Validation analysis of basic electronics textbooks 2 integrating creative thinking in the Physics Department, Universitas Negeri Padang

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Abstract. This study aims to determine the validity of basic electronics book 2 by integrating creative thinking skills. This type of research is research and development (R&D) using the ADDIE design model, the research steps include: analysis, design, development, implementation, evaluation. The data collection instrument used is a validation sheet that has been previously validated by the validator. Based on the results of data analysis of the validation of basic electronics book 2 by integrating creative thinking skills, an average value of 86.6% was obtained with very valid criteria.

1. Introduction
The low ability of students to think creatively in Indonesia, is a matter that must be of concern, especially for the world of education, the average creative thinking ability of students is at the level of 25.5%, including the less creative category[1]. This resulted in a high level thinking skills of students is also low, and the impact on low Human Development Index (HDI) of Indonesia, which in 2017 was ranked 113 of 188 countries in the world[2]. Quality human resources can only be realized through quality education. Improving the quality of education is something that must always be improved so that it can improve the quality of Indonesia's human resources. according to the national education system law states, among other things, national education functions, among others, to increase the potential of students to become knowledgeable, capable, creative and innovative human beings.

Creative people can be considered as people who have the ability to think synthetically, to build relationships between things that other people are not aware of. Therefore, creative people at least have creative thinking skills[3]. Furthermore, someone who thinks creatively will have a more creative and innovative thinking pattern to find new ideas in developing the information they get in accordance with the thoughts and views of the individual[4]. The ability to think creatively can be interpreted as a form of determining and finding new things in solving problems by finding new relationships between things, finding new solutions when given problems, finding new structures and various other forms of creative thinking[5]. Creative people will be able to understand problems and find solutions with varied and innovative strategies.

In order to develop creative thinking skills, student learning activities must be facilitated and motivated to be able to develop thinking skills through physics concepts and principles and be able to solve problems both qualitatively and quantitatively. One of the thinking skills is creative thinking
skills. In order to improve the ability to think creatively, it is necessary to facilitate learning with good learning resources that support it. Textbooks play an important role in learning, the availability of quality textbooks will support the success of student learning, because almost 90% of learning activities use textbooks (Stake and Easley 978). Likewise, learning activities carried out by teachers / lecturers use 90% of their learning time using textbooks (Weiss, 1989).

Based on the analysis carried out on the electronics book used in basic electronics lectures 2 in the Physics Department of the State University of Padang, it is still not optimal in facilitating the development of students' creative thinking abilities. The results of the analysis show that for each indicator obtained, namely 36% fluency, 21% flexibility, 12% originality, and 32% elaboration. [6]. So that students can develop their thinking skills, especially creative thinking skills, a textbook is needed that can optimally facilitate the development of creative thinking skills. The development of this teaching material has been carried out through inquiry learning to improve scientific literacy with very valid and very practical results[7][8]. Furthermore, research on the development of teaching materials to support creative thinking skills through inquiry learning has been carried out to improve the creative thinking skills of high school students with the results that have been carried out by Wahyuni R and Hufri (2018)[9], Johan WO, Hufri (2018)[10] and Irani S, et al (2018)[11]. In this study, basic electronics textbook 2 was developed by integrating creative thinking skills, so that it can facilitate students in developing their creative thinking skills. So far, basic electronics textbook 2, which is used in the Physics department of the State University of Padang, has not facilitated the development of students' creative thinking abilities optimally.

To face the challenges of the future (to the 2045 generation) increasingly complex needs five minds for the future (five minds for the future) which includes: the disciplined mind, synthesizing mind, the mind creates, the respectful mind and the ethical mind. Furthermore, globalization must be "resisted" by developing creativity and entrepreneurship through transformative critical pedagogy in national education[12]. So learning must be able to produce students who can foster logical thinking, critical thinking and creative thinking skills. Creative thinking sensitivity can be measured by indicators that have been determined by experts, according to Torrance[13]. The ability to think creatively contains 4 aspects, namely: fluency, flexibility, originality, and elaboration.

Creative thinking is a thinking activity to be able to generate creativity, or think to produce new things for themselves. LTSIN[14] states that "a person's idea to think creatively has at least one of the characteristics of:

a. The idea didn't exist before
b. It's been in another place, but he doesn't know
c. It invented a new process for doing something
d. It applies existing processes to different areas
e. He developed a way to see things from a different perspective.

From the five characteristics of creative thinking, students can find new ideas or perfect existing ideas. According to Moma[15] explains "The characteristics possessed in creative thinking skills, namely.

a. fluency includes:
   1) Come up with many ideas in the problem
   2) Provide many answers to a question
   3) Work faster and do more than others
b. flexibility includes:
   1) Generating variations in problem solving ideas or answers to a question
   2) Can see a problem from a different point of view
c. Originality includes:
   1) Providing relatively new ideas in solving problems
   2) Making unusual combinations of parts or elements
d. Elaboration includes:
1) Develop or enrich the ideas of others
2) Add, organize or detail an idea so that it can improve the quality of the idea.

Furthermore, Torrance (1979)[16] also describes the fluency process, which refers to the production of a large number of ideas or alternative solutions to a problem with the keywords, including comparing, changing, calculating, determining, identifying, compatibility. Flexibility refers to the production of ideas that show various possibilities or domains of thought involving the ability to see things from different points of view, to use many different approaches or strategies. Key words include Changing, demonstrating, differentiating, employing, extrapolating, interpolating, interpreting, predicting. Elaboration is the process of enhancing an idea by providing more detail. Additional detail and clarity increases interest in, and understanding of, the topic. The key words include, Assess, criticize, determine, evaluate, assess, measure, choose, and test. Originality is the production of unique or unusual ideas. It involves synthesizing or putting information about a topic back together in new ways. Key words, among others, create, design, produce, integrate, modify, rearrange, reconstruct, revise.

So learning activities must be able to facilitate students to be able to put forward many ideas in the activities carried out by students, both in the form of questions or answers. In a given problem, students must be able to create a variety of ideas so that each student's thought has a different answer. Students are able to provide identical ideas according to the ideas developed by students in order to solve a problem so that creative thinking skills are formed.

The ability to think creatively is needed in finding ideas and solving problems. Creative thinking is a basic process for developing or finding constructive ideas and relating to views and concepts and emphasizing the aspects of intuitive and rational thinking, especially by using information and to bring up or explain the perspective of the results of thinking. So students must have the ability to think creatively to find an idea or ideas in learning rationally or rationally.

Learning using teaching materials that can facilitate the development of creative thinking skills will be able to help students become more independent in learning and will find it easier to develop their thinking skills. A material that can facilitate the development of creative thinking skills, becomes a solution for students in supporting the learning process and the implementation of learning effectively and efficiently. So the ability to think creatively is the ability of students to understand problems and find solutions with various answers. With a variety of methods so that students are required to be able to understand several different methods and strategies in order to create something new, so that they can develop their thinking skills. So, the creative thinking process can support students' creative thinking abilities. By thinking creatively, students will be more confident in developing their potential.

The purpose of this study was to determine the validity of basic electronics textbook 2 integrating creative thinking to improve student competence in the Department of Physics, State University of Padang.

2. Research Methods
The textbook developed in this study is a basic electronics textbook integrating creative thinking. This research procedure consists of several research steps. In this study, researchers used the ADDIE development model[17]. Research and development steps for the ADDIE model include: analysis, design, development, implementation, and evaluation. The data collection instrument in this study was an instrument to test the validity of basic electronics textbooks integrating creative thinking. This validation instrument, in the form of a validity test sheet, has previously been validated by 3 validators who are experts in their fields. For the validation of basic electronics textbooks, integrating creative thinking was carried out by 3 validators. The data from the validation test were analyzed using a formula.

\[
\text{Validation value} = \frac{\text{number of scores obtained}}{\text{maximum score}} \times 100\% \tag{1}
\]
The criteria for the modified validation test from Riduwan (2005: 88)[18] can be determined using Table 1.

| No | Percentage | Criteria       |
|----|------------|----------------|
| 1. | 0% - 20%   | Invalid        |
| 2. | 21% - 40%  | Less valid     |
| 3. | 41% – 60%  | Quite valid    |
| 4. | 61% – 80%  | Valid          |
| 5. | 81% – 100% | Very valid     |

The validity assessment is determined based on the interpretation criteria of the scores obtained. The validity value classification used in this study is very valid and valid.

3. Result and Discussion

3.1. Result

The validation results for basic electronics textbook 2 by integrating creative thinking, which were developed can be seen in Figure 1.

![Figure 1. Validity results](image)

With
1. Content eligibility
2. Construction feasibility
3. Language eligibility
4. Feasibility of teaching material display
5. The feasibility of creative thinking in textbooks
6. Average

In Figure 1, the average value of textbooks developed is 86.6% with very valid criteria. This shows that the teaching materials developed can be used in the learning process. Each component consists of
several indicators and each indicator is assessed for its suitability. The content feasibility component consists of five validation indicators. The value for each indicator can be seen in Figure 2.

![Figure 2](image2.png)

**Figure 2.** The results of the content eligibility component

- 1. Textbooks made in accordance with the Semester Learning Plan (RPS)
- 2. The substance of the material in the textbook is correct
- 3. Textbooks made in accordance with the latest issues
- 4. Facts of concepts / materials in the textbook presented are appropriate
- 5. Textbooks can add knowledge insights
- 6. average

Second, the construction feasibility component which consists of five indicators. The results of the analysis on the construction feasibility component that have been assessed by the validator can be seen in Figure 3.

![Figure 3](image3.png)

**Figure 3.** The results of the construction feasibility component analysis

- 1. Writing systematics in Textbooks is good
- 2. Textbook structure sequence is correct
- 3. The purpose in the Textbook is clear
- 4. The information provided is good
- 5. Interactivity (stimulus and response) in Textbook is clear
- 6. The information presented in the textbook is complete
- 7. average
The language eligibility component consists of five indicators. The results of the analysis on the language feasibility component that have been assessed by experts can be seen in Figure 4.

![Figure 4](image1.png)

**Figure 4.** The results of the analysis of the language eligibility components.

With

1. The sentences used in the Textbook are clear and easy to understand
2. The relationship between paragraph one and another paragraph in the Textbook is clear
3. The correct punctuation used in the Textbook is correct
4. The conjunctions used in the Textbook are correct
5. The writing of titles and subtitles in Textbooks is good
6. average

Textbook display, a textbook display eligibility component which consists of five indicators. The results of the indicator analysis on the textbook display components are in Figure 5.

![Figure 5](image2.png)

**Figure 5.** The results of the indicator value analysis on the textbook display component

With

1. The appearance at the beginning of the textbook is good
2. The layout of the titles and subtitles in the textbook is good
3. The type and size of the fonts used in the Textbook are appropriate and interesting
4. The layout on the cover and between the sections in the textbook is interesting
5. The placement of illustrations, graphics, and pictures in textbooks is interesting
6. average
The creative thinking qualification component in the textbook consists of four indicators. The results of the analysis for indicators on the feasibility of creative thinking in the textbook can be seen in Figure 6.

![Bar chart showing the results of the indicator analysis on the feasibility component of creative thinking in textbooks]

**Figure 6.** The results of the indicator analysis on the feasibility component of creative thinking in textbooks

| Indicator | Result |
|-----------|--------|
| 1. Fluency | 67% |
| 2. Elaboration | 60% |
| 3. Flexibility | 67% |
| 4. Originality | 73% |
| 5. Average | 67% |

With

1. Textbooks have guided students in putting forward many ideas in problems (fluency)
2. Textbooks have guided students in producing variations of problem solving ideas or answers to questions (flexibility)
3. Textbooks have guided students in providing relatively new ideas in solving problems (originality)
4. Textbooks have guided students in adding, arranging or detailing ideas so that they can improve the quality of ideas (elaboration)
5. Average

### 3.2. Discussion

The preparation of textbooks has paid attention to the principles of textbook preparation. The development of quality textbooks requires several aspects that must be considered. These aspects include material, presentation and language. Based on the material aspect, the textbooks to be developed have paid attention to the suitability of the curriculum, the suitability of the material with the competencies that must be achieved, educational goals, the truth of the material according to the science being taught and the suitability of the material with the cognitive development of students. Based on the presentation aspect, the textbook developed has also paid attention to the learning stages carried out, the presentation must also be able to arouse student motivation, be easy to understand and encourage creative thinking skills and student activeness to think and reason, related study materials must be related to the material prepared. Based on the linguistic aspect, the developed textbooks have paid attention to the proper and correct use of Indonesian, the use of language that can improve
students’ reasoning power and creativity, use of language according to the level of student mastery, clarity and attractiveness of the visual illustrations contained in textbooks and suitability. material with the level of student analysis skills.

Based on the results of the validation data analysis of the development of basic electronics textbooks integrating creative thinking to improve student competence in the Department of Physics, Faculty of Mathematics and Natural Sciences, Padang State University, it is obtained that the feasibility of content with five indicators can be seen in Figure 2, having the lowest score of 87% and with the highest score of 100% with very valid criteria. The feasibility of construction has six indicators with a range of values from 87% to 100% with very valid criteria. Figure 3. For the language feasibility component with five indicators, it has the lowest value of 80% with valid criteria and the highest value is 100% with very valid criteria as shown in Figure 4. Furthermore, for the feasibility of display with five indicators, the lowest score is 80% with valid criteria, the highest value is 93% with very valid criteria as shown in Figure 5. For the feasibility of creative thinking in textbooks, it has a value ranging from 60% with criteria valid enough to 73%. valid criteria as shown in Figure 6.

Overall, basic electronics textbook 2 integrates creative thinking to improve student competence in the Department of Physics, State University of Padang has a validity value with the lowest score of 67% with valid criteria and the highest score of 96% with very valid criteria, with an average score of 86.6% with very valid criteria as in Figure 1. So based on the results of data analysis the validation by the validator is in accordance with the textbook structure both from the components of the feasibility of content, construction, language, appearance and integration of creative thinking skills. This shows that the textbook developed has been declared valid by the validator so that it can be continued at the next stage of practicality and effectiveness.

4. Conclusion
Based on the discussion and the results of the research that has been done, it can be concluded that the basic electronics textbook 2 integrates creative thinking to improve student competence in the Department of Physics, Faculty of Mathematics and Natural Sciences, Padang State University, has an average validity value of 85% with very valid criteria. This shows that basic electronics textbook 2 integrating creative thinking meets valid criteria so that it can be used to determine practicality and effectiveness in learning.

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