

# Development of Design and Implementation of Hybrid Learning About Vibration and Waves Using Understanding by Design (UbD) Approach

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**Abstract.** The purpose of this study was to analyse the design of Understanding by Design approach with backward design and find out its effectiveness on the Vibration and Waves during hybrid learning. The product development using research and development ADDIE concept. As the testing of this product, researcher use quasi experiment with the 2 groups pretest-posttest design with a sampling technique of cluster random sampling. The instrument used is an instrument of conceptual understanding that has been validated by experts. The data analysis technique used in this research is descriptive quantitative data analysis technique. The quantitative descriptive analysis technique was obtained from a worksheet which was then quantified in order to get the results in the form of numbers. The results obtained indicate that there is a significant effect on students' conceptual understanding using Understanding by Design (UbD) approach on vibration and wave.

**Keywords:** Understanding by Design (UbD), Hybrid Learning, conceptual understanding.

## 1 Introduction

The main task of a teacher is to teach. Teaching is making learning happen [1]. This can be done when there is an attempt to use different strategies, methods and techniques to achieve certain competencies/learning outcomes, namely changing from incapable to capable [2]. Competencies that must be mastered by students are stated in the learning objectives [3]. Learning objectives can be achieved if the learning designer creates a conducive learning environment so that students feel comfortable and involved in the learning process. This is one of the main tasks of a teacher [4].

As long as the author is teaching often finds in the lesson plan that the evaluation of learning and learning activities is not in line with the learning objectives, so the learning objectives are not achieved optimally. There are even teachers who teach without implementing the lesson

plans that have been prepared. Learning process plans usually only apply as a supplement to administration.

Susan Clayton wrote in her journal article "Understanding by Design: Learning Design, Assessment, and Teaching for Understanding" that a Singaporean teacher found that the challenge was that today's learning attitude is a millennia-old cultural aspect that has placed the teacher at the center of the educational process [5].

In the evolving world of education, Wiggins and McTighe introduced a new approach to instructional design, called understanding by design by Wiggins and McTighe. Understanding by design is an approach to planning and implementing learning that views learning as a means to improve student understanding or can be called "teaching for understanding" [6]. In this approach, lesson plans are designed to achieve the desired results, which in designing learning are guided by backward design. The backward design means a design that is compiled from behind, which begins with determining the desired end result, evaluating evidence, and learning steps to achieve these results.

The principle of Understanding By Design emphasizes long-term understanding (Enduring Understanding) with contextual learning. Basically, teaching follows a student-centered design approach, in which students are actively involved in learning. Therefore, the UbD method will help students understand the lesson by actively participating in the learning process.

On March 2, 2020, the Indonesian government announced that the first case of Corona Virus Disease (Covid-19) had been found in Indonesia. The COVID-19 pandemic has really changed all aspects of people's lives. Various things that are usually carried out face to face now have to meet via the screen. This also applies to the education sector. The government stipulates 100% online learning during the Enforcement of Community Activity Restrictions (PPKM). Over time, after the community started getting vaccines, slowly but surely the PPKM was relaxed, and the education sector was allowed to carry out limited face-to-face learning while still paying attention to health protocols referring to the 4 Ministerial Decree. The technical implementation of this limited face-to-face learning uses hybrid learning. Hybrid learning is a learning model that combines face-to-face activities (offline) and internet-based (online)[7]. The hybrid learning process at SMP Surabaya Grammar School utilizes Moodle as an application to support online learning.

Implementing a hybrid learning process is certainly different from face-to-face. Teachers must be able to design a learning process that can be understood by all students, both face-to-face and on the internet. With the UbD approach, teachers can design lesson plans that can help improve students' understanding of physics lessons.

## **2 Methods**

This type of research includes development research using the ADDIE development model. The research model used is quantitative research. The trial was divided into 2 stages, namely one-on-one evaluation by experts and field testing using a quasi-experimental with the 2 groups pretest-posttest design with a sampling technique of cluster random sampling. The instrument used is an instrument of conceptual understanding that has been validated by experts. The data analysis technique used in this research is the descriptive quantitative data

analysis technique. The quantitative descriptive analysis technique was obtained from a worksheet which was then quantified in order to get the results in the form of numbers. The research was carried out in a Junior High School which implemented hybrid learning using Zoom and Moodle.

### 3 Result and Discussion

#### 3.1 Implementation of the lesson plan

Analysis of the implementation of the Lesson Plan in 3 meetings:

Meeting	Execution	Percentage
1	14/14	100%
2	13/14	92.85%
3	13/14	92.85%
Average implementation of lesson plan		95,23%

#### 3.1 T-test Independent Group Pretest for both classes

Based on the results of the pretest of the two classes, the mean is obtained as follows:

**Table 1.** Comparison of the mean of the two classes.

Code		N	Mean	Standard deviation	Standard error mean
Pretest	Kontrol	20	40.81	10.26629	1.78713
	Eksperimen	20	40.33	15.05197	2.35072

**Table 2.** Uji T Independent Group kedua kelas.

		Levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
								Lower	upper	
Pretest	Equal variances assumed	3.390	.070	.393	72	.695	0.47619	3.07345	-4.91787	7.33576
	Equal variances not assumed			.409	70.261	.683	0.47619	2.95292	-4.68009	7.09797

### 3.3 T-test Independent Group Posttest both classes

Based on the results of the posttest of the two classes, the mean is obtained as follows:

**Table 3.** Comparison of the mean posttest of the control class and the experimental class.

Code		N	Mean	Standard deviation	Standard error mean
Pretest	Kontrol	20	62.35	13.89272	2.41841
	Eksperimen	20	82.55	16.53742	2.58271

**Table 4.** Uji T posttest Independent Group kedua kelas.

		Levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
									Lower	upper
Pretest	Equal variances assumed	.063	.803	-7.469	72	.000	-20.2	3.60577	34.1176	19.74182
	Equal variances not assumed			-7.611	71.850	.000	-20.2	3.53824	33.9838	19.87619

### 3.5 Completeness of learning outcomes

The following is the percentage of complete learning outcomes in both classes.

**Table 5.** Percentage of completeness of both classes.

Class	Percentage Complete	Percentage Incomplete
Control	55%	45%
Experiment	85%	15%

### 3.6 Analysis of the level of understanding of the two classes

**Table 6.** Percentage of understanding criteria in both classes.

Student Understanding Criteria	Percentage (%)	
	Controls	Experiment
So low	15.16	2.51
Low	28.13	3.43
Enough	24.49	3.74
High	18.32	25.82
Very high	13.90	64.50

Based on the table above, we can conclude that concept understanding using UbD approach in experiment class is better than control class.

#### 4 Conclusion

Based on the results of research and discussion that have been described in this study, it can be concluded that there is a significant effect on students' conceptual understanding using Understanding by Design (UbD) approach on vibration and wave.

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