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Research Article

Development of challenges-based learning thematic model to improve critical thinking skills for primary school students

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Abstract: Learning in elementary schools emphasizes receiving information and subject matter rather than developing thinking abilities and understanding concepts. However, in the 21st century which is full of challenges and rapid changes like now, students need the ability to develop critical thinking. This is a need that should be reflected in the curriculum, because individual growth is basically characterized by Critical and innovative Thinking Skills. Based on needs analysis, this research develops a learning model with a thematic challenges-based learning approach. The novelty of this research lies in the Challenges/Competition. This challenge is integrated with technology-based learning media so that students are able to think critically. The aim of this research is to produce a Thematic Challenges-based Learning model to train elementary school students' critical thinking. This research uses a Research & Development research design. Research and development, or better known as R & D, is research that produces products that can be used to overcome problems faced by practitioners in completing their tasks. This research is a development research that adopts the Ploom model. This research is a development research that adopts the Ploom model. The development process follows Akker et al (2013) development framework, which is divided into three main stages: (1) Preliminary study; (2) development and prototyping; and (3) evaluation. The data in this development research consists of qualitative data and quantitative data. The syntax of the thematic based learning challenge model includes: (1) Big Idea, (2) Thematic Integration (Webbed Model), (3) Main Question, (4) Challenge, (5) Guiding Question, (6) Guiding Activity , (7) Guiding Resources, (8) Direct experience, (9) Solutions, (10) Assessments, and (11) Publications. The advantage of the Challenges-based Learning Thematic learning model is that it can improve students' critical thinking skills because students can learn to solve problems related to everyday life.

Keywords: challenges-based learning thematic; critical thinking; learning model

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1. Introduction

Basic education, including elementary school, must prioritize the development of basic abilities and thinking skills as well as understanding concepts as a foundation for further education and preparation for facing challenges in the 21st century. From an early age, humans have the tendency and capacity to think critically. As rational creatures who have the desire to understand the world around them, humans tend to give meaning to various phenomena that occur around them (Rahman, 2019; Susanti, 2024; Thornhill-Miller et al., 2023).

In many schools, the emphasis in learning tends to be more on receiving information and subject matter than on developing thinking skills and understanding concepts. However, in the 21st century which is full of challenges and rapid changes like now, students need the ability to develop critical thinking (Thornhill-Miller et al., 2023). This is a need that should be reflected in the curriculum, because individual growth is basically characterized by critical and innovative thinking skills. The learning process still adopts conventional methods, where students only 'accept' what the teacher or parents convey, making it difficult for them to develop their own unique thoughts and ideas. They tend

to be passive individuals, just doing things they are used to doing. This condition reflects the reality of the current learning process (Ferrari & Schoolnet, 2009; Hattie, 2008).

Thematic learning in the 21st century learning guides students to be able to think critically. To train critical thinking skills, you need to face a challenge in order to be successful and able to compete in the global community. These challenges or abilities can be integrated into the learning model by developing a Challenges-based learning model. After having this challenge ability, it is hoped that students can create special strategies to be able to face and overcome challenges. Challenge abilities can be trained during learning at school so that these abilities can be useful for facing changing world situations (Alifah & Sukartono, 2023; Malik, 2018; Sundari et al., 2023).

The results of research Kobsiripat (2015) on the Effects of the media to promote the scratch programming capabilities creativity of elementary school students show that learning using technology in the classroom can train students' creativity to develop meaningful learning. This is supported by the opinion of Davies et al (2013) that the classroom environment can be designed with a creative environment and can have an impact on students' cognitive, affective, attentional and psychomotor aspects. The results of research show that learning styles in education and the teaching process can provide the best way to learn for individuals. Learning styles must be determined first by considering differences in personality, perception, ability and intelligence (Cardino Jr & Cruz, 2020).

The results of playing games include the fact of learning from exercises and routines, learning behavior ranging from playing simulations and role games, learning perceptual schemes, new decisions, can produce personality changes that occur when patterns a person's thinking and behavior begins to change as a result of repeated video games (Granic et al., 2014; Krath et al., 2021). Based on analysis of several articles, the process of critical thinking skills is also influenced by students' initial abilities. Initial abilities are the raw materials needed in learning to direct students to new material that will be studied so that they can achieve learning goals (Sellars et al., 2018; Shi & Qu, 2022; Silvia et al., 2021).

The learning model is an important element in teaching and learning activities where the learning model is used by teachers as a guide in planning learning in the classroom. Joyce et al (2015) argue that a learning model is a plan or pattern that can be used to form a curriculum (long-term learning plan), design learning materials, and guide learning in class or elsewhere. A learning model is a conceptual framework that describes procedures for organizing learning experiences to achieve learning goals.

As a result of empirical observations, interviews and needs analysis instruments carried out at SDN Bareng V and SD BSS Malang, data and information were obtained regarding the problems and obstacles faced in the learning process at elementary schools, especially in thematic learning. Based on preliminary studies, it was found that the learning model used was a learning model with a scientific approach. However, in practice, teachers still dominate classroom learning so that students' critical thinking abilities cannot develop well. In addition, learning planning and learning outcome assessment instruments designed by teachers are not specifically available to improve students' critical thinking abilities. Information obtained from direct observations of the learning process and interviews with teachers and students can be identified into two categories, namely supporting factors and inhibiting factors/obstacles (problems) which will be used as a basis for developing the Challenges-based Learning Thematic model.

From the various problems above, the learning process is one of the core and very important processes in achieving the desired learning goals. For this reason, innovation is needed in developing learning models by selecting from various existing models, approaches, strategies and learning methods to be developed into more effective learning models that will be applied in the learning carried out to achieve the desired learning objectives. This is a challenge for elementary school teachers to innovate by creating an effective learning model that is able to form competent students.

Based on these problems and needs analysis, a learning model that is appropriate to 21st century learning is needed which can improve students' critical thinking skills. The novelty of this research lies in the Challenges/Competition. This challenge is integrated with technology-based learning media so that students are able to think critically. From the background above, it is clear that the need for learning in elementary schools requires a learning design with activities based on Challenges-based learning that is appropriate to the characteristics of elementary school students. Based on needs analysis, this research develops a learning model with a thematic challenges-based learning approach.

2. Method

2.1 Research Design

This research is development research that adopts the Ploom model. The development process follows of Akker et al (2013) development framework, which is divided into three main stages: (1) Development study; (2) Validation study; and (3) Implementation studies.

2.2 Research Subject

The trial subjects to test the Challenges-based learning thematic model were divided into several stages: (a) The preliminary study stage involved 50 elementary school students in Batu City to evaluate their critical thinking skills and independent attitudes; (b) The small-scale trial phase was carried out on 20 elementary school students in Batu City who took part in learning using the Challenges-based learning thematic model; and (c) The large-scale trial phase involved 87 students in Batu City in learning using the Challenges-based learning thematic model.

2.3 Research Variables and Instruments

The variables in this research are divided into two categories, namely independent variables and dependent variables. In this research, the independent variable is the application of the thematic challenges-based learning model in the experimental class, while PBL is used in the control class. Meanwhile, the dependent variable consists of students' critical thinking skills. Apart from these two types of variables, there are also control variables in this research, such as the content of thematic learning material in elementary school, allocation of learning time, and the learning media used, namely in the Challenges Step there is technology-based media.

The data in this development research consists of qualitative data and quantitative data. Qualitative data was obtained from observations, interviews and instruments (questionnaires) starting from the problem identification stage, competency needs analysis, and needs analysis. From this data, learning tools are produced from 1) Learning Implementation Plan; 2) Challenges-based learning thematic model book; 3) Learning media; 4) Critical thinking skills test instrument; 5) Self-reliance attitude questionnaire; 6) Validation instrument; 7) Non-Test Instruments.

2.4 Procedures and Data Analysis

2.4.1 Model Validity Data Analysis

Validators evaluate Challenges-based learning thematic model together with learning tools which include 1) Learning Implementation Plan (RPP); 2) Challenges-based learning thematic model book; 3) Learning media; 4) Critical thinking skills test instrument; 5) Self-reliance attitude questionnaire; 6) Validation instrument; 7) Non-Test Instruments. After that, calculations are carried out to determine the average value of each validator's assessment. The assessment categories used are in the Table 1 (Akbar, 2013).

Table 1. Validity Category

Average value	Category
3.5-4	Very Valid
2.5-3.5	Valid
1.5 – 2.5	Fairly Valid
0-1.5	Invalid

2.4.2 Analysis of model practicality data

Data analysis of the practicality of the model was also analyzed based on the implementation of the model and the results of assessing the responses of teachers and students as users of the product being developed. To state the practical status of the product device, the assessment categories used are in the Table 2 (Manaf, 2016).

Table 2. The assessment categories

Average value	Category
T < 1.5	Nothing happened
1.5 < T < 2.5	A small part has been implemented
2.5 < T < 3.5	Most of it happened
3.5 < T < 4	Everything was done

2.4.3 Analysis of Model Effectiveness and Implementation

The quantitative data collected was then analyzed using the ANCOVA test after fulfilling the prerequisite tests, including the linearity test, normality test and homogeneity test. Statistical data analysis is carried out with the help of software IBM SPSS Statistics 25.

3. Results

Activities carried out in the initial phase of the development study included identifying problems in thematic learning, analyzing student skills needs in the 21st century era, as well as literature reviews and surveys to evaluate students' critical thinking and digital literacy skills. The results of this stage will be used as a basis for developing a challenge-based learning model along with relevant research instruments.

In the second stage, validation study, researchers developed the syntax of the Challenges-based Learning Thematic model by paying attention to the thematic learning foundations of various supporting aspects such as social systems, reaction principles, support systems, and the impact of teaching and accompaniment. Apart from that, this model is also enriched by the development of learning tools.

The activities carried out at this stage are as follows: (1) Designing a lesson plan for class III with the theme of technological development with content in mathematics, Indonesian and SBDP using the syntax or learning steps of the problem-based learning (PBL) model for the control class and the Challenges-based Learning Thematic model for the experimental class. The RPP is designed for two meetings (each meeting 6 JPs with each meeting lasting 35 minutes). (2) Design and development of the Challenges-based Learning Thematic model book. The Challenges-based Learning Thematic model steps consist of eleven stages, namely: (a) Big Idea, (b) Thematic Integration (Webbed Model), (c) Main Questions, (d) Challenges, (e) Guiding Questions, (f) Guiding Activities, (g) Guiding Resources, (h) Direct experience, (i) Solutions, (j) Assessments, and (k) Publications. (3) Preparation of LKPD in accordance with the Challenges-based Learning Thematic model. This LKPD was developed for class III with the theme of technological development. (4) Development of learning media using the Canva application and development of challenge-based quizzes using the wordwall application. (5) Preparation and development of critical thinking skills test instruments. The instrument used to measure critical thinking skills is in the form of a test, consisting of 10 multiple choice questions and 10 essay questions. The instruments used to assess critical thinking skills

are adapted to five skills, namely elementary clarification, basic support, inference, advanced clarification, strategy and tactics (Irwan & Pammu, 2023; Kumala et al., 2022; Nurhayati et al., 2022). However, it is important to adapt elementary students' critical thinking skills to their level of development and characteristics. There are five indicators of elementary school students' critical thinking skills, which include basic classification, basis for decision making, drawing conclusions, explaining conclusions and reviewing.

The Thematic Challenges-based Learning model and learning tools were then validated by a number of experts. After validation, this model was refined and tested in limited trials. The average score of each evaluation component is used as a reference to assess the validity of the model that has been developed. This validity determines the extent to which the learning model is suitable for application in the field. The results of the validation of the CBLT learning model show a mean score of 3.32 on a scale of 4.00, this shows that the CBLT learning model is considered valid and suitable for use with revisions. Based on the calculation results, validation data was obtained with four aspects in Table 3.

Table 3. Validation data

Rated aspect	Average validator score			Average
	I	II	III	
Rational Syntax for Development of the Challenges-based Learning Thematic Model	3.00	4.00	3.00	3.33
Suitability of the Model Steps Developed with Thematic Learning Principles	3.09	3.64	3.00	3.24
Alignment with Critical Thinking Skills	3.20	3.60	3.00	3.27
Suitability of the Model with the Attitude of Independence	3.50	3.75	3.00	3.42
Average	3.19	3.75	3.00	3.32

In the third stage, implementation study, the refined Challenges-based Learning Thematic model was tested to measure its effectiveness. The data that supports this effectiveness test consists of quantitative data in the form of critical thinking skills tests and independence attitude questionnaires, as well as qualitative data obtained from interviews. Qualitative data functions as a support for quantitative data. The validation results of the Challenges-based Learning Thematic Model show an average score of 3.32 on a scale of 4.00. The device validation results show a mean score of 3.15 on a scale of 4.00. Meanwhile, the implementation results show a mean score of 3.50 on a scale of 4.00. The results of student responses were more than 70% of students agreeing with several points of positive statements regarding the implementation of the Challenges-based Learning Thematic Model. This shows that the use of the Challenges-based Learning Thematic Model in thematic learning has a positive impact.

This research uses a quasi-experimental design with a Pretest-Posttest Control Group Design to evaluate differences in student digital literacy between groups that implement the Challenges-based Learning Thematic Model and those that do not. The same design was also used to assess differences in critical thinking skills between groups that used the Challenges-based Learning Thematic model and those that did not.

4. Discussion

4.1. Gathering Information on Potentials and Problems

As a result of empirical observations, interviews and needs analysis instruments carried out at SDN Batu City, data and information were obtained regarding the problems and obstacles faced in the learning process at elementary schools, especially in thematic learning. Based on preliminary studies, it was found that the learning model used was a learning model with a scientific approach. However, in practice, teachers still dominate classroom learning so that students' critical thinking abilities cannot develop well. In addition, learning planning and learning outcome assessment instruments designed by

teachers are not specifically available to improve students' critical thinking abilities. Information obtained from direct observations of the learning process and interviews with teachers and students can be identified into two categories, namely supporting factors and inhibiting factors/obstacles (problems) which will be used as a basis for developing the Challenges-based Learning Thematic model.

4.2 Data Collection

Data collection was carried out with data in this development research consisting of qualitative data and quantitative data. Qualitative data was obtained from observations, interviews and instruments (questionnaires) starting from the problem identification stage, competency needs analysis, and needs analysis. From this data, learning tools are produced from syllabus, lesson plans, learning modules, practice questions, evaluation questions and learning media.

Developing the syntax for thematic Challenges-based learning model by paying attention to various supporting aspects such as social systems, reaction principles, support systems, and the impact of teaching and accompaniment. Apart from that, this model is also enriched by the development of learning tools such as Student Worksheets (LKPD), as well as measurement instruments which include critical thinking tests, questionnaires and interviews related to critical thinking skills.

4.3. Initial Product Development

The product specifications produce a Challenges-based Learning Thematic Model to improve Critical Thinking Skills, namely in the form of steps: (1) Big Idea, (2) Thematic Integration (Webbed Model), (3) Main Questions, (4) Challenges, (5) Guiding Questions, (6) Guiding Activities, (7) Guiding Resources, (8) Direct experience, (9) Solutions, (10) Assessments, and (11) Publications. Each step can be explained in Table 4.

Table 4. Procedure Challenges-based Learning Thematic Model

Stages	Explanation
Stage 1: *Big Idea*	A Big Idea is a broad concept that can be explored in a variety of ways, which attracts attention
Stage 2: *Thematic Integration*	Students explore previous knowledge by integrating some knowledge between subjects
Stage 3: *Essential Question*	Essential Questions come from describing things that are interesting to students and important to society. Essential questions identify information that is important to understand about the main idea
Stage 4: *The Challenges*	The Challenge is the result of essential questions, challenging students to formulate concrete answers or solutions that can be implemented in real action. This challenge is integrated with technology-based learning media
Stage 5: *Guiding Question*	Guiding Questions are used by students to guide the understanding needed to find solutions to the challenges posed
Stage 6: *Guiding Activities*	Guiding Activities such as lessons, simulations, games, and other activities help students answer guiding questions and build the foundation for innovative and realistic solutions
Stage 7: *Guiding Resources*	Guiding Resources include podcasts, websites, videos, databases, and experts that support students' activities in finding solutions
Stage 7: *Direct experience*	Provide direct experience to students by conducting experiments
Stage 9: *Solution*	Solutions to challenges are explained broadly to consider various alternatives. Solutions must be reasonable, realistic, feasible, and clearly expressed in a multimedia publication format
Stage 10: *Assessment*	Assessment of solutions includes relevance to challenges, suitability to content, clarity of communication, applicability and effectiveness of ideas. Teams are also assessed for their contribution to reaching a solution
Stage 11: *Publishing*	Publication (Publishing) allows documentation of experiences and results to be published to the public. Students are encouraged to publish their work online and get feedback

4.4 Product Validation

The Thematic Challenges-based Learning model has gone through a validation process by experts to assess its level of suitability. Validation of the Challenges-based Learning Thematic Model involves assessing eleven main components. The average score from each evaluation component is used as a reference to assess the validity of the learning model developed. The validation results of the Challenges-based Learning Thematic Model show an average score of 3.32 on a scale of 4.00. The device validation results show a mean score of 3.15 on a scale of 4.00. Meanwhile, the implementation results show a mean score of 3.50 on a scale of 4.00. The results of student responses were more than 70% of students agreeing with several points of positive statements regarding the implementation of the CBLT model. This shows that the Challenges-based Learning Thematic Model is very suitable for use with minor revisions.

4.5 Small Scale Trials

Small-scale trials were carried out to evaluate the practicality of the learning model that had been developed. The focus of this trial is on the theme "Development of Transportation Technology". The implementation of the Challenges-based Learning Thematic Model was carried out specifically on this theme. Participants in this small-scale trial were 20 class III students at SDN Junrejo 02 Batu City. The trial was carried out in 3 meetings (each meeting 4 JP @ 35 minutes) with reference to the RPP using a Challenges-based Learning Thematic Model. Based on the results of small-scale trials, the total average of observers was 3.54 on a scale of 4.00. This shows that most of the steps in the Challenges-based Learning Thematic Model stage have been implemented well.

4.6 Large Scale Trials

The focus of this trial is on the theme "Development of Transportation Technology". The implementation of the Challenges-based learning thematic learning model was carried out specifically on this theme. Participants in this large-scale trial were 87 grade III students at SDN Junrejo 02, Dadaprejo 02, and SDN Beji 01 Batu City. The trial was carried out in 3 meetings (each meeting 4 JP @ 35 minutes) in each of the 3 elementary schools with reference to the RPP using a challenge based learning thematic model. Based on the results of small-scale trials, the total average of observers was 3.50 on a scale of 4.00. This shows that most of the steps in the Challenges-based Learning Thematic model stage have been implemented well.

The Challenges-based Learning Thematic model places more emphasis on the ability to think to construct new knowledge from learning experiences. Thinking and problem solving skills are needed to find solutions to challenges (Fitarahmawati & Suhartini, 2021). The stages of the Challenges-based Learning Thematic model include big ideas, important questions, challenges, guiding questions, guiding activities, guiding sources, solutions, assessment and publication (Nichols & Cator, 2008).

At these stages, students are involved in active interaction to discover, investigate, and solve challenges given by educators (O'Mahony et al., 2012; Pedaste et al., 2015). Learner challenges relate to real life problems that are designed in an interesting way for learning activities (O'Mahony et al., 2012). It is hoped that interesting challenges can stimulate students' extrinsic motivation to study seriously (Alsawaier, 2018; Gbollie & Keamu, 2017; Liu, 2020). The challenges given can require students to be independent, creative and innovative in investigative activities, students find their own challenges, carry out investigative activities, and provide solutions to these challenges.

Based on the results of research conducted in several elementary schools, it shows that the Challenges-based Thematic Learning Model has the potential to strengthen students' critical thinking abilities because they are involved in problem solving processes that require high level thinking. The results of this research are in line with other research that showing that team work in problem solving can improve students' thinking skills (Aein et al., 2020; Spoon et al., 2021). Apart from that, research also emphasized that problem solving activities in learning can train thinking skills because they produce new

solutions, think creatively, and handle complex problems (Ananda et al., 2023; Naser & Almutairi, 2015).

Based on the research results, it was concluded that students' critical thinking skills can be improved through the Challenges-based Learning Thematic model by providing structured and systematic questions in evaluating certain topics, so that they can reach conclusions independently and credibly. Well-crafted questions allow students to engage in deep learning. These questions should be presented in sequence to help students understand the problem, issue, project, or decision well. This view is in line with the opinion of Tofade et al (2013), who states that effective questions can encourage students to think critically. Ruggeri et al (2021) also emphasized that the process of asking is a stimulus for children to think and learn, so that they can gain better knowledge.

5. Conclusions

Based on the results of the validation and implementation of the Challenges-based Learning Thematic Model in elementary schools, it was concluded that the Challenges-based learning thematic learning model had a positive impact, namely being able to improve students' critical thinking skills. This is proven by each stage of model development being said to be valid by experts or validators. During implementation, both small scale and large-scale trials were also seen at each stage of the Challenges-based Learning Thematic Model in accordance with the design developed. The advantage of the Challenges-based Learning Thematic Model is that it can improve students' critical thinking skills because students can learn to solve problems related to everyday life.

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