
THE IMPLEMENTATION OF UNDERSTANDING BY DESIGN APPROACH IN MATHEMATICS LEARNING ON ELEMENTARY SCHOOL

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ABSTRACT

This research is motivated by the lack of understanding of students in learning. Understanding by Design (UbD) can be implemented in the planning and implementation of learning to overcome these problems. Such as learning that is only focused on the teacher, the lack of involvement of students in the learning process so that students are less able to build their own understanding concepts. The purpose of this study is to determine the implementation of Understanding by Design in planning and implementing mathematic learning. In this reseach using the Systematic Literature Review method by collecting around 50 journal articles relevant to the research which were then re-selected. Understanding by Design (UbD) emphasizes understanding of students, in the process UbD uses a backwards design where the first thing to do is to determine what results are expected, then determine acceptable evidence, then in the last stage arrange steps in learning activities according to needs and learning objectives. Based on literature studies that have been carried out using a number of articles that are relevant to research and have gone through a re-selection process, the implementation of Understanding by Design (UbD) in learning is proven to increase students' mathematic understanding because in this learning students are actively involved so that learning is not teacher centered and this design can be an alternative learning design to improve the quality of education.

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INTRODUCTION

Mathematics as one of the subjects taught in elementary schools contains concepts that are fundamental to life. As mentioned by Sholihah (2015) that mathematics has a role in answering problems that occur in everyday life, therefore learning mathematics in elementary schools equips elementary school students to think logically, analytically, systematically, critically, creatively and the ability to cooperate needed in everyday life. One of the materials in grade 5 elementary school is the speed chapter. Based on Zulfa (2022) that grade 5

students' thinking ability in solving mathematics problems Speed Material is at low level. The ability of students to complete practice questions regarding speed was still low. Some students do not understand how to calculate speed correctly. It is regrettable that there are still many students who do not understand the speed material. On the basis of this, there must be improvements in the learning design.

Learning design is making decisions on various choices that will be implemented to achieve predetermined goals, where planning contains a series of decisions and explanations of objectives, policy determination, program determination, determination of certain methods and procedures and determination of activities to be carried out (Suryapermana, 2017). Learning design must be designed or prepared before carrying out learning by first preparing learning objectives, learning steps and evaluation. The learning process that guides students to build knowledge into a learning concept, the design process as a process of interaction of students with learning resources will take place. Learning design is very important because it is a guiding tool for teachers in carrying out the learning process, therefore planning must be complete, systematic, easy to apply but flexible and accountable (Abidin, 2016).

Improving the quality of learning can be done by reviewing the learning designs made (Fox in Pertiwi et al, 2019). One learning design that can be used to adjust objectives, activities and assessments is the Understanding by Design approach. Understanding by Design (UbD) is a curriculum development pattern that can be used by teachers in designing learning.

Understanding by Design uses a Backward Design approach where the design process starts backwards or in reverse from the systematics. Based on Yurtseven and Altun (2017) stated that "UbD refers to the task of designing a unit plan covering a three-staged template during the teachers' designing process. At the first stage of the template, named desired results, concepts such as transfer, understanding, and acquisition are mentioned. This approach consists of 3 stages, namely 1) Beginning with determining the goals to be achieved. This goal relates to what abilities/skills must be mastered by students. 2) Determine the assessment process, the extent to which students are successful in mastering it, 3) Devise activity plans to achieve the goals to be achieved by students. The UbD approach ensures teachers to clarify learning objectives to be achieved, plan learning and assessments around these objectives and ensure student learning through understanding. (Wiggins and McTighe in Joshi, 2021).

In this case the application of Understanding by Design is beginning to be reapplied in Indonesia through the use of an independent curriculum. According to Fox and Doherty (Asari, 2014) backward design is able to produce learning tools that can improve students' communication literacy. Student literacy in learning, especially in the field of mathematics. But in practice the implementation is left to the teacher. Whether teachers really understand how to properly implement backward design in learning still requires further study and research.

Thus, this article wants to examine more deeply about the implementation of UbD in planning and implementing mathematics learning.

METHOD

The method used in this study uses a systematic literature review, so the data collection must be in accordance with the systematic literature review research procedure. The initial stage in preparing this article is to collect literature. The literature used must be relevant, neatly and systematically arranged for research needs (Ipmawan & Kharisma, 2020). This literature review method is carried out by conducting sequential studies of previous studies to obtain solutions to the problems in the article (Prasela et al, 2020). Identification of various literature is carried out in order to obtain literature that is truly relevant to the required variables. A

literature review was conducted to review the contents of previous research in order to provide meaning and context for the writing of the article being carried out. By conducting a literature review, researchers can reveal what they have studied in a comprehensive manner, reveal what problems occur and what are the solutions to these problems.

The purpose of conducting this literature review is to understand issues relevant to the topic of discussion, conduct a review, understand the theory used in research, and demonstrate an attitude in solving problems in the discussion of research topics. While the benefits of conducting a literature review are that it makes it easier to find solutions to the problems studied, provides convenience during the research process, makes it easier to determine research criteria, and verifies research results.

The following is a systematic literature review research procedure design according to Zawacki-richter (2020) in Figure 1.

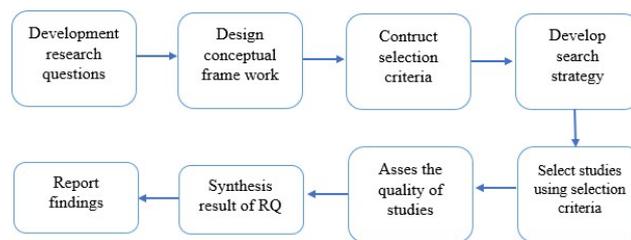


Figure 1. Stages of Systematic Literature Review

1. Development research questions

The questions that will be developed in this research are as follows:

- RQ1. How is UbD implemented in learning mathematics in elementary schools?
- RQ2. How is the preparation of UbD in learning mathematics in elementary schools?
- RQ3. How does UbD improve mathematical understanding?

2. Selection criteria

Next, namely the selection criteria for this study, as follows:

Table 1. Criteria of Inclusion and Exclusion

Inclusion Criteria (Reception)	1) Article journals / scientific works relevant with searched topic or RQ(UbD implemented in learning) 2) Publication year between 2011-2022 3) National journal articles and international 4) Journal articles / scientific works accredited SINTA
Exclusion Criteria (Rejection)	1) Article journals / scientific works irrelevant or outside topic search 2) Publication more than last 10 years 3) Article journals / scientific work non-accredited scholar

3. Develop search strategy

The search process uses a search engine (using Google Chrome) with the address <https://garuda.kemdikbud.go.id> and <https://scholar.google.com>. The search string is needed to make the search more specific and avoid filtering in large numbers. The keywords are “Implementasi Ubd dalam pembelajaran*” or “Understanding by Design*” or “Understanding by Design dalam pembelajaran matematika*” or “Understanding by Design dalam Matematika*”.

4. The study selection process

After identification of scientific work is carried out in the selection process to ensure that the scientific work meets the criteria or not. In this process, selection is made where the title and abstract of scientific work are examined first in order to find out whether the research is relevant or not to the topic being sought (Zawacki, 2020).

5. Appraising the quality of studies

In systematic literature review (SLR) research, the data that has been found will then be evaluated based on the question of quality assessment criteria, which are as follows:

- a. QA1. Was the scientific work published in 2012-2022?
- b. QA2. Is the scientific work in a journal that has been accredited by SINTA?
- c. QA3. Does the scientific work write down the notion of Understanding by Design?
- d. QA4. Does the scientific work write down the implementation of Understanding by Design in learning specially mathematics?

Furthermore, to answer each of the questions above, each scientific paper / journal article is given the following answer values: a. Y(Yes) b. N (No).

Therefore, the results of the search obtained 50 articles which would then be selected, around 20 articles that were included in the acceptance category. For QA1 questions, all accepted scientific papers were published within the year range (2006 2022). For QA2 questions, all scientific works that have been received are indexed at least SINTA 5. For QA3 questions, all scientific works write down the meaning of Understanding by Design. For QA4 questions, all scientific papers write about the implementation of Understanding by Design in learning specially mathematics.

RESULTS AND DISCUSSION

Results

The understanding by design approach focuses on providing understanding and meaning to students. In the understanding by design approach according to Mctighe (2020) understanding by design is derived into two ideas; (1) the focus of modern education on teaching and assessment for understanding and imparting knowledge to learners, and (2) the reverse design “backward” process for developing curricula with these goals in mind. This means that in understanding by design (UbD) design learning starts from the bottom or basically the UbD framework tends to help education identify big ideas that we want students to understand in depth so they can transfer their learning to new situations. Furthermore, other research from Kuntari et all (2019) Understanding by Design (UbD) helps in making connections between components of learning objectives, learning steps, and evaluation so as to help students understand the material and get maximum grades. Understanding by Design (UbD) is relevant

in making learning designs for various materials. Improvement and development of this design is still needed.

In essence, UbD has the aim that students can understand the material content and apply it or transfer what is learned in different contexts, the design framework offers a strong assessment orientation for people involved in curriculum development to design programs in a systematic and directed manner.

The learning offered by UbD assists teachers in compiling an interactive learning process. Understanding by design as an approach and perspective on the learning process in preparing the design and implementation of learning to realize student understanding and student achievement. In terms of implementation when learning UbD is identical to the backward design method where the drafting starts in reverse. According to Wiggins and McTighe (Yovinda, 2014) the stages of backward design are:

Table 2. The stages of backward design

The Stages of Backward Design	Description
Identify Desired Results	At the stage of identifying the desired results, after determining the teaching material the teacher must consider the main objectives to be achieved, determine what questions students must be able to understand, what understanding must be mastered and what skills must be possessed by students.
Determine Acceptable Evidence	After determining what understanding is desired, a teacher needs evidence to see the achievement of student understanding. The criteria for students having an understanding consist of 6 aspects, namely students can explain, interpret, apply, have a point of view, have empathy and self-knowledge (McTighe & Hibah, 2015). So this evidence intersects with physical evidence that shows students' abilities such as performance tasks and other evidence, namely quizzes, written tests, observations, and homework.
Plan learning experiences and instruction	There are two elements that can be made as learning activities namely 1) creating learning activities with the desired results by identifying the instructional design stages. 2) using Whereto to create meaningful and permanent learning activities for students (Melike, 2021). Learning planning that uses the WHERETO principle is described below, namely: 1) W (Where and why) ensures students will understand what/the purpose of learning is and the reasons for studying it. 2) H (Hook and Hold) attracts students' attention to the opening activity and maintains students' attention to the entire learning process 3) E (Equip) equips students with the competencies needed to meet learning objectives 4) R (Rethnik & Reflect) provides opportunities for

The Stages of Backward Design	Description
	students to identify big ideas, reflect on their activities and improve their assignments
	5) E (Evaluate) helps students evaluate and assess themselves
	6) T (Tailored) Adapting learning to their talents, interests, learning styles and needs
	7) O (Organized) organize and optimize students' understanding

Discussion

Based on that explanation, the researcher tries to implement the learning mathematics in grade 5 of speed chapter. The planning stages using UBD with the principle of backward design consist of:

Table 3. The planning stages using UBD of speed chapter in grade 5 elementary school

The Stages of Backward Design	Description
Identify Desired Results	The main goal is: students are able to calculate the speed correctly
Determine Acceptable Evidence	Criteria: students complete practice questions related to speed With evidence determined through the work of lesson sheets and written tests
Plan learning experiences and instruction	Using the whereto principle, the learning steps are: W – Where and Why : Provides initial recognition of units, time, distance, and speed. It's related to each other H - Hook and hold: Hooking up speed in everyday life E - Equip : Helping students in exploring speed material and how to calculate it R - Rethnik & Reflect: Provide opportunities for students to improve their understanding through formative assessment activities E - Evaluate: Evaluate students' understanding and assignments T - Tailored : Customize learning O - Organize: Organize learning effectively that can involve students

Based on the activities above, this understanding by design approach places more emphasis on student understanding which is prepared by determining the goals to be achieved, with evidence that needs to be tested up to making learning steps in such a way as to achieve the desired results.

Based on several studies, researchers found that there is an Implementation of Understanding by Design (UbD) in Indonesia, one of which is research conducted by (Lagos, 2020) with the results stating that learning designed with the UbD approach is more effective than

conventional learning to help students understand concepts mathematics. Subsequent research was also conducted in Indonesia which was conducted by (Nool, 2012), stating the conclusion that the learning design in the realm of mathematical involvement analyzed in the affective, cognitive and behavioral domains can be used as an alternative learning design to improve the quality of education. The important thing that underlies it is that in UbD it is emphasized that learning objectives, learning evaluation, learning steps must be intertwined. So the use of UbD in designing learning is recommended for teachers in learning mathematics.

CONCLUSION

Based on literature studies that have been carried out using a number of articles that are relevant to research and have gone through a re-selection process, the implementation of Understanding by Design (UbD) in learning is proven to increase students' mathematic understanding because in this learning students are actively involved so that learning is not teacher centered and this design can be an alternative learning design to improve the quality of education. Implementation of the understanding by design approach in learning mathematics in elementary schools consists of 3 stages, 1) Beginning with determining the goals to be achieved. This goal relates to what abilities/skills must be mastered by students. 2) Determine the assessment process, the extent to which students are successful in mastering it, 3) Devise activity plans to achieve the goals to be achieved by students. The UbD approach ensures teachers to clarify learning objectives to be achieved, plan learning and assessments around these objectives and ensure student learning through understanding. The implementation of Understanding by Design (UbD) in learning is proven to increase students' mathematic understanding because in this learning students are actively involved so that learning is not teacher centered and this design can be an alternative learning design to improve the quality of education.

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