ABSTRACT
This preliminary research is focused on finding out the learning media used in the electronics engineering study program at the AUB Technology Academy (AT AUB) Surakarta. This research was conducted in three stages, namely: (1) collecting data on the types of learning media used at the AUB Technology Academy at the moment; (2) giving final exams to students to find out students' understanding of the material given using existing learning media; (3) giving questionnaires to students to find out whether new learning media are needed, and what kind of media are needed by students to increase understanding of learning material. The learning media used for this research are for the Computer Assembly and Installation Practicum course, the purpose of this course is to make students understand the components of the computer system, the ability to assemble a computer, and the competency of a computer installation. The results of this preliminary study are (1) Types of learning media used today, still using books and display screens; (2) the average score of student competence is still low; (3) Student needs for learning multimedia that are easy to use and can be accessed anywhere, encourage students to learn independently and learn independently. For this reason, it is necessary to create mobile-based learning multimedia Augmented Reality to improve student understanding of learning material.

Keywords: learning multimedia, mobile Augmented Reality, technology, learning media

INTRODUCTION
Industrial Revolution 4.0 has fundamentally changed human life and work. This 4th generation industrial revolution has a broader scale, scope, and complexity. Advances in new technologies that integrate the physical, digital and biological worlds have influenced all disciplines, economics, industry, and government (Schwab, 2017). Areas that have experienced breakthroughs thanks to new technological advances include (1) artificial intelligence robots, (2) nanotechnology, (3) biotechnology, and (4) quantum computer technology, (5) blockchain (such as bitcoin), (6) internet-based technology (augmented reality and virtual reality), and (7) 3D printers. Society 5.0 is defined as a human-centered society that balances economic progress with the resolution of social problems with systems that deeply integrate cyberspace and real space. Society 5.0 is an improvement from CPS to cyber-physical-human systems. Where human is not only used as an object (passive element) but plays an active role as a subject (active player) working with physical systems in achieving goals. So the interaction between machines (physical systems) and humans is still needed. The impact, production can be multiplied and distributed to various regions more massively. However, this industrial revolution also had a negative effect on the form of mass unemployment.

Workers in the face of the Industrial Revolution 4.0 and Society 5.0, need to have the skills to collaborate, communicate, innovate, and think critically in solving a problem. The skills developed are usually through social and emotional learning, also known as Social and Emotional Learning (SEL). When combined with traditional skills, these social and emotional skills can equip workers to be successful in this constantly evolving digital economy. Excellent leadership skills, coupled with curiosity, are also essential for students to find information about the job or career they want to have later. Some of the skills that will be needed in dealing with the Industrial Revolution 4.0
and society 5.0 according to the World Economic Forum are as follows: Complex problem solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgment and decision making, service orientation, negotiation, and cognitive flexibility.

Vocational education in the era of industrial revolution 4.0 and society 5.0 requires the application of several scientific disciplines, namely science, technology, social, culture, and economics. Competency development in learning is based on the needs of work competencies, the development of new technologies, and new policies. The authentic context of the world of work can be in the form of new technological contexts, science, policies, location and natural conditions, the situation and expectations of society, time, culture, social, political, economic, and trade.

Diploma 3 in Electronic Engineering Study Program at the Technology Academy of AUB is one of the vocational education programs that apply practical knowledge and can be used in the world of professional work. The purpose of this electronics engineering study program is to prepare competent human resources in the field of Electronic Engineering in National and International Companies in the context of welcoming the Industrial Revolution 4.0 and Society 5.0. To produce diploma program graduates who have high competitiveness in dealing with R.I 4.0 and society 5.0 is not easy. Students are required to be able to master the theory and practice following expertise in a particular field. However, at this time, the quality of students is still not as expected.

One of the factors that determine the success of vocational education is the learning process. The learning process is planned efforts in manipulating learning resources so that the learning process occurs within the students. In learning activities, it is inseparable from the communication process, and then intermediary media is needed to deliver messages from educators to students, namely learning media.

Learning media are all things that can be used to channel messages from the sender to the recipient so that they can stimulate the thoughts, feelings, concerns, and interests and attention of students in such a way that the learning process occurs (Sadiman, 2018). Learning media is essential in the learning process, with the media can support the communication process carried out to be optimal. This is very helpful for educators in making it easier for students to accept and understand the lesson. The learning process requires the role of educators who can align learning methods and learning media.

The use of instructional media needs to be considered by educators; it can arouse students' learning motivation, arouse students' learning interest, and can also add to the learning experience of students. Besides, the use of new learning media will be able to increase students' understanding of the subject matter. The form of learning media can be in the form of graphics, films, slides, photos, in the form of animations, as well as media obtained online, which is called multimedia learning.

Multimedia learning is learning that utilizes multimedia tools, namely computers, smartphones, in the form of video, audio, video-audio. Multimedia learning is selected and used so that there are variations in the way of learning, which can be in the form of watching, imitating, practicing, feedback, conversation, helping, problem-solving, inquiry, critical thinking, listening, simulation, games, virtual environment.

The use of multimedia learning to facilitate students in understanding learning material needs to be continuously improved. Study analysis shows that the use of multimedia learning can increase the effectiveness and attractiveness of teaching and learn for students (Kesim&Ozarslan, 2012). The results of other studies that show that the use of multimedia learning can improve the quality of teaching and learning, to improve student competence (Nincarean, Alia, Halim, & Rahman, 2013). Other research shows that student motivation in vocational schools (TVET) can be increased by the use of multimedia computer-based learning and mobile learning (Bacca, Baldiris, Fabregat, Kinshuk, & Graf, 2015). This research shows that the use of multimedia based on mobile learning by utilizing Augmented Reality (AR) technology can motivate students in the learning
process at vocational schools (TVET). The use of augmented reality (AR) technology that combines 3D virtual objects into the real environment of 3D objects in real-time has interactive and exciting properties, making it easier for students to understand learning material. The use of AR technology in electronic engineering learning materials (such as components of a computer system) is realized in a 3-dimensional form that can be seen, touched, and projected like approaching an actual (real) atmosphere. AR technology can attract students' interest in learning, as well as being able to add to the learning experience of students.

The development of AR technology is currently very rapid, including AR technology based on mobile learning, commonly referred to as mobile Augmented Reality (mAR). MAR technology is an AR technology that utilizes mobile devices, such as smartphones. At present, almost all people from all walks of life have smartphones as an information and communication tool, only a few use of smartphones for learning purposes.

There are several Operating Systems (OS) smartphones that are used on the market, including Blackberry, iOS, Symbian, Windows Phone, and Android. According to a research report from StatCounter, in the period February 2016 to February 2017, the use of smartphones with Android OS is the highest in Indonesia. The use of Android as a learning aid is expected to improve student cognitive learning outcomes. It can also build student self-confidence that they can understand the material being taught, students can learn independently, not limited by space and time, and add to the learning experience. As research conducted by Saputro et al., That by utilizing augmented reality as an android-based learning media, students get a different learning experience, students have better self-confidence, to get better learning outcomes (Saputro & Saputra, 2015).

Augmented Reality Technology is a technology that combines 3D virtual objects into the real environment of 3D objects in real-time (Azuma, 1997). Augmented Reality (AR) shows information or virtual objects into the real world, which makes it possible for a reality where virtual objects appear to coexist in the same space as the real world. Unlike virtual reality (Virtual Reality), which completely replaces reality, augmented reality (Augmented Reality) adds, or complements fact (Azuma, 1997). Although AR and VR technology have been around for some time, they have only recently been used in an educational context (Bujak et al., 2013).

The use of Augmented Reality (AR) technology in Electronic Engineering learning media shows that students are more comfortable to observe, analyze, and understand the material in the motion of magnetic fields in 3-dimensional shapes (Matsutomo, Manabe, Cingoski, & Noguchi, 2017). Furthermore, the use of AR technology as a learning medium influences students, namely the feeling of presence, closeness, and understanding of learning material. By using AR, learning can be done anywhere, collaboratively, and situated learning (Wu, Lee, Chang, & Liang, 2013). The technology applied is interactive and more interesting because the information conveyed is more interactive with students who use it. Utilization of this computer graphics application allows to illustrate these images in the form of animations (moving and three-dimensional images) that can be explored in various points of view (top, bottom, right, left) so that it will give students a better understanding (Ossy et al., 2013).

**METHOD**

The location of this research is in the city of Surakarta. The object of study is the college student at the diploma III of electrical engineering program at the Technology Academy of AUB Surakarta. The population in this study is the students who take practical courses in computer assembling and installation. The sampling technique with the incidental sampling technique obtained a sample of 50 respondents.

The type of data used in this study is primary data. The research tool used is direct
observation and distributing questionnaires for students to find out the learning media needed by students. The survey contained statements with a Likert scale: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

This research is a type of descriptive study with a quantitative approach. The quantitative approach is research by obtaining data in the form of numbers or qualitative data that is leveraged. So quantitative descriptive analysis is research that describes the real situation without making comparisons with other variables and connecting with other variables in the form of numbers or qualitative data that is converted into numbers. This study aims to analyze certain conditions, present data systematically, factually and accurately following the facts that exist in the use of multimedia learning used in the diploma III of electrical engineering program at the Technology Academy of AUB Surakarta.

Data collection techniques used in this study were questionnaires. The questionnaires used in this study is the type of survey or inquiry that is closed because the respondent only has to give a mark on one of the answers that are considered correct. This preliminary research was carried out in several stages, namely: (1) collecting data on the types of learning media currently used in the Electronic Engineering Study Program, AUB Surakarta Academy of Technology; (2) conducting a Student’s Final Semester Examination; (3) create a questionnaire for students to find out the learning media needed by students to increase understanding of learning material, media that are easy to use, and can be accessed anytime and anywhere.

The research trials were conducted at the Diploma III Study Program in Electronic Engineering, Technology Academy of AUB Surakarta, for learning electronic engineering. Three classes are the subject of this study. This research is focused on the D3 Electronics Engineering study program because of the limitations of the learning media. Data obtained from the trial are in the form of data: (a) qualitative data, (b) quantitative data. Qualitative data were obtained from the responses of students and lecturers of the Electronic Engineering Study Program about the learning media used today. Quantitative data were obtained from a questionnaire given to students and the results of the Final Semester Examination conducted at the end of the lecture.

Data collection was obtained through observation, interviews, questionnaires, and documentation. Observation is used to see how students respond to the learning media developed. The interview is used to complete the information obtained from the questionnaire. Questionnaires are used to capture data about user responses to the developed model. Data collection instruments used in the form of (1) Field notes; (2) observation sheet; (3) interview guide; (4) Checklist; (5) Questionnaire for students.

The data analysis technique used is descriptive statistical analysis. Qualitative data were obtained to find out the type of learning media used today. Quantitative data collected from the results of students’ Final Semester Exams, the average value is taken. Quantitative data was also obtained from questionnaires given to students.

RESULTS AND DISCUSSION

**Learning Media used by Lecturers in the Study Program of Electronic Engineering**

The learning process requires the role of educators who can align learning methods and learning media. Learning media is essential in the learning process, with the media can support the communication process carried out to be optimal. This is very helpful for educators in making it easier for students to accept and understand the lesson (Sadiman, 2018).

Based on the results of observations made to the head of the study program and lecturers, it was found that the Study Program of Electronic Engineering has a variety of learning media, quantities, and conditions. There are two types of learning media, namely: (1) theoretical subjects are LCD media and video playback; (2) for practicum subjects, using trainers and computers, as well as a limited number of measurement tools.
The Use of Learning Media by Lecturers in the Study Program of Electronics Engineering

The use of multimedia learning to facilitate students in understanding learning material needs to be continuously improved. Study analysis shows that the use of multimedia learning can increase the effectiveness and attractiveness of teaching and learning for students (Kesim&Ozarslan, 2012). Learning in the Electronic Engineering study program is not only a mastery of the material in the form of theoretical knowledge but also practicum to train students to have the skills and competencies in electronics engineering.

Based on observations, learning media makes it easy for teachers to deliver material to students to be following the learning objectives, namely: (1) The media used by the lecturer must be appropriate and directed to achieve the learning objectives; (2) The media to be used must be following the learning material; (3) Learning media must be by the interests, needs, and conditions of students; (4) The media used must pay attention to effective and efficient; (5) The media used must be following the ability of the lecturer to operate it.

The average value of student competency in the Computer Assembly and Installation Practicum course

The average value is taken from the final exam results of the semester. Learning outcomes of Computer Assembly and Installation Practicum courses, students are expected to have several competencies, namely: (1) understanding the components of a computer system; (2) computer assembly competency; and (3) computer installation competencies. From the observational data, it can be seen that the results of the students' observations on average are still 2.8 from the maximum value of 4. This assessment is based on computer assembly and installation competencies. Furthermore, if the data are observed in detail, the average value of the competence of introducing computer system components is only 2.78, the average computer assembly value 2.75, and the average computer installation value 2.8. This can be seen that the competency of students in recognizing computer system components and computer assembly is still low and needs to be improved further.

CONCLUSION

There are two types of learning media used in the study program of Electronic Engineering at the Technology academy of AUB, namely: learning media for theoretical courses and practicum courses. For practicum courses, a trainer is needed for each student. However, there is a limited number of trainers (teaching aids) for the Computer Assembly and Installation Practicum course. This causes the lack of understanding of students towards learning material, so the average value of student competence in this course is only 2.7 from a scale of 4. Therefore it is necessary to develop multimedia learning in Electronic Engineering using mobile Augmented Reality (mAR) to overcome the limited number of learning media and to improve student understanding. This learning multimedia will be developed based on mobile Augmented Reality (mAR) that is easy to use and can be accessed anywhere, encouraging students to learn independently and learn independently.

REFERENCES


