# Development of Dinamic Fluid Learning Video Based on Contextual in Water Area for High School Students

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# Development of Dinamic Fluid Learning Video Based on Contextual in Water Area for High School Students

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**Abstract**

The research aims to develop a fluid dynamic learning video-based contextual in water areas that valid and practical. This research is a development study using the Rowntree model, which consists of planning, development, and evaluation stages. The evaluation phase uses the Tessmer evaluation only to the small group evaluation stage. The one to one and small group evaluation stages will be carried out at SMA Negeri 1 Air Saleh in the even semester 2018/2019. Data collected through a walkthrough and questionnaire. The data is then analyzed by determining the mean percentage then converted to get the conclusion of validity and practicality of the video developed. The research conducted concluded that a fluid dynamic learning video-based contextual in water areas have been successfully developed with a percentage of 94% and very practical with a percentage of 87%, making it feasible to use. The product developed can then be used by the teacher to teach the concept of dynamic fluid, especially in schools in water areas, so that students can understand the concept of dynamic fluid based on the surrounding environment.

**Keywords:** learning video; contextual approach; water area; dynamic fluid.



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## INTRODUCTION

Discussions on the fluid in schools emphasize fluid as an ideal fluid. The general characteristics of ideal fluids are incompressible (non-compressible), non-viscous (non-viscous), non-turbulent flow, non-turbulent flow. Two concepts are discussed in dynamic fluid, namely the concept of continuity equations and the Bernoulli principle. The continuity equation studies the flow of fluid in a pipe with a certain cross-sectional area, where the mass of fluid entering the pipe will be the same as coming out of the pipe during a certain time interval. Furthermore, the Bernoulli principle states that the greater the velocity of the fluid, the smaller the pressure and vice versa.

The dynamic fluid is one of the materials taught to students of class XI even semester. The process of teaching and learning dynamic fluid material is inseparable from several problems. Research on understanding the concept of dynamic fluid in students and concluded that 28% of students misunderstood the concept of dynamic fluid which assumes that fluids flowing in small pipes have a large velocity due to large fluid pressure (Sholihat, Samsudin, & Nugraha, 2017). The results of students' cognitive tests it was found that the cognitive abilities of students almost all dynamic fluid sub-materials were still low due to learning difficulties (Anggraeni, Faizah, & Septian, 2019; Fathiah, Kaniawati, & Utari, 2015). Learning difficulties identified include the concept of dynamic fluid is still abstract, has not been able to decipher the quantities that affect water flow, has not been able to formulate the relationship between quantities in dynamic fluid to solve a phenomenon, and the low problem-solving ability of students related to dynamic fluids. Along with the development of technology, one solution to overcome the difficulties of learning dynamic fluid is implementing learning integrated with the use of technology and the surrounding environment. This offers the use of technology as an example of a learning video that contains dynamic fluid concepts through a contextual approach.

The relationship between the knowledge that has been learned with the application in the lives of students in the family and community needs the help of educators to facilitate students in linking material in school with the real situation around or known as a contextual approach. Many studies have been conducted to apply contextual approaches to learning physics in high school (Fitriani, Jamal, & Wati, 2013; Huda & Kosim, 2019; Muzdalifa, 2015; Yulianti, Lestari, & Yulianto, 2010). The study results as a whole state the application of contextual approaches can improve physics learning outcomes. In addition, the application of a contextual approach can also attract students' learning interest to learn. The association with dynamic fluid learning using this contextual approach can utilize the community's environmental and cultural potential in managing natural resources as learning resources. One example can be applied to water areas.

The waters area is an area on the surface of the earth that is formed naturally or artificially so that covered water masses can be permanent or periodic either freshwater, brackish water, or seawater (Apriliani, Kurniasari, & Yuliati, 2019). Water areas are considered as productive natural resources to meet their daily needs and transportation media so that water areas can support the lives of people living in the area.

One of the regions in Indonesia, including water areas, is found in Saleh Jaya Village, Air Saleh District, Banyuasin Regency. The community in the village utilizes natural conditions surrounded by water for transportation and agricultural purposes. During the rainy season, Air Saleh Village can only be accessed via the waterway via the Musi River by speed boat from Palembang City. In the field of agriculture, residents use water flow for irrigation and the process of harvesting coconuts. Although located in a water area, Air Saleh Village has good facilities, and there are schools up to high school level so that education in the area is guaranteed. SMA Negeri 1 Air Saleh is one of the high schools located in the Air Saleh District. Although located in the waters of SMA Negeri 1 Air Saleh, there are facilities that support the implementation of learning by utilizing technology, one of which is a learning video developed. This study aims to develop a contextual video based on the dynamic learning of fluid in the waters. The benefit of this research is to provide alternative learning resources for students and teachers to understand the concept of dynamic fluid by utilizing its human resources in processing natural resources in their area of residence, namely the waters area.

A static fluid learning video has been developed in secondary schools where the video is developed containing the concept of static fluid along with applications in everyday life and technology, as well as a simple practicum that can be done anywhere (Nuzuliana, Bakri, & Budi, 2015). It has successfully developed science learning videos about environmental pollution and material damage through the ADDIE development method, and the results of 92.66 categories are very feasible (Mutia, Adlim, & Halim, 2018). Animal classification learning videos have been developed as supplements for teaching biology materials. The learning videos developed are expected to help in visualizing animals that are rarely encountered by students in everyday life (Fechera, Somantri, & Hamik, 2012; Yusriya, Santoso, & Priyono, 2014). Some of the results of these studies, video learning, are alternative as a substitute material or additional teaching material to facilitate students' learning (Khairani, Sutisna, & Suyanto, 2019). The development of dynamic fluid video learning in aquatic areas adds to the environment around the research area so that students can learn while understanding the surrounding environment well.

The difference in research conducted with previous research lies in the research environment. The environment in question is a water area. This is because not much teaching material is developed focusing on just one specific area. Based on the background of the problem, the aim of the research is to develop a fluid dynamic learning video-based contextual in water areas that valid and practical.

## METHOD

This study uses a product-oriented development model, the Rowntree model. The Rowntree model consists of three stages: the planning stage, the development stage, and the evaluation stage. The planning stage consists of the needs analysis phase, the need for developing contextual dynamic based video learning in waters, and the analysis of dynamic fluid material related to phenomena in the water area to formulate learning objectives. The development phase began with developing topics, drafting, and producing contextual video learning prototypes based on dynamic fluid material waters. The evaluation stage is to evaluate the results of the product being evaluated using the Tessmer formative evaluation model. The stages of Tessmer's formative evaluation are (1) self-evaluation; (2) expert review; (3) one to one evaluation; (4) small group evaluation; and (5) Field Test. The research carried out only reached stage 4, namely small group evaluation.

This research has been carried out in the odd semester of the academic year 2018/2019 at the Physics Education Study Program of the University of Sriwijaya, and the prototype video trial of dynamic fluid learning based on the waters of the region for the one to one stage and small group evaluation was carried out in the even semester of the 2018/2019 academic year in SMA Negeri 1 Air Saleh.

Data collection was carried out using two techniques, namely walkthrough, and questionnaire. Walkthroughs are carried out for experts or material and media experts with design and content validation grids presented in table 1.

Table 1 Design and Content Validation Grids

| Aspect | Indicators | Number of Statement |
|---|---|---|
| Content | Suitability with SK and KD dynamic fluid in high school | 2 |
| | The truth is the concept of dynamic fluid | 3 |

| Aspect | Indicators | Number of Statement |
|---|---|---|
| Design | The truth is the concept of dynamic fluid based on contectual in water area | 4 |
| | Attractive learning video display | 3 |
| | Ease of use of learning videos | 2 |
| | Quality music and video learning narratives | 3 |
| | Learning video presentation format | 3 |

The questionnaire was given at the stage of one to one evaluation and small group evaluation to students to get the practicality of learning video data that was developed. The number of students as respondents at each stage amounted to 3 people and 9 people.

Table 2 Indicator questionnaire responses of students

| Aspect | Indicators | Number of Statement |
|---|---|---|
| Content | The concept of dynamic fluid contained in the video | 2 |
| | Ease in understanding dynamic fluid material | 2 |
| | Clarity of dynamic fluid learning video content | 2 |
| | Ease of understanding the examples provided | 2 |
| Design | Learning video display | 2 |
| | Color composition in the learning video | 2 |
| | Audio quality and use of music as a background for learning videos | 1 |

Data obtained from walktrough analyzed by determining the percentage of each validator. Percentages were then converted using categories such validation results Table 3.

Table 3 Expert Validation Results Category (EVR)

| Percentage | *Category* |
|---|---|
| $86 \leq EVR \leq 100$ | Very Valid |
| $70 \leq EVR < 86$ | Valid |
| $56 \leq EVR < 70$ | Less Valid |
| $0 < EVR < 56$ | Invalid |

(Wiyono, 2015)

Furthermore, the data obtained through questionnaires at the stage of one to one evaluation and small group evaluation to students were analyzed by determining the average percentage obtained from all students as respondents. The category of product practicality can be seen in table 4.

Table 4 One-to-One and Small Group Results Categories (HEOS)

| Percentage | *Category* |
|---|---|
| $86 \leq HEOS \leq 100$ | Very practical |
| $70 \leq HEOS < 86$ | Practical |
| $56 \leq HEOS < 70$ | Less Practical |
| $0 < HEOS < 56$ | Not practical |

(Wiyono, 2015)

## RESULT AND DISCUSSION

The results of the planning phase of the research obtained from the needs analysis carried out at SMA Negeri 1 Air Saleh show that the lack of students' knowledge that some natural resource processing processes that are around them are the application of the concept of physics one example of the concept of dynamic fluid. Another result obtained is that computer laboratories in schools are rarely used for teaching and learning, and learning resources are only focused on textbooks that are loaned to schools. The results of this needs analysis show that there is a need for other learning resources that can help students understand the concept of dynamic fluid and the surrounding environment while utilizing technological developments by maximizing the use of computer laboratories in schools. The students' knowledge about the contextual area of their residence is still lacking. This is what encourages researchers to develop contextual-based learning videos so that students know the local culture and can preserve it (Hidayanto, Sriyono, & Ngazizah, 2016).

The development phase begins with the creation of material description, the outline of the contents of the media, and the script (storyboard) presented in Table 5. Then the storyboarding stage is carried out to provide an overview of the developed video content followed by the next development stage, namely the collection of audio and visual material. Audio material is done by recording dubbing narration and selecting several instruments to be used as backsounds—visual aspects in the form of videos, images, and animations related to dynamic fluid material. The next step is making a prototype I using audio and visual data that has been collected.

Table 5 Material Description

| Content | Indicator | Media |
|---|---|---|
| Dynamic fluid | Explain the concept of dynamic fluid | Text, video and narration |
| | Give examples of dynamic fluid in the process of harvesting coconut, irrigating land, spraying pests, and transporting water using a speedboat | Video and narration |
| | Calculate dynamic fluid values | Text |
| Fluid flow type | Explain the concept of flow types | Text, video and narration |
| | Explain the concept of flow rate | Text, video and narration |
| | Give examples of types of flow in coconut harvesting, land irrigation, pest spraying, and water transportation using speedboats | Video and narration |
| Continuity Equation | Give examples of flow rates in coconut harvesting, land irrigation, pest spraying, and water transportation using speedboats | Video and narration |
| | Calculate the potential energy value | Text |
| | Explain the concept of continuity equations | Text, video and narration |
| Bernoulli's principle | Explain the equation of continuity in coconut harvesting, land irrigation, pest spraying, and water transportation using speedboats | Text, video and narration |
| | Explain the principle of Bernoulli | Text and narration |
| | Explain the principle of Bernoulli in harvesting coconut, irrigating land, spraying pests, and transporting water using a speedboat | Text, video and narration |

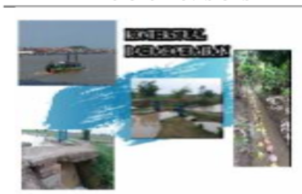
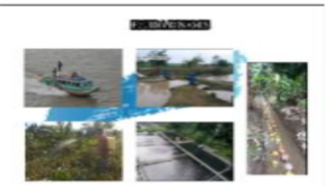
The evaluation phase begins with a self-evaluation, which examines the prototype I developed by the researchers themselves covering the entire component of the video that was developed and revised if there are errors then proceed to the expert review stage. The Expert review stage is conducted to obtain valid products based on advice from media and material experts. The expert review results showed that the video developed had a 94% EVR with a very valid category and is presented in table 6 below.

Table 6 Recapitulation of the expert review stage

| No | Expert review result | Score |
|---|---|---|
| 1 | Content validation | 43 |
| 2 | Design validation | 43 |
| | Total score | 86 |
| | EVR | 94 |
| | Category | Very valid |

The results in table 6 show that the teaching material produced is valid with a very valid category. The validity was obtained based on expert analysis of the content and media aspects. The expert review stage provides some suggestions for improvements that have been implemented and are summarized in table 7.

Table 7 Revision of the first prototype

| Before Revisions | Suggestion | After Revisions |
|---|---|---|
|  | Add an example of applying dynamic fluid in an area of water and replace "contextual waters" to "dynamic fluid" |  |
|   | Add the word "contextual based" |   |
|  | Image Speed Boat replaced without Ampera Bridge |  |

The next stage was a one to one evaluation conducted on three students of class XI of SMA Negeri 1 Air Saleh to fill in the prototype I response questionnaire. The results of the questionnaire given at this stage were 84% and included in the practical category. The revision results after the expert review and one to one evaluation stages are then referred to as prototype II and then proceed to the small group evaluation stage. The small group evaluation phase was conducted on nine students of class XI of SMA Negeri 1 Air Saleh so that the results obtained were 87% with a very practical category.

Saleh Jaya Village, Air Saleh Subdistrict, Banyuasin Regency, is one example of waters in South Sumatra. The video developed explains that this village has the characteristics of its citizens in processing natural resources around by utilizing the flow of water that surrounds the village. One example of processing resources in the village that utilizes the concept of dynamic fluid is the irrigation system using water gates.

The irrigation system implemented in Desa Air Saleh Jaya is regulated using a floodgate called a DAM. Floodgates can be used to explain the concept of fluid continuity and the Bernoulli principle. Fluid continuity explains the relationship of fluid flow velocity in one place to another place in which each place has a constant water discharge value (Giancoli, 2001). The irrigation system described in the developed video has several sluice gates that have a water flow velocity and the cross-sectional area around the sluice varies depending on the position of the sluice. Large compared to the cross-sectional area of water flow near the floodgates. Based on the concept of continuity, areas with larger cross-sectional areas have smaller water flow velocities than those with smaller cross-sectional areas. It can be said that the flow of water near the floodgates is quite heavy, so it is dangerous if children are playing around the floodgates. This explanation will be easier for students to understand. In addition to learning to use videos that are developed, students can make observations directly to the floodgates close to home or school.

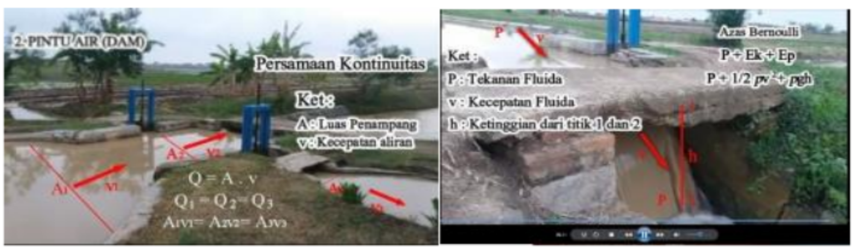



Figure 1 Video display explaining the concept of dynamic fluid and the Bernoulli principle on floodgates

Furthermore, an explanation of the principle of Bernoulli can also be explained using floodgates. Bernoulli's principle explains that in an ideal dynamic fluid, there is no frictional force, so the mechanical conservation law applies where the amount of pressure, kinetic energy per unit volume and potential energy per unit volume have the same value at each point along a straight line place has a constant water discharge value (Giancoli, 2001). The connection with the floodgates, when the flow of water flows into the floodgates will change position shown in figure 1. This is because the floodgates near the water source are made with a position slightly higher than the river or ditch to drain water into the people's fields.

Besides explaining the concept of dynamic fluid using sluice examples, contextual water-based dynamic fluid learning videos provide several other examples such as the coconut harvest process to explain the concept of water flow rate, using water taps to fill reservoirs to explain the concept of water discharge, and pest sprayers to explain the concept of water flow rate.

## CONCLUSION

It has been successfully developed a highly valid contextual water based dynamic video learning waters with a percentage of 94% and very practical with a percentage of 87%. It can be stated that contextual video-based dynamic fluid learning is appropriate for use. The resulting product is expected to be an additional source of learning related to dynamic fluid materials, especially high schools in water areas. Further research is needed for other physics concepts for high schools in water areas.

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