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Development of Hypercontent-Based Open-Ended Approach-Based Learning Devices to Improve SMK Students' Creative Thinking Abilities

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ABSTRACT

This study aims to: 1) obtain learning tools developed using an open-ended approach using hypercontent that meet validity, practicability, and effectiveness to improve students' creative thinking skills; and 2) describe how to apply learning tools developed using an open-ended approach using hypercontent to improve students' creative thinking skills. This study is concerned with development. The ADDIE development paradigm was used in this study. 1) The development of learning tools based on an open-ended approach using hypercontent meets the criteria of validity, practicability, and effectiveness of learning tools; 2) In trial I and trial II, the ability to improve creative thinking skills using learning tools based on an open-ended approach using hypercontent increased from 0.22 with low criteria to 0.39 with moderate criteria.

A. INTRODUCTION

The quality of education is very important for sustainable development in all aspects of human life which need to be improved in order to educate the nation's population. The nation's education system needs to be continuously improved to meet local, national and international needs and developments. Advances in science and technology affect the use of teaching aids and media in schools and other educational institutions. Therefore, the fourth industrial revolution which is often referred to as the industrial revolution 4.0 is taking place.

Information technology is a talent that everyone, including teachers and students, may utilize and possess in a modern educational setting. This will become an up-to-date reference so that educators may continue to stimulate innovation and creativity in the learning process and match technological improvements with efforts to develop quality education. Developments in information and communication technology can substantially benefit the field of education in terms of recommendations and options that facilitate the learning process. Students can comprehend that learning is not limited to rote memorization without comprehension (rotating learning), but also includes meaningful comprehension of learning content (meaning learning).

In 2020 is a year of concern for all nations because to the introduction and spread of Corona Virus Disease (Covid-19), also known as the corona virus. The initial occurrence occurred in China, specifically in the city of Wuhan. In 2020, the Covid-19 sickness began to influence numerous businesses in Indonesia, including education. As a result, the central government issued regulations mandating the closure of all educational institutions in all areas. To prevent the spread of Covid-19 illness. To prevent the spread of the disease, which requires everyone to adopt social and physical distancing, education policies that encourage learning at home while using the internet are also enforced.

Doing online or online learning is one of the innovations in the circumstances mentioned above (in the network). In this regard, the school urges all students to use laptops or smartphones to carry out online or distance learning (in the network). Therefore, in these circumstances, online learning refers to learning through certain media online. Discussions are still allowed between group members and with the teacher and other students. The media used can vary, which are commonly used such as WhatsApp (WA), Telegram, zoom, google classroom, google meet, teams, dragonlearn and so on.

Because they are technologically literate in addition to being knowledgeable, students who are proficient in online learning will perform better than those who are proficient in traditional learning. Online courses do offer a variety of learning resources, such as YouTube-based learning videos, video conferencing media, scientific journal media, and digitally arranged course materials. Teachers must not only have a solid understanding of the scientific subjects they teach, but also be technologically literate, inventive and resourceful.

Independent learning can be accomplished with hypercontent-based modules (Hidayat & Rusijono, 2020). Prawiradilaga and Chaeruman (2018:2) define "hypercontent" as a word derived from nonlinear digital reading patterns. Virtual places and linked meanings are also features of hypercontent. Simply expressed, hypercontent is a notion that connects one piece of content with another in particular digital technology applications at the same time.

Modules on sequences and series consisting of elements of arithmetic sequences and series, geometric sequences and series, as well as applications of sequences such as development, decay, various interest, and annuity prove that students lack innovative thinking power. must be understood by students because of its large application in everyday life. Researchers chose this problem because it requires some methodology of solving problems that require a high degree of mathematical creativity.

The results of Hardiyanti's research (2016) state that students face difficulties in rowam and queuing questions, especially difficulties in devising the method for the nth number of arithmetic sequences and queuing in geometry, mastering the thoughts of the first few utterances of a sequence, and mastering the meaning of that sequence. questions submitted so that students have difficulty managing what is known and asked. From the results of monitoring that researchers tried in category 10 Vocational High School (SMK) Negeri 1 Tebing Besar City was exposed if students did not generate innovative assumptions that appeared from some of the innovative assumption markers that had not been found in the category.

According to the research of Afifah, IN Sudargo, and Prasetyowati (2019), there are still many teachers who adhere to the learning paradigm of transferring knowledge, which does not invite students to use their minds. Much of the mathematics taught in schools is not discovered through mathematical inquiry but through notification. Finally, the strategy of guiding teachers who are emphasizing wrong teaching and learning activities through conventional forms and placing more emphasis on guidance in responding to questions or carrying out drills, is one of the triggers for the decline in students' mathematical power. Students who follow conventional teaching and learning methods and learn in an orderly way to respond to guidance problems become less involved and have a decreased understanding of mathematical principles and numbers.

Learning mathematics via an open-ended manner is an example of learning that appears to have a grammar or phase. For the purpose of measuring students' capacity for higher-order thinking in mathematics, an open-ended method was developed. The Open Ended approach is defined as instruction that encourages student engagement with teaching materials in a way that generates problem-solving strategies. The open-ended method can provide students with opportunities to learn information, gain experience, identify and solve problems using a variety of strategies, enabling them to develop creative ideas and mathematical mindsets by recalling previous mathematical principles. The open-ended technique requires substantially more self-efficacy and inventiveness than is typical in children. The advantage of learning using an open-ended approach is that there are different techniques for dealing with problems as well as multiple potential answers. As a result, the goal of open-ended learning is to provide students with the tools they need to develop both their creative reasoning and quantitative perspectives at the same time. Advanced arithmetic skills include the capacity to solve mathematical issues in addition to the ability to think creatively.

The authors did research titled "Development of Hypercontent-Based Open-Ended Approach-Based Learning Devices to Improve SMK Students' Creative Thinking Abilities"

B. RESEARCH METHODS

This research is Development of Learning Devices using The ADDIE development model created by Dick and Carry. The ADDIE development model created by Dick and Carry in 1996 was used in this study. To apply the ADDIE paradigm, there are five processes involved: (1) analysis (Analysis), (2) design (Design), (3) development (development), implementation (implementation), and (5) evaluation (evaluation). The ADDIE model was chosen because the five application processes are systematically organized and interconnected. That is, from the first to the fifth stage, the implementation must be systematic and cannot be done sequentially.

This research was conducted in the even semester of the 2021–2022 academic year, at SMK Negeri 1 Tebing Tinggi City, one of the SMK in Bajenis District, Tebing Tinggi City. The time for conducting this research was set for March to April 2022. Grade 10 students at Tebing Tinggi City 1 Vocational School were

used as research subjects, and the object of research was learning devices designed using an open-ended methodology to improve student learning abilities. critical thinking skills about the sequence and sequence of content. The following flow chart provides a summary of the research procedure described above:

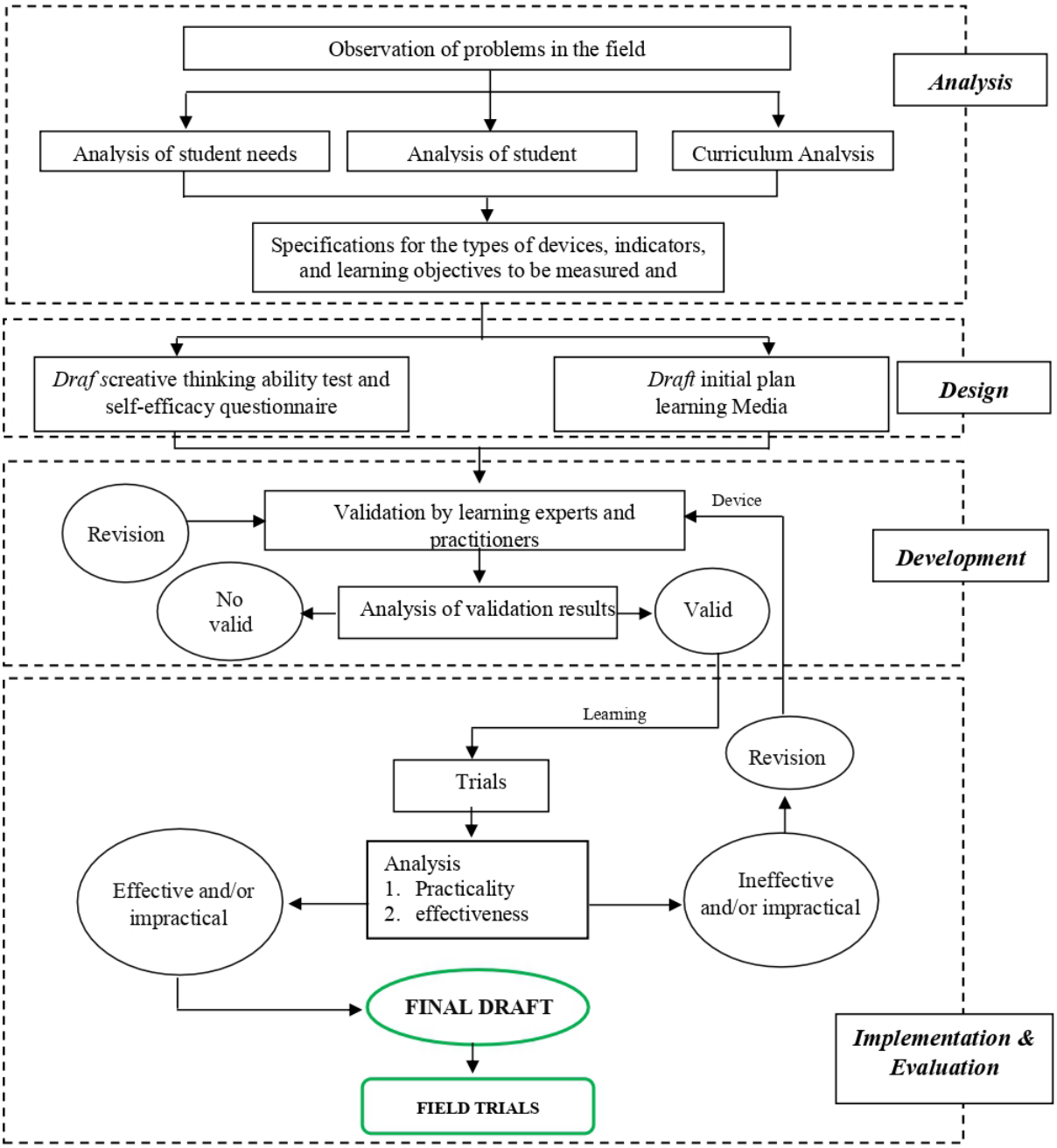

Figure 1. Research Procedure

This study will employ a Two-Group Pretest-Posttest Design for its application. The initial stage involves taking measurements as a test (pretest). The sample is then submitted to therapy within a specified time frame, followed by a final test (posttest). The design of the research can be described as follows.

Table 1. The design of the research

Pretest	Treatment	*Posttest*
O1	X1	O2
O3	X2	O4

(Modification of Lestari and Yudhanegara, 2018: 123)

Information:
O1 = Preliminary ability teststudents' creative thinkingin the experimental class I
X = Treatment in the experimental class I through learninglearning tools based on the Open Ended approachthat has been developed
O2 = Ability final testcreative thinkingstudents in the experimental class I
O3 = Preliminary ability teststudents' creative thinkingin the experimental class II
X2 = Treatment in the experimental class II through learninglearning tools based on the Open Ended approachwhich have been developed and revised from the previous class
O4 = Ability final teststudents' creative thinkingin the experimental class II

This research is development research, and its product is educational tools. The purpose of this study was to: (1) obtain learning tools developed using an open-ended approach that are valid, practical, and effective for increasing creative thinking skills at SMK Negeri 1 Kota Tebing Tinggi; and (2) describe how open discovery-based learning tools are used to teach creative thinking skills at SMK Negeri 1 Kota Tebing Tinggi. At each level of development, data analysis and research findings are provided as follows:

Description of Device Development Stages

In stage I Analysis (Analysis), carried out four activities, namely (1) Analysis of student needs; (2) Analysis of student character; (3) Curriculum analysis; (4) Formulation of learning objectives. The results of each activity at the Analysis stage are described as follows:

Analysis of student needs

Based on the findings of observation and analysis of available learning resources at SMK Negeri 1 Kota Tebing Tinggi, it appears that there are still deficiencies in learning methods which indirectly contribute to the low ability of students' creative thinking. The questions given to measure learning outcomes do not help develop critical thinking skills because the learning process in lesson plans does not refer to the learning model that has been described, still uses Teacher Centered, and does not contain a clear time allocation for each activity. The existing LKPD used is not in accordance with the RPP, resulting in not achieving the desired learning objectives in the RPP on the existing LKPD and the lack of contextual questions in the handbook used. Besides that, it was found that teachers and students still use inadequate textbooks, which have several drawbacks, including: 1) learning materials are presented in a ready-to-use form); 2) Because the kinds of questions offered are conventional, they have an indirect impact on pupils' inadequate ability to think creatively. This is considered to be why pupils' ability to think creatively remains poor. Based on the comments above, learning mathematics at SMK Negeri 1 Kota Tebing Tinggi has revealed several major issues. To address this issue, it is vital to develop learning tools that fulfill dependable, practical, and efficient requirements, and their use can boost students' creative thinking power at SMK Negeri 1 Tebing Tinggi City.

Student Character Analysis

On this occasion, character learning was carried out for students of SMK Negeri 1 Kota Tebing Tinggi by taking into account cognitive development, academic skills, and personal or social skills related to learning topics, tools, formats, and language to be used. Chosen. To find out the characteristics of students in accordance with the planning and development of subjects that have been determined in the preliminary and conclusive analysis, an analysis of student character is carried out.

The formal operational stage of cognitive development is often entered by students of SMK Negeri 1 Kota Tebing Tinggi. This is shown by the fact that most of the students are between 14 and 15 years old; At this age, students' cognitive development is influenced by the use of logical, abstract, and idealistic thinking processes. As this is believed to improve children's creative thinking abilities, it is very appropriate for mathematics lessons at school to use visual aids that can help students acquire concepts by starting from familiar concrete or abstract things.

According to the analysis of the first creative thinking test administered at SMK Negeri 1 Kota Tebing Tinggi, the level of originality of these kids is still relatively low. According to the results of interviews with a mathematics instructor at SMK Negeri 1 Kota Tebing Tinggi, a considerable percentage of pupils did not get the KKM score (75) on the previous semester's mathematics exam. Concerned teachers also noticed that some youngsters were less engaged in math. When students appear bored throughout the teaching and learning process in class and do not understand the teacher's explanation in front of the class, student learning results suffer.

Curriculum Analysis

The subject matter used in this study is the material for rows and rows for grade 10 SMK even semester which is determined through the activity of analyzing the material presented in the textbooks used and comparing it with student needs and its relevance to the 2013 curriculum. Concepts students will learn in the sequence and contents of the series are identified, explained, and methodically arranged in this curriculum analysis to create a concept map. This concept map is then adapted to the learning device used. Overall, the concept map produced in the research canseen in Figure 2.

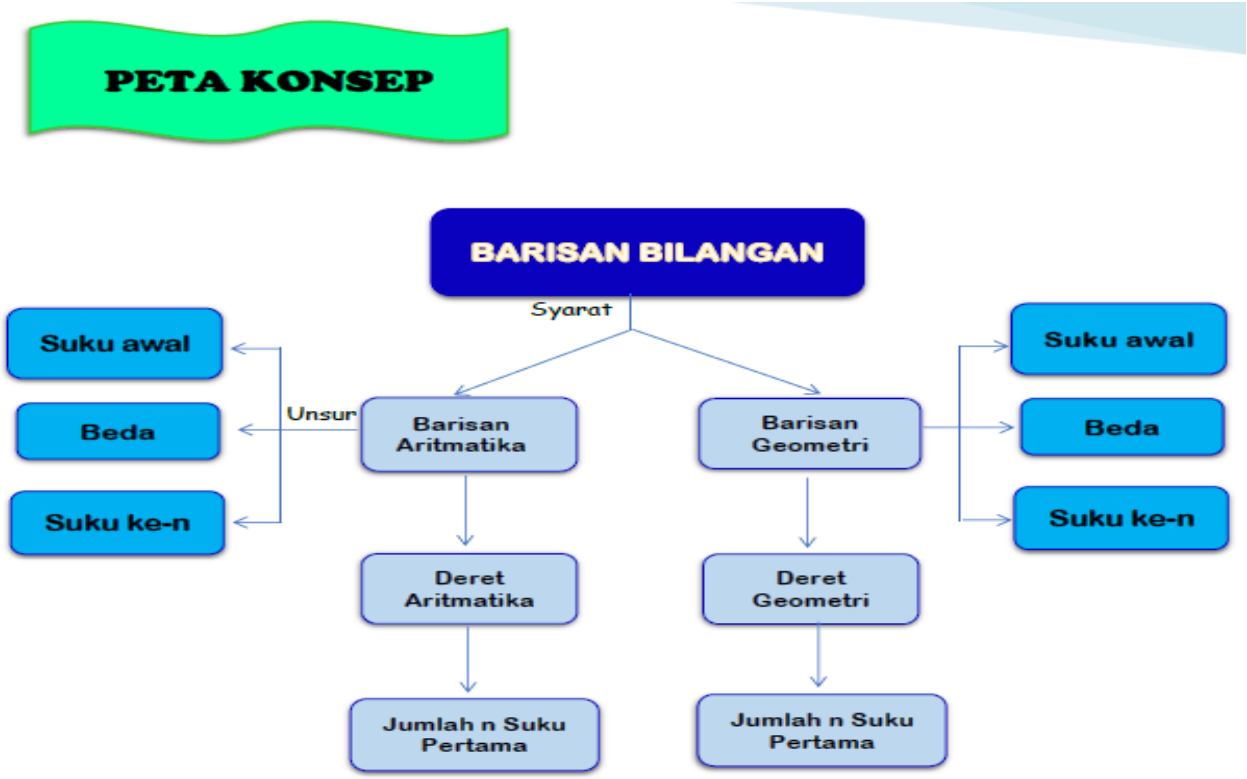

Figure 2. Concept Analysis Results for Sequences and Series Materials

Formulation of Learning Objectives

From the analysis stage, it was concluded that grade 10 students at SMK Negeri 1 Kota Tebing Tinggi need a math learning tool that can make it easier for them to learn and can improve their creative thinking skills, especially in the material for sequences and series.

Description of stage II, namely design (Design), carried out four stages:

1. Test Preparation
   The task analysis and concept analysis outlined in the definition of learning objectives serve as the basis for exam preparation. The test in question measures the candidate's capacity for original thinking with regard to sequences and series material. Four descriptive questions form an examination of a person's capacity to think creatively. The creative thinking capacity test has a 60-minute completion window.
2. Media selection
   To find learning media that are in accordance with the characteristics of the contents of the sequence and sequence, media selection is carried out. The media selection method was modified based on the findings of the curriculum review, the design of learning objectives, and an analysis of students' needs and characteristics. This is very helpful in helping students develop basic skills. In other words, the selection of media is done to maximize the effectiveness of the use of teaching materials while at the same time creating learning aids for learning in the classroom. The use of media and learning aids based on hypercontent can assist students in independent learning. Through activities and modules on guided material, students can understand the strengths and weaknesses of the material.t in class 10 SMK.
3. Format options

The structure of the results of the selection study was updated to accommodate the 2013 curriculum. The following components constitute the lesson plan: School identity, namely the name of the academic section. Class/semester, subject matter, and identification of subjects or themes/sub-themes; The number of study hours allowed in the syllabus and KD that must be achieved is considered in allocating time according to KD needs and learning load. Learning objectives are based on KD and use visible and measurable operational verbs such as attitudes, knowledge, and abilities; basic competency indicators and competency achievement; Point-based teaching materials are in line with the development of competency success indicators and include related information, concepts, principles and procedures; To convey the subject matter, researchers used open learning strategies, KD, and learning process aids. Books, print and electronic media, smartphones and other devices, nature, and other learning aids are examples of learning resources; the first, middle, and final stages of the learning process are completed, and the learning outcomes are evaluated.

4. Preliminary design
   In the final stage of design activities, the primary activity is the creation of learning tools. This level includes the development of a first draft of the Learning Implementation Plan (RPP) for four meetings, Student Modules and LKPD for each meeting, tests of mathematical creative thinking skills, assessment processes, and answer keys. All outcomes at this stage of the design process are referred to as the initial draft of the learning device and the initial draft of the test for creative thinking skills, respectively.

Stage III Description Development (Develop)

During the analysis and design phase, the initial design for the learning set, known as draft I, was created. Initially, field testing were conducted following the validation of draft I by development professionals. To develop a usable version of draft II, the expert review involves content validation, which includes all the learning tools identified during draft I's design phase. Based on the results of the expert validation draft I, the learning tools and instruments are altered and improved. Aspects such as device design, learning/instruction methods, and the quality of objectives and materials have been validated. In the initial phase of development, experts (expert review) and field trials confirmed Draft I of the problem-based learning device. Expert validation has been performed on the resulting learning tools with a focus on format, content, graphics, and language. Expert validation generates validation values, corrections, criticisms, and suggestions that are utilized to improve and perfect learning products.

Description of Phase IV Trial (Implementation)

The learning tools that emerged from the revision were called draft II and met the required standards. Trial I will test draft II which is currently valid. The effectiveness and application of learning tools created using learning based on an open-ended approach will be evaluated in trial I. Trial I is stopped if the proposed device meets the effective and practical requirements.

Stage V Description Evaluation

In trial 1, the practicality of learning tools with the Open-ended approach that was developed did not meet the established practical criteria. Because the observation of the implementation of learning to measure practicality has not been fulfilled, due to the lack of implementation of learning carried out during the utilizing the provided tools, implement four meetings. The findings of the evaluation include the lack of implementation of learning steps, particularly in concluding activities and activities that involve solving contextual problems, in the social system of implementing learning, specifically the creation of a democratic environment and student activities that collaborate in learning, and with regard to the principle of management reactions, particularly teacher activities that frequently fail to position themselves as resources. While permitting children to express their point of view. Because there are still indicators of effectiveness that have not been met, such as the posttest results of students' creative thinking skills in trial 1 that have not met the criteria for achieving success classically, the effectiveness of the open-ended learning tools does not meet all of the established criteria for effectiveness. However, the success of Trial 1 was determined by the positive response of the students to the designed components of the learning gadget. The effectiveness of the open-ended learning tools that were created did not match all the specified criteria for effectiveness. However, the success of Trial 1 was determined by the positive response of the students to the designed components of the learning gadget. The effectiveness of the open-ended learning tools that were created did not match all the specified criteria for effectiveness. However, the success of Trial 1 was determined by the positive response of the students to the designed components of the learning gadget.

The results of trial I that have been practised serve as a guide and provide feedback for the development of open learning tools. After the review, an open revision process was carried out on the learning tools, and the improvements/revisions made to the results of trial I were tested again in trial II.

C. RESULT AND DISCUSSION

1. Development of Learning Devices

Student Modules, Student Worksheets (LKPD), and tests of students' creative thinking skills are some of the learning resources developed in this study. The Open-ended approach serves as the basis for every learning tool created.

To meet the criteria for an appropriate device, validator validation procedures and statistical validation procedures were used in the field in the development of this learning aid. In the following, a summary of the results of the validation assessment from the team of experts will be presented as shown in Table 2 following:

Table 2. Validated Instruments

No	Assessed devices	The average value of the total validation	Validation Level
1.	RPP	4.58	Valid
2.	LKPD	4,41	Valid
3.	Student Book	4.51	Valid
4.	Initial Test of Students' Creative Thinking Ability	4.46	Valid
5.	Final Test of Students' Creative Thinking Ability	4.46	Valid

In addition to validity, practicability is a requirement for effective learning tools. In this study's Trial I, a practicality indicator, Observation of Learning Implementation, was established with an average score of 2.52 in the poorly implemented group, indicating that the learning device may be employed with minor modifications.

Effectiveness is also needed as a prerequisite for the success of learning devices, apart from practicality. Traditionally done student learning completeness because 26.67% of students were able to get a minimum passing grade, and student responses to learning that had an average score of 90% were two effective indicators found in this study.

Two indicators in trial I did not meet the required standards, but two indicators in trial II did. This is consistent with Nieeven's (2007) viewpoint, according to which it relates to how students complete the curriculum experience and how well they perform academically in relation to the developer's goals. The following will describe the percentage of students who achieve completeness for each meeting in trial I and trial II in Table 3 following:

Table 3. Results of Classical Completeness Analysis in Trial I and Trial II

Category	Trial I	Trial II
complete	26.67%	86,67%
Not Completed	73.33%	13,33%

According to Table 4, the classical completeness of students' creative thinking abilities in trial I was 26.67%, while the classical completeness of students' creative thinking abilities in trial II was 86.67%.

Based on the results of individual and traditional student mastery exams, guided discovery-based learning aids have met the criterion for efficacy and are valuable for learning. Table 4 presents an overview of students' critical thinking abilities based on the average value of their creative thinking abilities in trials I and II for each indication.

Table 4. Results of Students' Creative Thinking Ability in Every Aspect of Trials I and II

Aspects of creative thinking	Average (Mean)	
	Trial I	Trial II
Fluency	3,20	3.86
Flexibility	2.67	3.53
Elaboration	2.40	3.07
Originality	2.07	2.67
Sum Of All Aspects	10,4	13,13

According to Table 5, the scores for trials I and II were as follows: the fluency indicator in trial I was 3.20, while in trial II it was 3.86; the Flexibility indicator in the first trial was 2.67, while in the second trial it was 3.53; the Elaboration indicator in trial I was 2.4, while in trial II it was 3.07; and the Originality indicator in trial I was 2.07, while in trial II it was 2.67. Figure 3 shows students' mathematical critical thinking skills in trials I and II below.

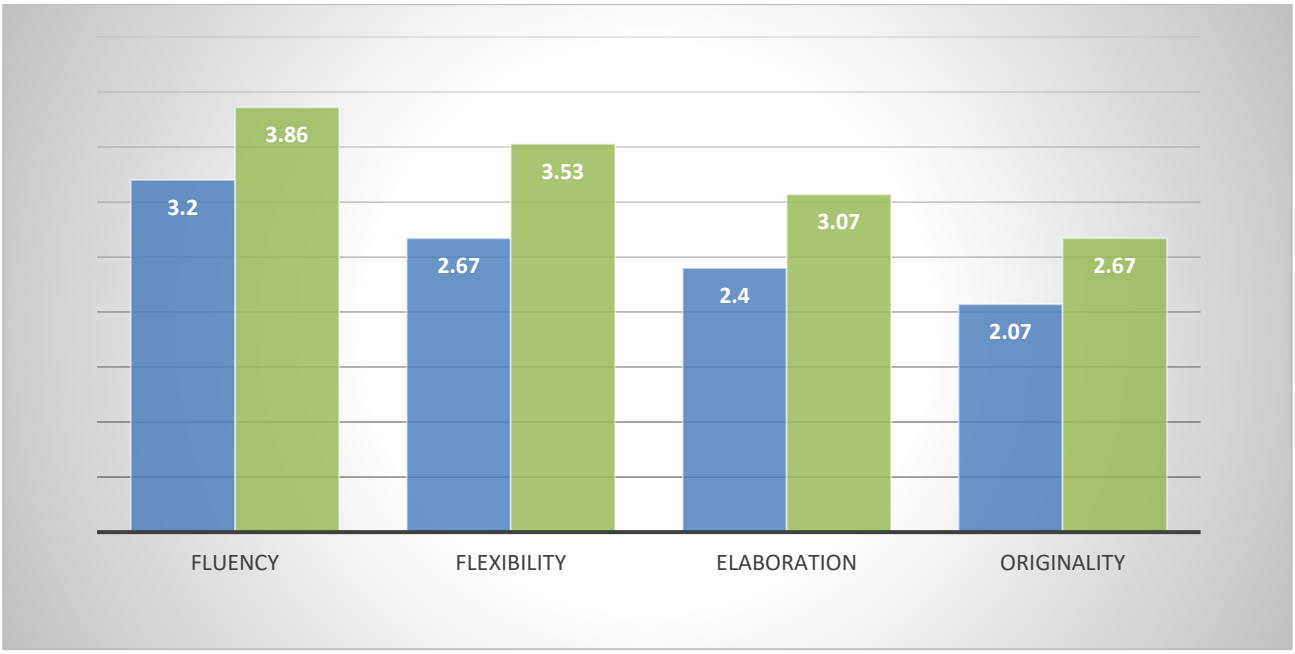

Figure 3. Test Results for Students' Creative Thinking Ability in Each Aspect in Trials I and II

According to the average score of each indication in Table 5 and Figure 4, it can be stated that students' creative thinking skills improved from trial I to trial II. Table 5 shows the outcomes of watching the application of learning the average score at each meeting in trials I and II:

Table 5. Results of Observation of Implementation of Learning inTrials I and II

Aspect	Trial I	Trial II
Syntax	2,3	3,6
Social systems in the implementation of learning	2.43	3.87
Management reaction principle	2.75	4.08
Average	7,48	11.55

According to Table 5, there has been an increase in the implementation of learning from trial I to trial II, as indicated by the average score of each facet. Figure 4 depicts the teacher's capacity to guide learning in Trials I and II.

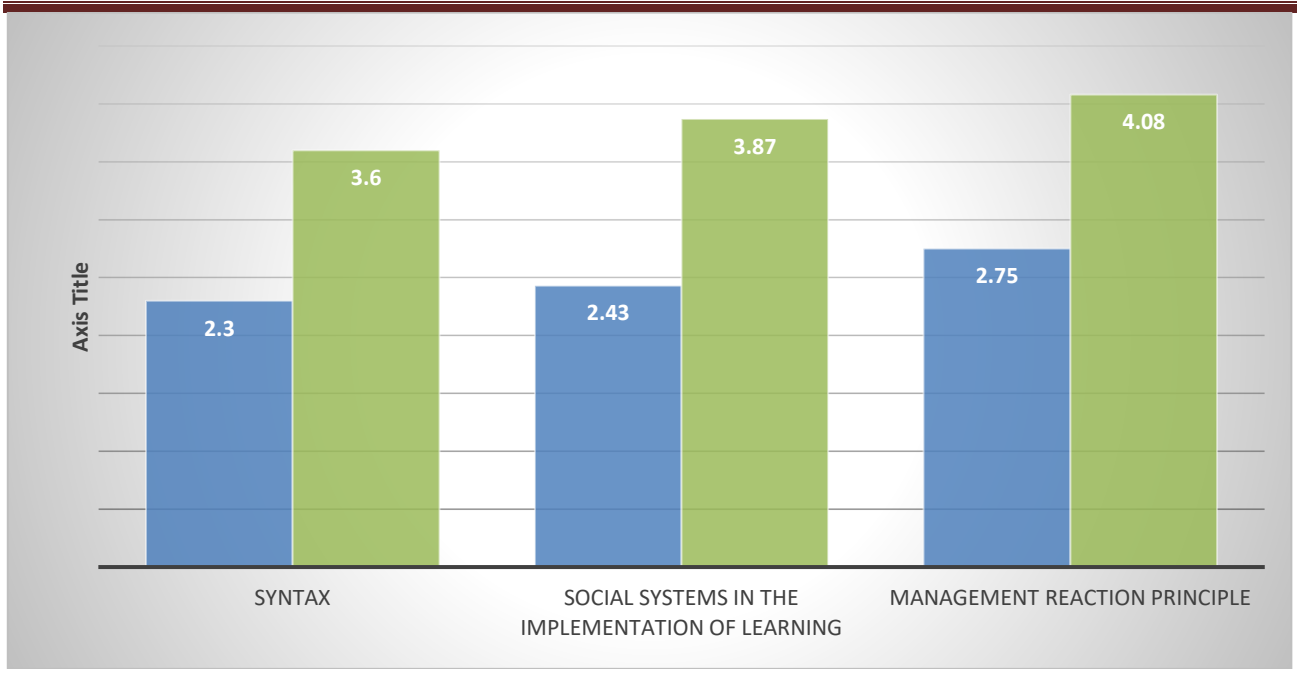

Figure 4. Observation Results of Learning Implementation in Trials I and II

Based on the outcomes of the learning implementation, it is possible to infer that guided Open-Ended based learning aids are "practical" for use in learning.

2. Students' Creative Thinking Ability

Thinking Ability Improvement Data Creative Students

As previously said, the ability to think creatively refers to the ability to generate or discover new ideas that are distinct, uncommon, and original and provide definite and precise consequences. Table 6 displays the results of the N-Gain test for students' creative thinking skills based on the outcomes of trials I and II. following:

Table 6. N-Gain Results of Students' Creative Thinking Ability in Trial I and Trial II

Aspects of creative thinking	***N-Gains***	
	Trial I	**Trial II**
Fluency	0.36	0.82
Flexibility	0.28	0.59
Elaboration	0.17	0.46
Originality	0.19	0.35
Kall aspects	1.02	2,22

From Table 6 above, it can be seen that the N-Gain values for the indicators of students' creative thinking in Trial I were 0.36 each; 0.28; 0.17; 0.19; and 1.02. While in Trial II each was 0.82; 0.59; 0.46; 0.35; and 2.22. So that the indicator with the highest increase was the first indicator in Trial I, namely 0.36 and in Trial II, namely 0.82, namely: Fluency.

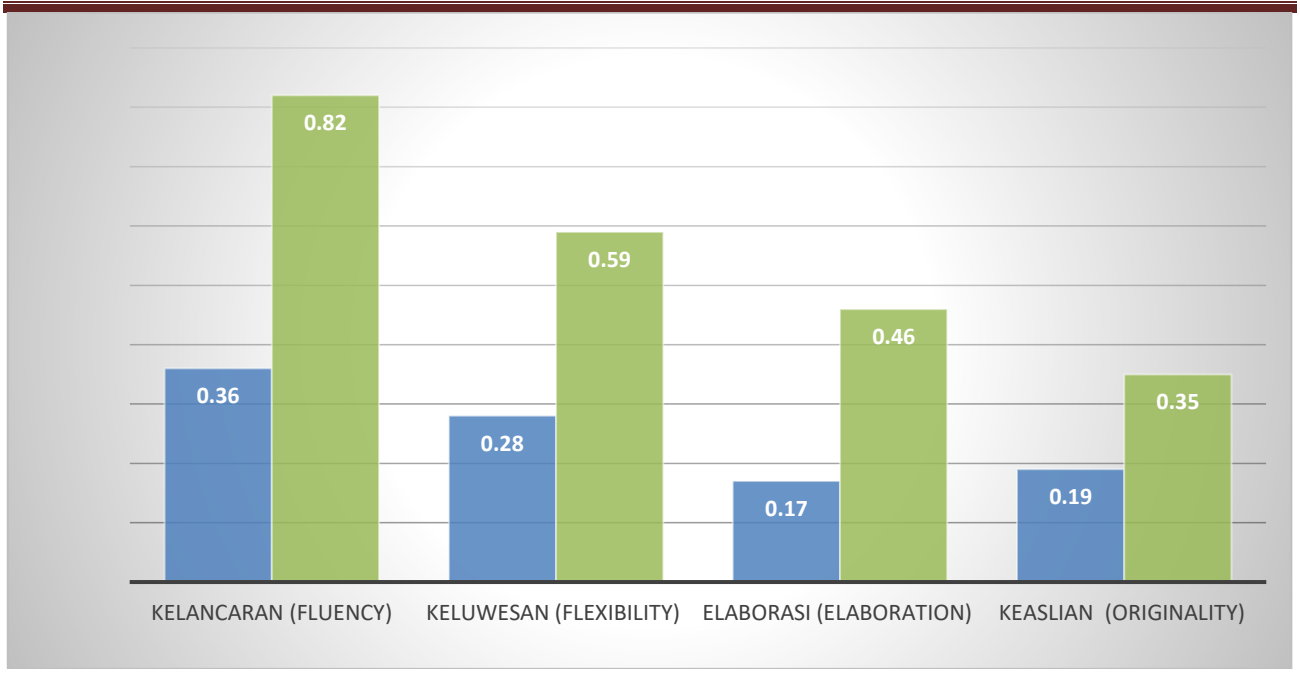

Figure 5. N-Gain Results of Creative Thinking Ability Trials I and Trials II

Based on Figure 5, using the teaching method based on the Open-ended approach that has been made in the "medium" category, students' overall creative thinking abilities increase as seen from the N-Gain results from trials I to II.

The tools used with students meet the standards of high-quality learning tools; when the learning tools used are high quality, and the Open-ended approach learning model is used, students' creative thinking abilities increase.

D. CONCLUSION AND SUGGESTIONS

From the data from Trials I and II, the following conclusions were obtained:

1. The learning tools developed using the Open-ended approach were stated to be valid, applicable, and effectively used to increase student creativity. thinking skills at SMK Negeri 1 Kota Tebing Tinggi.
2. Improving the creative thinking skills of students at SMK Negeri 1 Tebing Tinggi City who are taught using Open-ended learning tools. compared to trial I.

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