Rahmi*** *is currently pursuing master's degree program in Mathematics Education at Ahmad Dahlan University, Indonesia*
- ***Suparman*** *is an associate professor in mathematics education at Ahmad Dahlan University, Indonesia, PH-081328201198. E-mail: suparman@pmat.uad.ac.id*

model is easy to use by many people in the field where the scope is wide enough to be used and guides users along a simple process path from beginning to end with the existence of a final evaluation [12]. ADDIE is a basic model for instructions which steps follow and support each other to complete the learning process [13]. As for the most commonly used instructional design framework it is also based on a systems approach and represented by ADDIE (Analysis, Design, Development, Implementation, and Evaluation) [14].

2 METHOD

This research is a qualitative research. This is because the data obtained in this study come from interview guidelines, observation and literature studies. Interviews and observations are among the main sources of data in qualitative research [15]. Observations are usually carried out in various types of quality research, for example, such as in ethnography, case studies, and qualitative action research studies [15]. As for the real world of data collection, namely at the time of interviews and formal conversation often intertwined or related to observation [15]. This research was conducted on eighth grade students at junior high school, Yogyakarta. Data analysis will be performed using Miles-Huberman analysis which consists of data reduction, data presentation, and conclusion drawing [16]. The design used is the ADDIE model design as can be seen in Figure 1 [17].

	Analyze	Design	Develop	Implement	Evaluate
Concept	Identify the probable causes for a performance gap	Verify the desired performances and appropriate testing methods	Generate and validate the learning resources	Prepare the learning environment and engage the students	Assess the quality of the instructional products and processes, both before and after implementation
Common Procedures	1. Validate the performance gap 2. Determine instructional goals 3. Confirm the intended audience 4. Identify required resources 5. Determine potential delivery systems (including cost estimates) 6. Compose a project management plan	7. Conduct a task inventory 8. Compose performance objectives 9. Generate testing strategies 10. Calculate return on investment	11. Generate content 12. Select or develop supporting media 13. Develop guidance for the student 14. Develop guidance for the teacher 15. Conduct formative revisions 16. Conduct a Pilot Test	17. Prepare the teacher 18. Prepare the student	19. Determine evaluation criteria 20. Select evaluation tools 21. Conduct evaluations
	Analysis Summary	Design Brief	Learning Resources	Implementation Strategy	Evaluation Plan

Figure 1. *ADDIE Model of Learning Design*

3 RESULTS AND DISCUSSION

In this study, researchers will apply or create a design with a particular model of learning design on a mathematics teaching material, namely the ADDIE learning design model. The teaching material chosen by researchers here is a module, which is a mathematics learning module. One solution that can be done is to develop teaching materials in the form of modules, so that this is expected to be able to facilitate students to be able to follow and complete basic competencies well [18], [19]. [20], [21], [22], [23]. The stages of the ADDIE model of learning design can be seen in Figure 2.

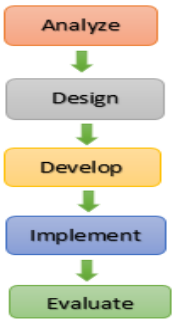

Figure 2. *Stages of the ADDIE model design*

3.1. Analysis

The analysis phase is the first step to begin the next stage or step, the learning design process. This stage is very important to identify student needs. During the analysis phase, there are several steps that must be done such as analyzing students, determining learning objectives, and developing learning objectives [13]. Based on observations obtained that the manual used in the process of learning Mathematics in class VIII is a Mathematics Textbook containing practice questions, the Mathematics Package Book 13 and the Mathematics Package Book KTSP 2006. These Mathematics books can be seen in Figure 3.

Figure 3. *A kind of Worksheet, K 13 Mathematics Textbook and KTSP 2006 Mathematics Textbook*

Based on the results of the interview it was found that students were not enough and could not just use the Mathematics Package Book 13 because the material presented was incomplete, difficult to understand and so on. Then the speakers also stated that it cannot be generalized between certain schools and other schools in terms of the use of the K 13 Mathematics Book Package, because students in a particular school will have different and certain characteristics. In this case, the one who knows more about the learning resources or study guidelines that are suitable for use is the teacher or teacher directly concerned with the student. The percentage of active students is around 20% of the total number of students who were present in class at the time the mathematics learning took place. Form of activity that is like asking questions, doing exercises and so forth. The problem of their lack of activeness in learning is caused by several factors. These factors include the lack of concentration, learning motivation and preparation of students in learning mathematics. Then related to the material, students have difficulty with material number patterns, namely in determining the nth term formula. While material related to number patterns including learning or knowledge is important for students to understand well. Apart from a variety of

psychological studies related to early mathematical knowledge, almost all learning focuses on knowledge related to numbers [24]. Mathematics has indeed been defined as a pattern science. Where the consensus document on mathematics education includes knowledge of patterns as a topic of central algebra [24]. Next, examples of number pattern problems from Mathematics K 13 textbooks for grade VIII which were tested on students can be seen in figure 4.

Figure 4. *Problem Tests for Number Patterns*

Based on the question of Number Pattern no. 1 above is known that the 1st pattern, 2nd pattern, and 3rd pattern are respectively composed of 6, 9 and 12 matchsticks. Then the question of the problem is determine how many matchsticks will be arranged in the 10th pattern. These a description of the researchers' answers to the problem of Number Patterns no.1 can be seen in figure 5.

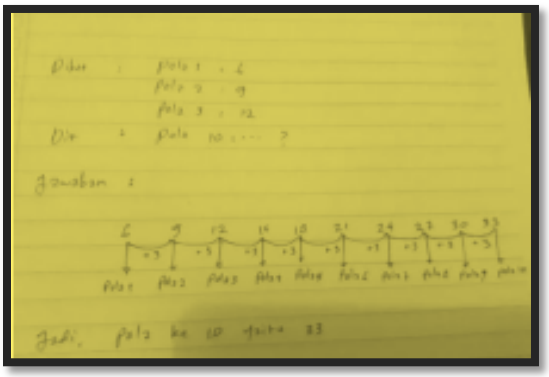

Figure 5. *Answers to Number Patterns No.1*

The answers written by different students, for example students A, B and C, for the question number number 1 given by the researcher are as listed in figure 6, figure 7 and figure 8.

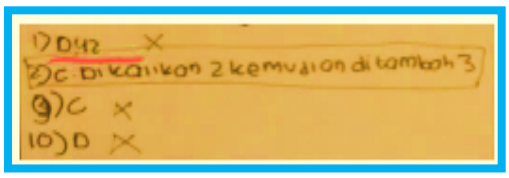

Figure 6. *Student answers A*

In Figure 6, students present the results of direct answers without mentioning how the search process is so that they can get the final results and the answers obtained are ultimately also wrong or incorrect.

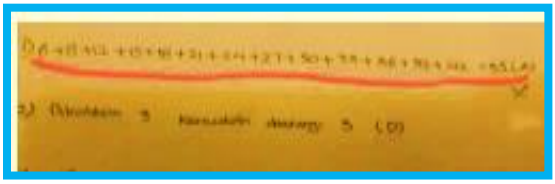

Figure 7*. Student answers B*

In Figure 7, students add up the terms in a sequence of number patterns, but the unique answer is correct, but the result written is not the result of the sum done, but a value of one of the sequence terms of the terms added together.

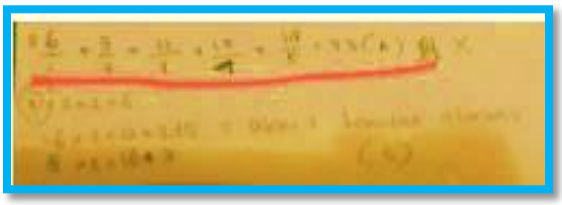

Figure 8. *Student answers C*

In Figure 8, students also add up the terms in the number pattern, the difference is that in this case students only do the sorting and adding up to the 5th term, even though the process is wrong but the answer results obtained are correct with predictions that the possibility of these students add up the 4th and 5th terms, so that the answer is 15 + 18 = 33.

3.2. Design

The design phase is the next stage or step after the analysis phase, where the results of the previous step will illuminate the next process, namely the design phase [13]. In this design phase, learning objectives and assessment tools must be clarified and completed [13]. Characteristics of student learning environments must be defined to obtain an effective learning process [13]. Based on the results of interviews, it is known that students have difficulty with material number patterns. So for the design designed in this study is the design of a module which will discuss the related number patterns.

3.2.1. Cover (cover module front and back)

The following is a design made by the researcher for the front cover and the back cover of teaching material in the form of modules, which is a mathematics learning module that raises or discusses the topic of certain mathematics subject matter. The making of this module will also be associated with a particular learning approach or model and also associated with increasing student motivation and learning skills. The page design created for the module's cover can be seen in Figure 9.

Figure 9. *Page Design of Module's Cover*

In front cover of the book it appears that the motif or background of the module is paired with a landscape of paddy fields. This was chosen because according to the researchers the existence of levels or levels such as stairs that appear on the paddy field expresses indirectly about the existence of patterns formed there. Patterns in mathematical contexts are defined as predictable sequences [24]. So the researchers considered that the view of the paddy field was suitable to be paired as the background of the front cover of the module. In front these cover, the researcher also includes several statements which aim to further clarify or explain the module. These statements include several parts. The first part, there is a module title that is associated with the learning approach or model that will be used and learning material that will be discussed or elaborated in the module. The module title is "Mathematics Module with CTL Approach, Number Pattern". The second part, class-related information that is, this module will be intended for class VIII junior high school, then the cover is written ***"Class VIII"*** in the form of a light blue trapezium. The third part, the information related to the skills that want to be improved through the presentation of this module, namely, this module has one goal to improve students' 4C skills, so that they are included in the ***"4 C's"*** writing module contained in a red ellipse or oval. The fourth part, the information related to the module publisher, here the researchers determine or create their own module publisher name is ***"ATRA Press"***. The publisher's name is located at the bottom of the front cover of the module with black writing. The word ATRA is taken from the name of the module maker or writer later. The fifth part, the information related to the module's author's name, here the researcher lists his own name as the module's author's name, namely by writing ***"Athifah Rahmi S.Si"***. The author's name is written at the top of the front cover of the module with the writing light blue. Meanwhile, the back cover of the module will contain a brief review of the contents of the module. Then the researchers also re-listed the name of the publisher and there is ISBN information at the bottom.

3.2.2. Preface

Page design of preface that was created temporarily by researchers. The page design created for preface can be seen in Figure 10.

Figure 10. *Page Design of Preface*

The preface in the module will contain about the expression of the author's thanks and expressions related to how this module can be realized. The background chosen by the researcher for this introductory page is quite simple and simple, consisting of certain shapes and color combinations in it.

3.2.3. Table of Contents

The following is a Table of Contents page design that was created temporarily by researchers. The page design created for table of contents can be seen in Figure 11.

Figure 11*. Page Design of Table of Contents*

This Table of Contents aims to make it easier for readers to find out the contents and also find the location of certain contents of the module. The background design of the page is intentionally made almost the same or not much different from the background page Preface, but still adjusted to load the Table of Contents in it.

3.2.4. Concept Map

Then, there is a design of the page that contains the Concept Map related material Numbers Pattern. The page design created for concept map can be seen in Figure 12.

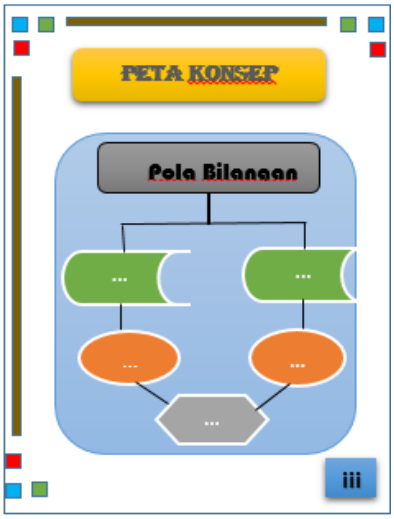

Figure 12. *Page Design of Concept Map*

This concept map is useful to make it easier for readers to know what sub material is or will be discussed in the material Number Patterns. The background design of the page is intentionally made almost the same or not much different from the background of the previous page but still adjusted to load the Concept Map inside.

3.2.5. Competence

Following are page designs related to Competencies that will be adapted to the K 13 curriculum and the level of education and grade levels of students. The page design created for competence can be seen in Figure 13.

Figure 13. *Page Design of Competence*

This competency consists of core competencies and Basic Competencies. The background design of the page is intentionally made almost the same or not much different from the background of the previous page, but adjusted to contain the competencies to be included in it.

3.2.6. Discussion of Material of Number Patterns

The page design created for discussion of material of number patterns can be seen in Figure 14.

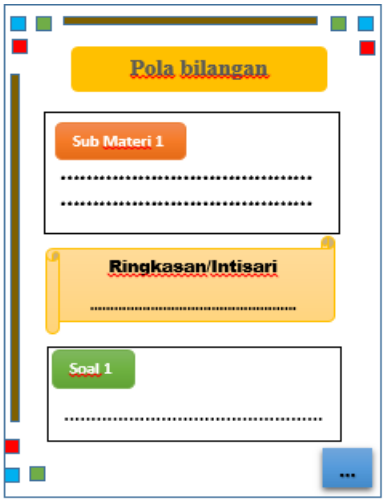

Figure 14. *Page Design of Material's Discussion*

The following is a page design that contains a discussion related to material number patterns consisting of several parts, including sub material 1, summary / introduction of sub material 1, questions 1 and so on will be continued until all sub material related to the number pattern is finished. The background design of the page is intentionally made almost the same or not much different from the background of the previous page, but adjusted to contain the discussion of the Number Pattern material later.

3.2.7. Module Creator Reference

Then, there is a design of the page related to the Library which contains references used by the author to support and complete the writing related to the study of material about Number Patterns. The page design created for module creator reference can be seen in Figure 15.

Figure 15*. Page Design of Module Creator Reference*

The background design of the page is intentionally made almost the same or not much different from the background of the previous page, but adjusted to contain a reference list or library.

3.3. Development

The development phase is the third stage or step of ADDIE [13]. This phase focuses on everything before implementing the process ie materials and learning activities, content, storyboards, assessment tools, and technology integration strategies must be carried out and crystallized at the end of this process [13].

3.4. Implementation

The implementation phase is an examination for instructional designers [13]. This phase is a place to receive actual content and related material, so that you can understand whether this design is successful or not [13]. This phase is also the first step for students to be actively involved in the learning process by integrating the environment, instructors, and other students [13].

3.5. Evaluation

The final stage or step of ADDIE is the evaluation phase [13]. This phase focuses on dealing with the results of the implementation phase [13]. Then the whole design process is evaluated to improve learning design [13]. The summative or formative evaluation can help designers show how the learning design is implemented effectively [13]. If the design does not work well or does not meet sufficient expectations, then the designer must return to the first phase and repeat all steps in detail [13]. In this study, researchers have only conducted research until the second stage of applying the ADDIE model design. The module aims to overcome student learning difficulties. The design created is expected to encourage student enthusiasm for learning and make it easier for students to understand the material of number patterns. From the results of the above research, the researcher also recommends the existence of a learning model or approach that is implemented into the module so that students understand the concept of material number patterns properly and correctly. One of them is the CTL approach where ideas will be implemented into a mathematical module that wants to be designed and developed. CTL aims to help students understand the meaning of knowledge and skills so that they can guide them in the acquisition of knowledge and skills [11]. The CTL approach has seven steps namely constructivism, question and answer, inquiry, learning community, modeling, reflection, and authentic assessment [11]. CTL can increase student motivation and give meaning in the context of actions and interactions in their daily situations from what they learn and apply [11]. Students are invited to learn through experience not just memorizing [11]. CTL has three basic principles namely (1) seeks to produce relatively permanent changes in student behavior, where the teacher is the agent of change, (2) students are expected to have the potential for natural seeds to be planted nonstop and (3) to instill that changes or attainment of ideal qualities do not grow naturally in the life process [25].

4 CONCLUSION

From the results of the research above, it can be concluded that students are still found to be incorrect or there is an incorrect understanding of the concepts in the material number patterns, so based on these facts the researcher tries to recommend a teaching material that is appropriate and needed by the student, namely the teaching material can explain mathematics learning material clearly, simply, completely and with an attractive and pleasing display. Based on the study of literature conducted, mathematics teaching materials in the form of mathematics modules with CTL learning approaches or models and designed with ADDIE learning design models, are expected to be able to become alternative solutions to make students more interested in learning the material presented and the mathematical modules are expected can help students understand learning material properly and correctly. Then more than that the mathematical module that is designed is also expected to increase students' motivation to learn, and will have a positive impact on the formation and development of 4C skills in students.

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