

# Implementation of Learning Innovation Ultrasonic Autoplay System for Classroom Gallery Walk

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**Abstract:** Over the past decade, various learning technologies have been popular among practitioners and education experts from various disciplines, especially classroom learning strategies. In this research the implementation of ultrasonic auto play system technology was carried out and have purpose of this research to (1) implementation learning technology that is able to contribute effectively in the learning process based on learning styles and student preferences, (2) describe implementation of technology in the walk gallery active learning strategy, (3) calculate the effect of technology that has been applied based on student learning outcomes. This research method was used quasi experiment with 2 practice classes and research subject of 50 students. Data has been analyzed with two tail test (t-test sig. 0.05) SPSS 22 software. Research conclude that (1) implementation of technology has contributed positively to improve learning process, (2) implementation of technology has improved soft skills based on learning interaction process, (3) Output analysis showed that there were significant differences between the experimental and control classes.

## 1 INTRODUCTION

The social community's need for technology in life is getting faster and many kinds of influence on the development of science and technology in higher education, one of which is the university, then efforts to develop more innovative learning have been developed. The main objective of innovation learning efforts is to optimize the learning process, so that students can develop independent, creative and productive attitudes. Innovation study was expected to support the development of students' academic potential in a holistic manner, including the potential cognitive and affective skills. Learning innovation efforts have been expected to create student-based skills utilizing learning resources through learning resources by design and learning resources by utilizations for students. One of the results of a long process of education can be measured based on outcome learning. This relates to graduates who have been referred to in the curriculum that has been regulated by universities.

Learning has been carried out at the university had hoped to creation of sustainable innovation, and produce learning outcomes experts, educators who are professionals in various types and levels the field

of life. The presidential regulation of graduate level-based characteristics of the learning outcome is defined at the sixth level standard according to Republic of Indonesia Presidential Regulation Number 8 of 2012 concerning the Indonesian National Qualification Framework which has been called KKNI.

In general, innovation can be illustrated as a form that has the purpose of applying technology to various fields. In this case it is in the classroom learning process. This means that innovation is a design used for instrumental actions to reduce irregularities in a causal relationship to achieve a certain goal. Furthermore, innovation can also be interpreted as ideas, practices, or new objects that can be felt as something new by the individual or target community. The definition of innovation is not only limited to objects or goods produced, but also includes ideology, beliefs, attitudes, information, behaviour, or movement towards the process of change in all forms of life.

Learning innovation is an effort to make something new in learning, beginning with an idea that has never been applied to learning in the classroom. These innovations have the purpose of carry out learning steps, so that the desired learning outcomes can be obtained. Based on the theoretical

definition of learning innovation occurs from changes in learning techniques. Changes in learning originate from the results of reflection on learning to the existence of previous learning styles. then there has been a change in new learning styles accompanied by learning innovations that can solve problems in classroom learning [1].

The essence of innovation in this research, there conditioning flexible learning-based gallery walk by implementing ultrasonic wave technology. This effort contributes to improve the communication skill to understanding learning topic then can be solve learning classroom problems. This research can be an indicator of the application of ultrasonic auto play system technology and management of gallery walk learning styles to be applied in the classroom. Then it has contributed an interesting and unique learning experience that can improve the meaningfulness of the learning process.

Referring to the PTO S1 curriculum in particular the Power Transfer System (PTOM 638) consisting of SKS 3 and JS 5 with the prerequisite course of the gasoline motor practice (PTOM 634) and diesel motor practice (PTOM 635), it can be concluded that this course requires a basic conceptual understanding from the course previous. The target of the course is skilled students doing maintenance of the power transfer system. the description of competency include that: (1) student must be competent to maintaining clutch; (2) student must be competent to maintaining manual transmission; (3) student must be competent to conduct propeller shaft maintenance; (4) student must be competent in performing differential care and; (5) student must be competent to maintaining the main axle shaft [2].

Based on 2017/2018 academic year observations it was found that some of the students were not fully able to achieve the graduates' achievement targets as stated in the curriculum of the energy transfer system in absolute terms. This indicates that there are obstacles in the student learning process, especially in understanding the concept of the power transfer system. So that research into the development of learning innovations is intended to improve understanding and effectiveness in the learning process of students, especially in the FT-UM. From these various problems, the research is expected to be able to design technology and manage learning resources that are interconnected with each other with the purpose of being able to be applied in lectures on power transfer systems carried out in automotive laboratories, mechanical engineering department, FT-UM and able to contribute learning experiences

interesting and unique students so as to increase the meaningfulness of the learning process.

## **2 CLASSROOM GALLERY WALKS**

Cooperative learning models have various forms, one of which is a gallery walk model. This walk gallery model has purpose of building group collaboration and giving appreciation and correction learning process in the classroom. Gallery walk can also be used as an alternative to independent learning strategies for students. In practice, one class can be divided into 5 groups, each of which has 5 student members. Student activities will be continued by making an important note from each group. A note has contained: (1) important things, (2) opinions of content, (3) questions and answers, (4) positive criticism and suggestions. The note has been based on students' understanding and analytical thinking skills. These results have been written and can be used as a learning summary. In general, the purpose of implementation of this strategy for build group collaboration and give each other appreciation and correction in the learning process [3].

The advantages of the walk gallery include that:

(1) Students can manage the conditions of cooperation culture and solve problems in learning independently; (2) improve synergy to strengthen each student's understanding of learning objectives; (3) Make students respect and appreciate the learning outcomes of his friends; (4) Enabling students' physical and mental health during learning process; (5) Learning students becomes more interesting and fun; (6) stimulate students to develop student creativity; (7) adjusting the development of modern learning technology; (8) Create a kind of interaction between students; (9) familiarize critical thinking and higher order thinking [4].

The disadvantages of the walk gallery include that: (1) The teacher must be fully involved in the learning process as a facilitator; (2) Facilities and infrastructure that support learning in class; (3) A teacher must manage the class optimally; (4) Requires extra energy, physical thinking and time for a long time; (5) Not all material can be applied, although this learning model can be applied in various curriculum; (6) If there are too many group members, some students will depend on their work; (7) Teachers need to be extra careful to monitor and observe individual and collective activity; (8) Setting class has more complicated.

This action of learning innovation is expected to improve student learning achievement, through the application of technology-based walk galleries can encourage students to understand the meaning, and benefits of learning so that they will provide stimulus and motivation to them for always actively studying in class. It can encourage students to be excited or have a desire strong to learn [5].

The increase in the spirit of learning will have an effect on student achievement. through appropriate learning strategies, student achievement is definitely increasing. Therefore, the implementation of a gallery walk is a part of active learning which is both fun learning. The Fun learning will motivate students to learn and reduce bored when all day in class. This makes the enthusiasm of students more and more continued desire to seek knowledge [6].

This approach will also be more meaningful. then able have found a good situation when studying with friends and able to solve individual and group problems. The approach-based technology is teaching actions that invite students to improve classification, analysis and communication of images, diagrams, wiring standard operating procedures their self-based actual conditions in life, through the efforts of the students' understanding has improved. based on this activity students can be learning and solve independent problems. Students will be authentically learn as learning subjects. The role of the teacher is to guide and facilitate the learning process. Students carry out their own activities or in groups for discuss problems with the material already determined.

### **3 ULTRASONIC AUTO-PLAY SYSTEM**

Ultrasonic sensors are sensors that function to convert physical quantities (sounds) into electrical quantities. The workings of this sensor are based on the principle of wave reflection. The results of reflection of sound waves are used to interpret the existence (distance) of an object with frequency. Ultrasonic waves have a very high frequency, actually in range of 20,000 Hz. Ultrasonic sound can be propagated through a medium of solid, liquid or gas. The reflectivity of ultrasonic sound on the surface of solids is almost the same as the reflectivity of ultrasonic sound on the surface of the liquid [7].

The workings of ultrasonic waves are emitted from one side of the ultrasonic transmitter on the device duration of frequency. The signal has been sent with frequency above 20kHz. To measure the distance of objects (proximity sensor), the frequency

that is commonly used is 40kHz. The signal that is emitted will propagate as a sound wave with a speed of around 340 m/s, when pounding an object, the signal will be reflected by the object. After the reflection wave reaches the receiver, the signal will be processed to calculate the distance of the object [8].

Ultrasonic sensor type HC-SR04 is an ultrasonic sensor that is ready to use and is commonly found for robotic and electronic circuits. one tool that functions as the sender, receiver, and ultrasonic wave controller. This tool can be used to measure the distance of objects from between 2 cm – 4 m with an accuracy of 3 mm. This tool has 4 pins, Vcc, Gnd, Trigger and Echo pins. Vcc pins for positive electricity and Gnd for ground. Trigger pin for trigger signal exit from the sensor and Echo pin to capture reflected signals from objects. when there is a positive voltage on the Trigger pin for 10  $\mu$ s, the sensor will send 8 steps of ultrasonic signals with a frequency of 40kHz. Next, the signal will be received on the Echo pin. To measure the distance of objects reflecting the signal, the difference in time when sending and receiving signals is used to determine the distance of the object [9].

The specification of the sensor is a single operating source voltage of 5.0 V, 15 mA current consumption, 40 kHz operating frequency, minimum detection distance of 0.02 m (2 cm), maximum detection distance of 4 m, measuring wave angle of 15 degrees, minimum ignition time 10 microseconds TTL level pulses, TTL level detection pulses with duration corresponding to the detection distance, Dimensions 45 x 20 x 15 mm. The ultrasonic sensor is then assembled using additional electronic devices. then combined the Arduino Board microcontroller Arduino board is a microcontroller board using Atmega328 microcontroller chips that are flexible and open-source. Software and hardware are relatively easy to use so it is widely used to design electronic and robotic circuits. The Arduino board is connected to a computer using a USB cable or with a 7-12 V DC adapter or Power Supply. Arduino can be used to detect the environment by reading data from various sensors such as distance, infrared, temperature, light, ultrasonic, pressure, and humidity [10].

Simple technology called Ultrasonic Auto-Play System basically involves 3 aspects of the component, this system includes that: (1) ultrasonic sensor (2) RF remote control; (3) IC modules and (4) actuators in the form of panel displays / screens / monitors. Hardware and coding of software programmable logic has been planted in an electronic

module control device (IC Module) will be connected to each other in the sensor and actuator parts which are responsible for taking data from environmental information. In more detail, it can be explained that the RF remote control function functions to turn on and turn off electronic system performance, then when the system is turn on, the ultrasonic sensor can be detected students approaching objects nearby station group in classroom gallery walk. The IC module functions to manage input data from the sensor and simultaneously determine the alternative commands to the actuator. The last actuator will be display video or animation that has been stored on the memory of the electronic device.

## 4 METHOD

In this research involved 50 students divided into classes control and observed especially in chasis and powertrain system class, Mechanical Engineering Department, State University of Malang. This research was conducted with the duration of the implementation the classroom gallery walks with ultrasonic auto-play system technology for 2 months. In the research, each class of 25 students was divided into 5 groups, each group consisted of 5 students. Each group has a station to explain the topics of learning that have been shared. group members take turns visiting other group stations. Visiting group members observe and respond to each other and has given their conclusion in end of lesson. The instruments used in this research include (1) group observation sheets; (2) individual questionnaire; (3) learning outcomes. Result of research were analysed by two tail tests with Sig. 0.05 percent of SPSS version 22.

## 5 RESULT

The results of the questionnaire sheet measure the implementation of ultrasonic auto-play technology in the classroom gallery walk on the effectiveness of the learning process involving students as respondents get a positive response with a value of 74 percent. Based on the observation sheet show that the implementation of ultrasonic auto-play system in the classroom gallery walk on the effectiveness of the learning process in the classroom, get positive results shown from indicators (1) student activity; (2) student enthusiasm; (3) learning motivation; (4) learning effectiveness; (5) critical

thinking skill; (6) teamwork skill; (7) problem solving skill; (8) communication skill [12]. overall conclude that 83 percent. Based on the achievement of learning outcomes between classroom gallery walks toward the classroom gallery walk with ultrasonic auto-play system, there were significant differences alpha 0,00 using t-test with sig. 0.05.

## 6 CONCLUSIONS

Research concluded that the implementation of ultrasonic auto-play system for classroom gallery walk of the chassis and powertrain system class mechanical engineering department, State University of Malang. Positive and effective contributions shown from (1) implementation of technology has contributed positively to improve learning process, (2) implementation of technology has improved soft skills based on learning interaction process, (3) Output analysis showed that there were significant differences between the experimental and control classes.

## REFERENCES

- Gilbert, D. H. 2012. From chalk and talk to walking the walk: Facilitating dynamic learning contexts for entrepreneurship students in fast-tracking innovations. *Education and Training*, 54, 152–166.
- Universitas Negeri Malang. (2017). *Kurikulum SI pendidikan teknik otomotif (SI-PTO)*. Malang: UM Press.
- Hogan, J. P., & Cernusca, D. (2011). Integrating Gallery Walks and Wikis in a synergic instructional activity: An exploratory study of students' perceptions. *Computers in Education Journal*, 21, 37–48.
- Schendel, J., Liu, C., Chelberg, D., & Franklin, T. (2008). Virtual gallery walks, an innovative outlet for sharing student research work in K-12 classrooms. Paper presented at *Frontiers in Education Conference, FIE*.
- Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, 15, 171–193.
- Ismail, I., Anitah W, S., Sunardi, S., & Rochsantiningih, D. (2017). The Effectiveness of Gallery Walk and Simulation (GALSIM) to Improve Students' Achievement in Fiqh Learning. *Jurnal Penelitian Sosial Keagamaan*, 25, 231-252.
- Wicaksono. M.F. (2017). *Microcontroller Arduino, Ethernet dan Wireless Server Project*. Bandung: Informatika Bandung.
- Fang, N., Xi, D., Xu, J., Ambati, M., Srituravanich, W., Sun, C., & Zhang, X. (2006). Ultrasonic metamaterials with negative modulus. *Nature Materials*, 5, 452–456.

- Krautkrämer, J., & Krautkrämer, H. (1983). *Ultrasonic Testing of Materials*. New York: Springer-Verlag.
- Indoware, & SparkFun Electronics Data Sheet. (2013). Ultrasonic Ranging Module HC - SR04. *Datasheet*, 1–4.
- Harris, B., & Bradshaw, L. (2019). *Gallery Walk in Battling Boredom*. USA: Routledge.
- Kennedy, M. J., Mimmack, J., & Flannery, K. B. (2017). Innovation in Data-Driven Decision Making within SWPBIS Systems: Welcome to the Gallery Walk. *Beyond Behavior*, 21, 8–14.