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The Kinematic Learning Model using Video and Interfaces Analysis

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Abstract. An educator currently in demand to apply the learning to not be separated from the development of technology. Educators often experience difficulties when explaining kinematics material, this is because kinematics is one of the lessons that often relate the concept to real life. Kinematics is one of the courses of physics that explains the cause of motion of an object, Therefore it takes the thinking skills and analytical skills in understanding these symptoms. Technology is one that can bridge between conceptual relationship with real life. A framework of technology-based learning models has been developed using video and interfaces analysis on kinematics concept. By using this learning model, learners will be better able to understand the concept that is taught by the teacher. This learning model is able to improve the ability of creative thinking, analytical skills, and problem-solving skills on the concept of kinematics.

1. Introduction

Physics is based on experimental observations and is explained by quantitative measurement. Mathematics became the basic law, namely as a tool to build a bridge between theory and experiment. Cultivate the curiosity of students in learning physics into the main capital in pedagogy. However, in current physics education experiments in the laboratory alone is not enough in providing an authentic research experience. The skills needed in physics learning are the emphasis on critical thinking, creative thinking, analyzing and problem-solving skills. Moreover, providing opportunities for learners to participate in contextual based inquiry through direct observation and inquiry into the real world is very supportive in developing the ability of understanding the concepts of physics and scientific skills.

Current technological advances make it easy for educators and learners to learn science, Today's technology has developed many media such as video capture and video analysis [4] in physics learning, even today more affordable and accessible. Physics software like hers Vernier Logger Pro, a video analysis tools such as Videopoint and Tracker can be freely downloaded and used on a computer device.. Through such software, teachers can failitate learners in motion video capture and analsis [5]. Students simply insert a video file into the program and observe it from the motion of the object for analysis. Through this program students can capture video of a live event and analyze it very easily.

One of the new methods of creative teaching on the subject of physics, and what makes science more appealing to students is the video analysis using Logger Pro program. Logger pro is a learning tool that is widely used in the experimental activities especially in the field of physics. Software

Logger pro in the work requires the help of a device called the interface (LabQuest). Labquest is mounted and connected to sensor devices, such as voltage sensors, magnetic field sensors, oxygen sensors, carbon dioxide sensors, temperature sensors, etc. However, this software can also be used without the use of labquest, which is doing tracking video which is usually useful to calculate the speed of moving objects. This Logger Pro software can be accessed and downloaded through https://www.vernier.com/downloads/. This program is one that is able to make it easier to measure position coordinates (x and y) and time for a moving object. Logger Pro is also capable of displaying systematic data in the form of graphs and mathematical equations depending on the object under review.

The use of computer-based interactive media such as video and image modeling that are analyzed using Logger Pro program play an important role in teaching physics concepts related to dynamics and kinematics [6], and other physics concepts, because by using video recording and image modeling [7] can be observed physical phenomena of physics. Besides, practical use at low cost [8] making this learning more effective, creative and interesting [9] compared to using traditional learning [3]. Through an observation with video analysis and image modelling it significantly affects the level of student understanding [3], problem solving skills [10], Analyze, representational ability, predict, collect data and explain.

2. Experimental Method

There are six features in the analysis and experimentation activities in which students can act alone in the investigation. thereforethe criteria for activity is the level of independence of students associated with each characteristic. The following is a rubric of inquiry characteristics that has been developed and validated by [11] so that it is successfully applied in various scientific disciplines to determine the level of performance presented in Figure 1.

Characteristic	Level 0: Confirmation	Level ½: Structured inquiry	Level 1: Guided inquiry	Level 2: Open inquiry	Level 3: Authentic inquiry
Problem/Question	Provided	Provided	Provided	Provided	Not provided
Theory/Background	Provided	Provided	Provided	Provided	Not provided
Procedures/Design	Provided	Provided	Provided	Not provided	Not provided
Results analysis	Provided	Provided	Not provided	Not provided	Not provided
Results communication	Provided	Not provided	Not provided	Not provided	Not provided
Conclusions	Provided	Not provided	Not provided	Not provided	Not provided

More structure ⟷ Less structure

Figure 1. Rubric of inquiry characteristics

From the description of the table above, the level corresponding to the level of competence of students physics teacher candidate is at level 2. At this level tutors only provide questions and theories to the students further stages undertaken by the students themselves without the guidance or mentoring of the tutor so that the ability and scientific skills can be explored and developed.

2.1. Teaching Strategy: Teaching kinematics in Higher Education

A very important skill owned by students in learning kinematics is the ability to create and interpret graphics. But the problem is that the ability is less controlled by learners, the problem they face is in connecting the concept of graphics and physics, graphics and the real world [12]. Reading and graphics require students to form abstractions from the real world, which involves individuals assuming that mathematics is a separate object [13]. This means it is difficult for students to connect the real world and graphics that are abstract representations of the same world. [12]

Experimental and demonstration methods are the right strategy to solve the above problems. By taking samples in nature, students are encouraged to observe the things that happen in everyday activities.

2.2. Video analisis dan Interface analisis

Video analysis is a learning tool that can be made as the right strategy to take samples in nature. Students in creative demands to take videos that occur in kinematics activities in everyday life, then they are in the race to understand the results of the video they get.

Interface analysis is a sensor program that can be used as a complement of video analysis. Through the analytics interface, this becomes an appropriate strategy for solving student problems. A teacher can practice this activity to the students. Video analysis and analysis interfaces have been built in a learning program called logger pro. Loger pro is one of the right programs to build analytical and problem-solving skills. In this program facilitates video analysis and interface analysis.

The model of video analysis and interface analysis can be packed with a level 2 inquiry study. The actual video analysis activities are performed by the students and data management through teacher guidance. While the activity of interface analysis is done entirely by the teacher, the students pay attention to the teacher in doing the demonstration.

3. Result and Discussion

In this connection PISA, divides the field of science applications into three groups, namely life and health, earth and environment, and technology. Problems and issues of science in these areas can be related to the individual child, as part of the community, and the citizens of the world.

Science teachers recognize that students should be prepared to get information related to technology issues of interest to the general public. While an important basic function of science teacher education is to prepare prospective teachers to connect science and technology optimally to the local community, to benefit the daily life of students, and wider social issues. [16,17]

Video analysis and interface analysis as a technology-based tool used to develop the ability to analyze and interpret the graph. These two activities lead students to study the science that exists in the natural environment. This learning model can be named as MIVA or abbreviation of Model Interface Video Analysis.

Capability development that can be done by student if using MIVA learning model is ability analysis, problem solving ability, and creative thinking ability. Here's the explanation in each development capability:

3.1. Creative Thinking Ability

In learning, students are grouped and then ordered to take video about the natural environment. Of course, taking videos according to the instructions and rules described by the teacher. So the indicators obtained by students, namely:

3.1.1. Increase creativity

After the teacher gives the correct instruction in taking the video, the student is given the flexibility to take the desired video, this makes a lot of creative thinking to make the video made as desired.

3.1.2. Active role of students

When the computer model learning process is supported by video analysis data, it can provide opportunities for students to engage in active inquiry-based learning. More importantly with video modeling when the object is driven by video analysis allows students to find better evidence and models for predicting and explaining bullet motion [14].

3.1.3. Development of teamwork and communication skills

The need for a video in doing this learning, making learners should think creatively in taking object. In addition to emphasizing to them to be able to work teams to produce the desired video, they can find good places and the correct technique in taking video.

3.2. Analytical skills

After the students have finished taking the video, they get guidance by the teacher to be able to manage the video results in the classroom. So this, get the following indicators:

3.2.1. Understanding the relationships between variable

After students are able to process the video into the application, they are required to understand the graph out of the relationship between variables that appear on the display.

3.2.2. Interpreting data

After students analyze the video, they are required to understand and process the data into an empirical data. Such as processing data to find mechanical energy.

3.2.3. Ability of representation

In this study [15] that analytical skills were able to apply student representation skills. This ability will be obtained when it has been able to understand the variables and interpret the data.

3.3 Problem solving skill

Problem solving skills, will be obtained by students when teachers demonstrate an interface activity analysis. Interface analysis is an additional program that uses sensors that are connected by programs contained on the computer. Here is an indicator of ability owned by students.

3.3.1 Tackling misconceptions

From the video analysis data obtained by students, then proven through sensor interface analysis to eliminate misconception.

3.3.2 Solve problems in everyday life

Data capture activities using video, this is the basis that this experimental activity is part of the application of everyday life.

3.3.3 Verification Hypothesis

By using an analytics interface, it is used to prove hypotheses for the work the learners get through video analysis.

3.3.4 Facilitate conceptual understanding

Activity using demonstration of sensor interface analysis tools, summarizes in student experiment activities, with this facilitate understanding the concept they get.

The analytical ability has an indicator of completion in representational skills, problems solving in everyday life, fostering creativity, making active students, and developing teamwork and communication skills. While the Interface analysis activities have an indicator of completion in tackling misconceptions, proving hypotheses, and facilitate understanding of concepts. This activity if united in the learning will be able to give understanding of relationships between variables, and interpret the data. More detailed description as described in Figure 2.

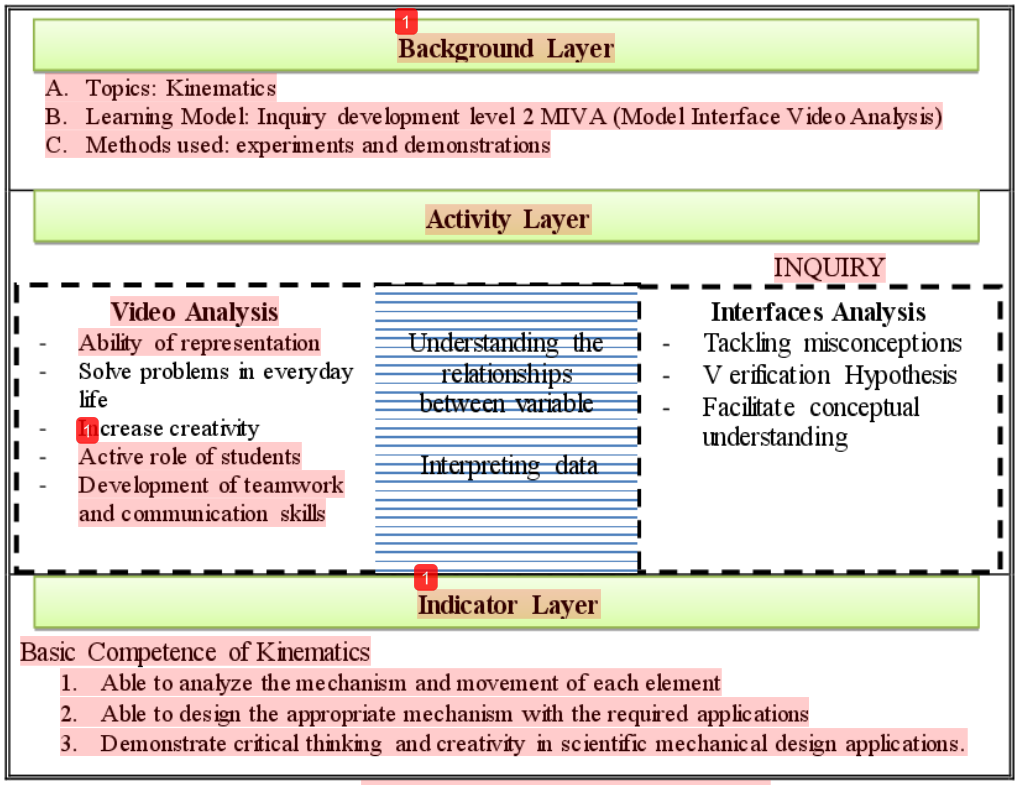

Figure 2. Layer of Learning Model MIVA

Kinematics learning has a basic competence that is consistent with that of the MIVA learning model. Basic competence in kinematics learning as described in the layer indicator in figure 2.

4. Conclusion

A science teacher, attempted to utilize the technology of learning activities as an effective learning tool and keep students away from the decline of the times. Kinematics is a material that takes many elements of real-world activities. The difficulty is how a teacher should be able to bring real-world activity into kinematics material. These two things can be bridged by technology-based learning media using video and interface analysis.

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