INTEGRATED DESIGN OF KNOWLEDGE DIMENSIONS AND THINKING PROCESS LEVEL ON MEASUREMENT MATERIALS FOR HIGH SCHOOL PHYSICS LEARNING

THESIS UNDERGRADUATED

Submitted as one of the requirements to get a degree Bachelor of Education

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STATEMENT

I hereby declare that:

1. This paper, a final project in the form of a thesis entitled "Integrated Design of Knowledge Dimensions and Levels of Thinking Processes on Measurement Materials for High School Physics Learning", is my own original work.
2. This paper contains ideas, formulations, from my research, without the help of other parties, except the supervisor.
3. In this paper, there are no works or opinions that have been written or published by others, except in writing that is clearly stated as a reference in the manuscript by mentioning the author and included in the literature.
4. I make this statement in truth and if there are deviations in this statement, I am willing to accept academic sanctions in the form of revocation of the degree that has been obtained because of this paper, as well as other sanctions in accordance with applicable legal norms and provisions.

Padang, August 30, 2021

Who made the statement

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ABSTRACT

Hanifah Ahmad : Integrated Design of Knowledge Dimensions and Thinking Process Levels in Measurement Materials for High School Physics Learning

The learning objectives of the 2013 curriculum expect changes and improvements in students' competencies. To encourage the achievement of these learning objectives, the learning tools should refer to the Graduate Competency Standards (SKL) which have been regulated in Permendikbud number 20 of 2016. It is explained that the revised Bloom's taxonomy is a reference in developing SKL. The revised Bloom's Taxonomy developed by Anderson and Krathwohl in 2001 categorizes learning outcomes by referring to the dimensions of knowledge and levels of thinking processes. However, the reality is that the intensity of the dimensions of knowledge and the level of thinking processes in learning devices is still not balanced. Thus, the learning objectives cannot be achieved optimally. This study aims to produce a design in the form of a learning device that is oriented to the integration of the dimensions of knowledge and the level of thinking processes.

The type of research used is R & D (Research and Development) using a development model, namely the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) which is limited to the stage development with valid criteria. The object of research is a learning device that includes lesson plans, teaching materials and evaluation instruments that are oriented towards the integration of the dimensions of knowledge and the level of thinking processes in the measurement material.

The results showed that the lesson plans were in the valid category with an average value of 3.23, teaching materials with an average value of 3.40 in the very valid category, and evaluation instruments with an average value of 3.42 in the very valid category. Thus, it can be concluded that the learning tools oriented to the integration of the dimensions of knowledge and the level of thinking processes are in the very valid category with an overall average value of 3.38.

Keywords: Design, Knowledge Dimensions, Thinking Process Levels, Measurement Materials

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Padang, 30 August 2021
Author,

Hanifah Ahmad
NIM.17033016

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CHAPTER 1 INTRODUCTION

A. Background of The Research Problem

In the 21st century, young people are required to master information technology with the aim of being able to adapt to the development of an increasingly advanced era. Therefore, many things must be prepared by the younger generation, starting from improving the way to communicate well, being literate in the use of information technology that has penetrated in various ways, increasing critical thinking in solving problems to creating various things innovatively. This can be trained in line with the teaching and education received by students. Until finally students are able to compete and be competent in the current of globalization in the 21st century.

According to the National Education Association, the achievement of success in global competition is marked by students' abilities in skills as communicators, creators, critical thinkers and collaborators (Trisdiono, 2013). This statement is in accordance with the demands of the 21st century in the field of education where it is expected that the learning system must refer to the achievement of learning objectives. This goal is in line with the presence of the 2013 Curriculum which has undergone several revisions. The 2013 curriculum by Anis Baswedan (in Kemendikbud, 2016) reveals that there are 3 basic main components, namely competence, literacy and character. The competency component consists of four main points, namely the ability to think critically, creatively, communicatively and collaboratively, while the character component has two points, namely morals and performance.

Critical thinking skills are characterized by the ability to reason, express, analyze and solve problems. Communication skills are characterized by good communication between the giver and recipient of information to improve the quality of information. The ability to collaborate is characterized by cooperation between various parties. Meanwhile, the ability to think creatively is marked by a new breakthrough/innovation of knowledge.

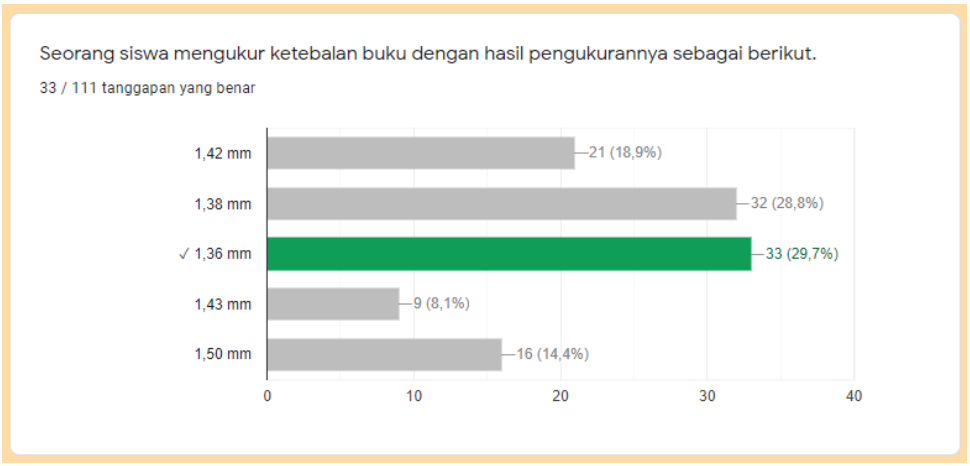
From the statement of the paragraph above, it can be indicated that each ability affects each other. Starting from the critical thinking skills possessed so as to be able to create new breakthroughs. If the competencies in the 2013 curriculum can be implemented properly, the learning objectives will be achieved. The minimum goals to be achieved are increasing knowledge, changing attitudes and increasing students' thinking abilities. To see if the 2013 curriculum is implemented well or not, it can be seen in the learning designed by the teacher which refers to the Process Standards that have been regulated in Permendikbud No.22 of 2016. Meanwhile, the Process Standards were developed referring to the Graduate Competency Standards (SKL) which has been regulated in Permendikbud No. 20 of 2016. In the regulation, it is stated that Bloom's taxonomy is a reference in developing SKL. Especially in the revised Bloom's taxonomy by Anderson and Krathwohl in 2001.

The revised Bloom's taxonomy categorizes learning outcomes into three domains, namely the knowledge dimension related to the mastery of knowledge, the attitude dimension related to the mastery of attitudes and behavior, and the skill dimension related to the mastery of skills (Permendikbud, 2016).

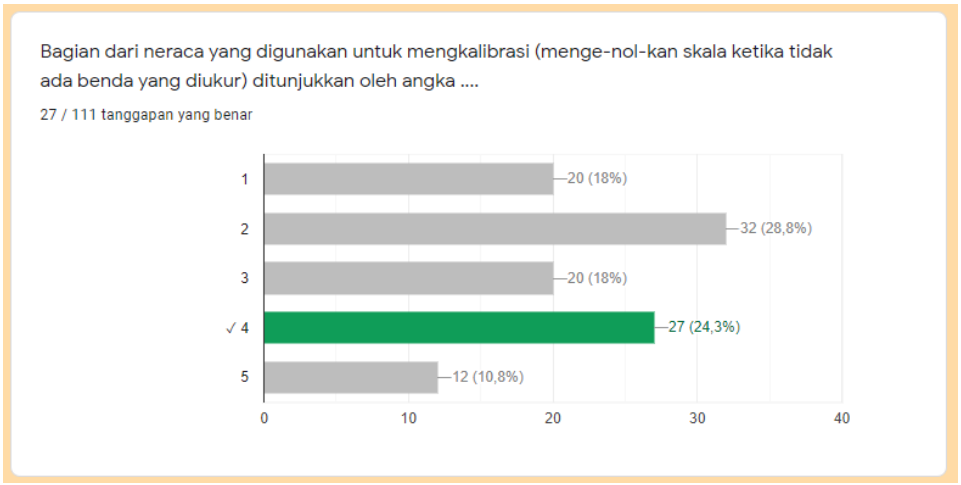
Meanwhile, SKL is used as a reference for determining generic competencies. This competence covers the domains of attitudes, knowledge and skills. In line with this, the revised Bloom's taxonomy also develops the level of competence in the cognitive domain.

Dimensions of knowledge and cognitive level are references to Core Competencies (KI) and Basic Competencies (KD) that exist in each subject in the 2013 curriculum. According to Bloom's taxonomy revision (2001), the knowledge dimension consists of 4 dimensions of knowledge, namely factual, conceptual, procedural. and metacognitive) while the cognitive level consists of 6 levels, namely remembering, understanding, applying, analyzing, evaluating and creating. If the dimensions of knowledge and cognitive levels can be carried out well in an integrated manner, it is certain that the learning objectives can be achieved. For this reason, the thing that needs to be considered is the extent to which students master knowledge in learning and the implementation of the curriculum in schools.

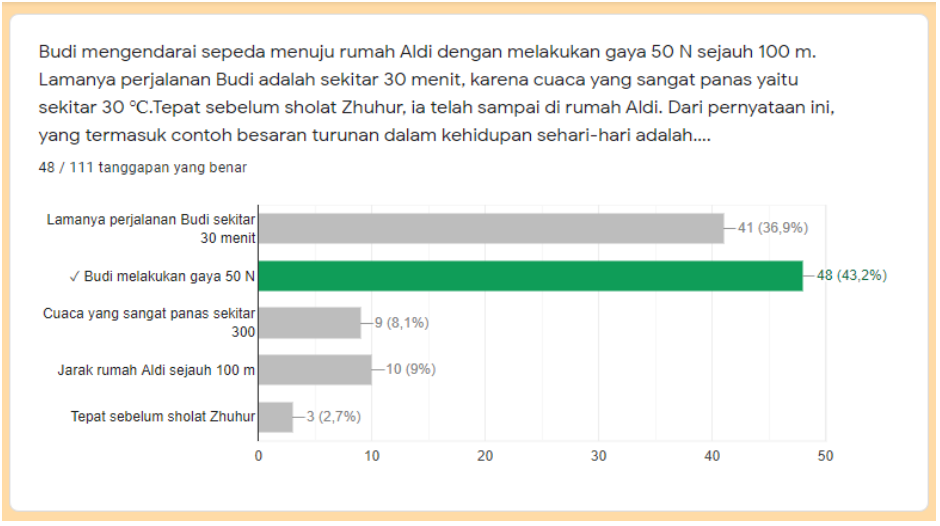
Referring to the mastery of knowledge in learning by students, it can be seen that this has not achieved output expected by all parties. Based on the conditions at the time of carrying out the Educational Field Practice (PLK) in class X MIPA SMA Negeri 1 X Koto Diatas during the odd semester, the data on student learning outcomes in the Mid-Semester Assessment (PTS) for the subject matter of Measurement, showed a low value. This can be seen in the image that has been presented below.



(1a)



(1b)



(1c)

Figure 1. Sample of student responses in PTS on measurement material

Based on Figure 1, it can be seen that students have not mastered the knowledge of measurement material. To find out more about these problems, the authors conducted interviews with physics teachers on Wednesday, September 29, 2020. From the results of the interviews, it can be concluded that since the launch of the 2013 curriculum, teachers at schools have implemented it in the learning process, from design learning to evaluation. learning. However, if viewed from the learning objectives, the 2013 curriculum has not been implemented optimally in SMA Negeri 1 X Koto Diatas.

From the problems that occurred in SMA Negeri 1 X Koto Diatas, the author made further observations at high schools throughout Solok Regency by distributing questionnaires to learning tools consisting of lesson plans, teaching materials and assessments. The results of the observations on the lesson plan show that on average 25.50% contains the intensity of observing, 29.74% contains the intensity of questioning, 25.71% contains the intensity of trying, 10.74% contains the intensity of reasoning and 8.31% contains the intensity of concluding. This indicates that the intensity of the scientific approach that has been implemented has not been balanced. Furthermore, the results of observations on teaching materials on average show that 22.47 % contains factual knowledge, 34.27 % contains conceptual knowledge, 21.63% contains procedural knowledge and 21.63% contains metacognitive knowledge. This indicates that the dimensions of knowledge are not yet balanced.

Furthermore, observations were made on the questions given by the teacher as a task for students to learn. The results of the analysis at the cognitive level

that were tested in the form of questions to students showed that 17% were tested for the ability to remember, 22.46% for the ability to understand, 25.85% for the ability to apply, 12.20% for the ability to analyze, 18.70% the ability evaluate, while to create is 3.78%. This indicates that the level of cognitive processes carried out is still not fulfilled properly. This is confirmed again by the fact that teachers are also still not familiar with training students' cognitive levels in material development. Teachers tend to perceive questions with lower cognitive levels as questions with higher cognitive abilities (Prihastuti, 2018).

To see the overall problem factors above, it can be traced by looking at learning as a system that has several components. This can be seen in the image presented below.

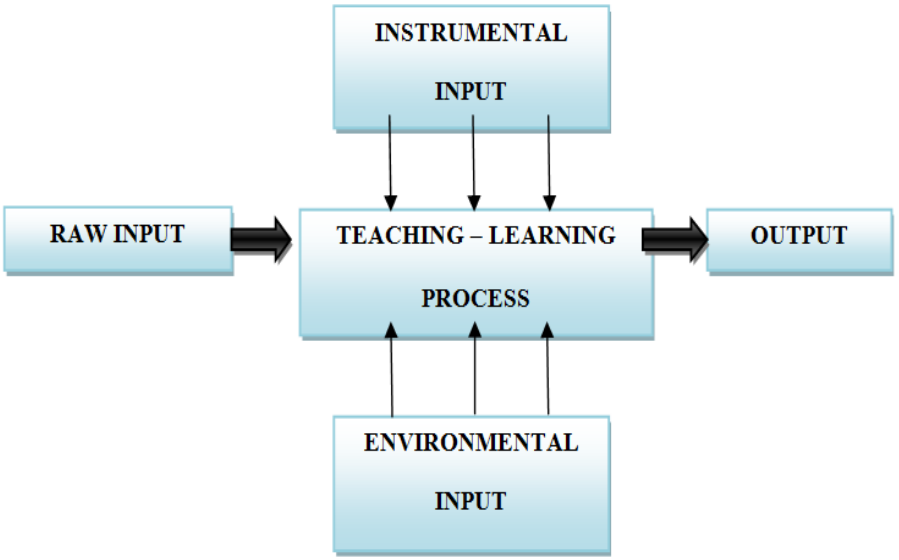


Figure 2. Learning as a system

According to Ngalim Purwanto (2003:106-107), learning as a system consists of 3 main components including raw input, teaching learning process and output. In this system there are also 2 components of influencing factors, namely

factors that are deliberately designed and manipulated or instrumental input and environmental input factors.

In learning, the raw input in question is students. Each student has its own characteristics, both physically and psychologically. Physically means the conditions in receiving learning while psychologically means interest, motivation, cognitive abilities and so on. All of these characters can affect the process and student learning outcomes. For instrumental input or factors that are intentionally designed and manipulated, it can be in the form of curriculum, educators, learning media, teaching materials, and so on. Of all the components, instrumental input is a very important component, because it is a decisive component in achieving output the expected/ learning outcomes. With this instrumental input, the learning process can be implemented.

Learning devices are one of the instrumental inputs used in a learning system. The learning tools used in the 2013 curriculum have referred to the application of the revised Bloom's taxonomy which combines the dimensions of knowledge and the level of cognitive processes. In addition, basically, the dimensions of knowledge presented in learning content (essential material) can improve students' thinking skills. Likewise, the assessment that is tested on students should be developed with reference to the level of cognitive processes.

In connection with the above conditions, it is necessary to design a learning device design that is oriented to the integration of the dimensions of knowledge and the level of cognitive processes. On this basis, the researche raised the title of the research **"Integrated Design of Knowledge Dimensions**

and Levels of Thinking Processes on Measurement Materials for High School Physics Learning".

B. Identification of The Research Problems

Based on the background that has been stated, it was found that students' mastery of the measurement material was still low. This is supported by the results of observational data that has been carried out by researchers during the Educational Field Practice (PLK). The main factor causing the low mastery of students in learning is the preparation of learning content and the level of questions that have not referred to the 2013 curriculum, namely the revised Bloom's taxonomy. So that it can be identified the causes of the problem are:

1. Unbalanced intensity of the availability of the scientific approach contained in the Learning Implementation Plan (RPP). It can be seen that the aspects of reasoning and inference tend to be less in the learning design.
2. Unbalanced distribution of knowledge dimensions in learning content in teaching materials. It can be seen that conceptual knowledge dominates in learning content, factual knowledge that only spurs memory skills is less productive for students, meanwhile procedural and metacognitive knowledge is very little in learning content in teaching materials.
3. The level of thinking processes that are trained to students has not been fulfilled, especially in the category of higher-order thinking. It can be seen that the ability to analyze and creative ability is still very little in the questions that are trained. As a result, students can only remember things that are temporary.

4. Teacher learning tools have not been fully designed based on the integration of the dimensions of knowledge and the level of the thinking process. Skills thinking that the expectations are difficult to achieve.

C. Limitation of The Problem

Based on the identification of the problem, the research problem needs to be limited. The limitations of the problem in this study are as follows:

1. The development of the learning device design is limited to the Learning Implementation Plan (RPP), teaching materials and evaluation instruments.
2. The integration of knowledge dimensions and levels of thinking processes refers to the 4 x 6 matrix form developed by Anderson and Krathwohl in Bloom's revised taxonomy.
3. The learning materials developed in this study are limited to Measurement material in class X semester 1.

D. Formulation of The Research Problem

Based on the background of the problems that have been stated, the problems in this study can be formulated, namely:

1. How is the design of learning devices oriented to the integration of the dimensions of knowledge and the level of thinking processes in the measurement material in high school physics lessons ?
2. How is the value of the validity of learning tools oriented to the integration of the dimensions of knowledge and the level of thinking processes in the measurement material in high school physics learning ?

E. Purposes of The Research

Based on the formulation of the problems that have been put forward, the purposes of this study are:

1. To produce a learning device design oriented to the integration of the dimensions of knowledge and the level of thinking processes in the measurement material for high school physics learning.
2. To determine the value of the validity of learning tools oriented to the integration of the dimensions of knowledge and the level of thinking processes in the measurement material for high school physics learning.

F. Specification of Product

Specification is a special feature of the product being developed. The learning tools developed have the following characteristics:

1. Learning tools are arranged based on the 2013 curriculum by combining the dimensions of knowledge and levels of thinking processes.
2. The RPP component refers to Permendikbud number 22 of 2016 and the RPP development module issued by the Director General of Primary and Secondary Education in 2017.
3. The format for compiling teaching materials refers to the 2008 Ministry of National Education.
4. The format for the preparation of evaluation instruments refers to the assessment book issued by the Director General of GTK in 2019.
5. Learning Compiled are tested for feasibility by experts.
6. Learning devices are arranged on the measurement material.

G. Benefits of The Research

With the achievement of the research objectives, the results of this study are expected to provide benefits for various parties, namely:

1. For researchers, as basic capital in self-development in the field of research and experience as prospective teachers and fulfill the requirements to complete a bachelor of education physics in the Department of Physics, FMIPA UNP.
2. For teachers, as one of the materials to consider in designing learning tools in schools.
3. For other researchers, as a source of ideas and references for further research.

CHAPTER V CONCLUSION

A. Conclusion

Based on the results of research and discussions that have been carried out, several conclusions can be drawn as follows:

1. The product that has been produced is in the form of learning tools (RPP, teaching materials and *assessments*) that are oriented to the integration of the dimensions of knowledge and the level of thinking processes on measurement materials in Physics learning high school with very good criteria.
2. The validity of learning tools (RPP, teaching materials and assessments) which are oriented to the integration of the dimensions of knowledge and the level of thinking processes in measurement materials in high school physics learning are in the very valid category. The average value of the validation of learning tools from physics lecturers and physics teachers is 3.38.

B. Suggestion

Based on the results achieved and the obstacles encountered in research activities, several suggestions can be put forward including:

1. Teachers can apply learning tools oriented to the integration of the dimensions of knowledge and the level of thinking processes as one of the learning tools that can be used in high school physics learning.
2. Students can use teaching materials and *assessments* contained in learning tools so that they can increase understanding of learning materials Learning tools are oriented to the integration of the dimensions of knowledge and

levels of thinking processes that can be developed by teachers or other researchers on other physics materials.

3. Learning tools oriented to the integration of the dimensions of knowledge and the level of thinking processes can be made not only for class X learning materials, but for class XI and XII semesters 1 and 2.
4. In this study, it was only limited to the development stage of the ADDIE model. For maximum results, it would be better if this research was continued until the evaluation stage.

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