

THE CREATIVE POTENTIAL TEST AND TECHNOLOGICAL SKILL OF TEACHERS: A NEW PARADIGM OF LEARNING IN THE 21ST CENTURY

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Abstract The 21st century in the era of the Industrial Revolution 4.0 is marked by changes and technological developments. In the field of education, it must adapt to changes in the era of the industrial revolution 4.0. So it is important for prospective teachers to be able to further develop their creativity in the use of technology for learning. Augmented Reality (AR) based learning can provide a reciprocal relationship between digital objects and real objects. AR is the latest technology that provides convenience to all areas of life, especially in education. The creative potential test in this study aims to make student teacher candidates understand AR-based learning by utilizing the "DEVAR 4D Augmented Reality" application. The research method used in this study is a descriptive quantitative method for descriptions or techniques that are carried out systematically, factually about statements of facts regarding the results of the application of "DEVAR". This research was conducted with descriptive qualitative method. The descriptive research method for this Potential Test Activity obtained very good results, especially for prospective teachers. Prospective teachers are more able to increase their creativity in managing learning.

Keywords: Augmented Reality; DEVAR; four dimensions; Industrial Revolution 4.0

A. INTRODUCTION

We are now in the 21st century and the industrial revolution of 4.0 (ir 4.0). This era was marked by technological change and development. Education is also required to adapt to changes in the industrial revolution 4.0. Anjarwati (2022) in 21st-century learning, each individual is required to be ill-equipped in 21st-century learning, known as the 4C's (*Critical thinking, Creativity, Collaboration, dan Communication*). Especially for student candidates. In addition to Karatas & Arpaci (2021) a 21-century skill required by student candidates is one of the technological and communication literacy. It is an urgency in the development of the potential teachers of the 21st century and the skill of the Information and Communication Technology (ICT) student candidates. ICT is changing the learning of each special individual student apprentice teacher, so it can be used asa basis for successfully communicating, collaboration, and solving complex problems, as well as for mastering and expanding the technological capabilities to create the new knowledge it must possess. It is deemed necessary to provide prospective teachers with a competence of digital teaching skills.

Learning in the 21st century that is centered on students also adjusts skills that must be improved in the 21st century with mastery of information and communication technology to increase students' learning motivation (Harahap & Siregar, 2020; Pratiwi et al., 2019). 21st century skills that are implemented in “Science” learning make prospective teacher educators more creative and innovative in thinking and innovating the skills possessed by each student. The skills of each student can be created through the development of interesting learning media teaching materials.

This learning media is a supporting tool that is used as an assistant in the teaching and learning process so that the learning outcomes taught are easy to understand and the realization of learning objectives.

The presence of new findings regarding Augmented Reality (AR) in the teaching and learning process that is closely related to technology has become a trend in the world of education. There are several substantial findings that can generate interest from researchers to be able to find out the use, advantages, and potential of AR in an educational environment. AR, a perfect amalgamation of digital information with the real world on the screen, can change the way individuals interact with virtual objects and visual-graphic experiences. In the application of AR, it does not mean that the virtual environment can change the real world. AR provides integration of the virtual world into the real world with the aim of AR giving a real impression of the interaction between the human-computer-physical world (Papadopoulos et al., 2021). In the application of AR in the field of education, it can provide encouragement for students to add a more creative and less boring learning experience.

In the world of education, AR has a variety of different ways. According to several studies, there are five types of AR that are used in the world of education, including the following: (1) learning based on a finding, students are given information about the real world that is unique and interesting according to him. For example, AR is applied by visiting or observing museums, places with high historical value, and astronomical simulations, to be able to provide information directly; (2) by varying the object, which allows individuals to examine certain points to be seen in different variations; (3) through the application of AR teaching modules, which offer four Dimension (4D) presentations and interactive and innovative learning experiences for individuals; (4) through skill simulation, which requires visual composite simulation; and (5) games in the application of AR seek to increase the power of games in the world of education. the application of AR in the world of education can add a variety of new techniques to show the relationship and connection of students with learning objects. Students who apply this type of application are expected to create interactive and innovative forms of learning.

AR can provide increased interest in the research community; because there is the provision of unique learning services for students by offering a platform that provides increased creativity through content and visualization of scientific phenomena so that there is a reduction in the cognitive load of students. AR applications have expanded their use into the social "Science"s. AR has a good influence on learning achievement and student learning outcomes (Avila-Garzon et al., 2021).

"Science" and technology are important factors in shaping living standards, necessary to solve the problems that humans face throughout life. According to Akbay (2022) A the use and development of "Science" and technology effectively requires several skills. This harmonizes with the skill required of 21st century learners. An effective way to train students' creativity and technological skills is through scientific study.

"Science" is a branch of "Science" that provides systematic, rational, and objective theories about the life of the universe. The word "Science" comes from the word "Natural Science". A natural that is naturally related to nature. "Science" means "Science". Stephen Gaukroge the essence of "Science" (1) a way of thinking; (2) "Science" as a way of clarity; (3) "Science" as a body of knowledge; (4) "Science" and mathematics with technology and society. It is therefore understandable that "Science" is the knowledge that enables learners to think scientifically, to conduct scientific investigations into found objects, to bring facts from a scientific investigation into developing new concepts. Society and technology have an important role in investigative activities. This was in harmony with the demands of the 21st century student in the revolutionary 4.0 era.

College as a pillar of education was also required to adapt to technological change and development in the industrial 4.0 revolution to prepare and print competencies and competitiveness graduates in the 2nd century. One is by applying AR based learning. Ar is the latest technology that offers excellent speculations in all areas of life, particularly education. AR has now seen significant developments (Sugiono, 2021). Cabero-Almenara & Roig-Vila (2019); Tushar Jaiswal, Amjad Ali Khan & S Prakash (2021) ar offers the possibility of a reciprocal relationship between objects derived from computer technology and those found in the real world. Ar gives the

impression of a physical entity with a digital object. AR can provide a variety of interactions in the class (Sáez-López et al., 2020). In "Science" study, application ar can be applied to problem - solving, application in a virtual laboratory (Kearney, 2020; Kumar & Mantri, 2022), cause and effect models, 3d objects (Chen et al., 2010) and interactive digital text modules (Kelpšienė, 2020; Nordin & Daud, 2020).

AR provides facilities for elementary school students in delivering abstract-visual understanding in the learning process into a more concrete understanding. This proves that AR is in line with constructivist theory. In the process of learning "Science" requires more scientific knowledge so that it is not limited to understanding facts, but mastering "Science" process skills, in order to increase critical thinking power in solving problems. As a prospective teacher, you must be able to combine scientific information, techniques, and skills in learning "Science", so that you can find out a scientific topic with face-to-face insight or e-learning learning.

AR-based learning can be done through several applications, one of which is the "DEVAR" application. To be able to use the application, students can scan the barcode first using smartphones and tablets. Smartphone and/or tablet cameras that have processed barcode scans can be directed at objects contained in books so that objects will appear (4D). The "DEVAR" application is one of the innovative learning applications. In the field of education, "DEVAR" can be used by prospective PROSPECTIVE TEACHER as well as for teachers as a support for creative and fun learning, so that it can improve the skills that students must have in 21st century learning. This application is very useful to be explored further by prospective teachers who want to practice teaching. This application is very helpful for prospective teachers in simulating problem solving in "Science" learning. "DEVAR" is a family-friendly AR platform that provides fun edutainment activities for both kids and adults. You'll find engaging AR games, interactive characters, amazing camera effects, cool animations, and really fun learning.

Therefore, prospective PROSPECTIVE TEACHER must be equipped with various 21st century learning skills, one of which is creativity, and technological skills, so that they are able to become professional teachers and have global competitiveness according to the demands of the industrial revolution era 4.0 and society 5.0 (society 5.0). In increasing the creativity of current education system policies tend to not involve students directly. Therefore, it is necessary to equip prospective PROSPECTIVE TEACHER to have creative thinking skills as a provision for creativity, especially in carrying out "Science" learning so that they become qualified graduates as a fulfillment of creative and innovative global economic demands.

Research Results (Gestiardi et al., 2022) some teachers stated that AR based learning, especially in "Science" learning in elementary schools, was considered very useful in improving student learning outcomes, making it easier for teachers to teach. However, the use of AR has not been maximally implemented in schools, so there is a need for wider socialization and training on teacher pedagogical development in AR-based "Science" learning materials. The results of the research by Chani Saputri & Susilowati (2022) that "Science" learning is the subject that is the most object of research based on AR learning, which is mostly implemented in grades IV, V, and VI.

B. METHODS

1. Research Sampling

Data were collected from 32 prospective teacher candidate from the University of University Panca Marga. This university is located in the city of Probolinggo with the majority of students having good creativity in the use of technology in the field of education. These prospective prospective teacher are very happy with the use of technology-based teaching materials for creative innovation in the learning process.

2. The Research Technique

In carrying out the research, researchers carried out descriptive qualitative methods. This description is to analyze the characteristics of the data accurately and significantly to the nature of the data. The purpose of using descriptive research methods is to provide a description of the description or technique that is carried out systematically, factually about the statement of facts regarding the results of the application of "DEVAR". The data obtained is based on the results of the analysis and distribution of questionnaires regarding the practice of applying the "DEVAR"

application. The final action is to obtain data analysis and provide a description of the discussion in accordance with the theme of the article. This article focus in theme "Implementation of the DEVAR Application in *science* subjects regarding human movement organs".

3. "DEVAR" Application Development

Development of teaching materials application "DEVAR" based on the ADDIE model.

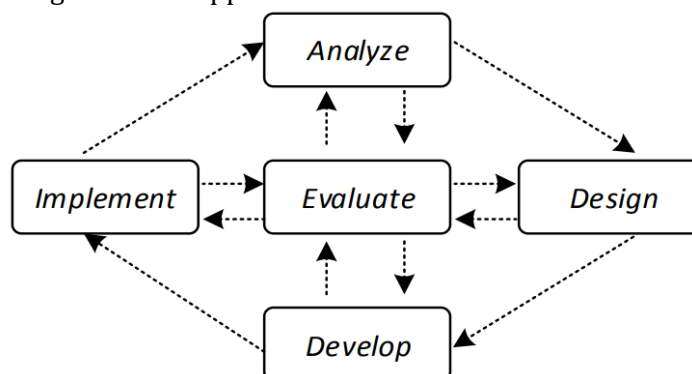


Figure 1. Stages of the ADDIE model according to Sugihartini & Yudiana (2018)

In the ADDIE model there are 5 stages, including the following: (1) Analyze, carried out to analyze deficiencies in "Science" learning so that researchers identify suitable discussions to meet the needs of prospective teachers to teach; (2) Design, implemented to first design an application that refers to learning techniques, learning objectives and learning outcomes; (3) Develop, at this stage consists of developing teaching materials in accordance with the discussion material "Human Movement Organs", compiling materials according to the guidebook/syllabus and evaluating with practical activities for each prospective teacher; (4) Implement, the stages in implementing the discussion material on the use of the "DEVAR" application; (5) Evaluate, evaluate the results of the implementation of the "Human Movement Organs" learning by using the "DEVAR" application.

When applying the "DEVAR" application, prospective teachers must really understand the operation of mobile phones and first explore the sequence in using the application. The purpose of prospective teachers must first understand so as not to cause mistakes when practicing with their students. This will greatly impact on these students, have an impact on students' interest in learning and their learning outcomes.

C. RESULT & DISCUSSION

1) Questionnaire Results

Based on research conducted on prospective teachers at Panca Marga University Probolinggo, the following results were obtained:

a) Understanding the concept of using the "DEVAR 4D Augmented Reality" application?

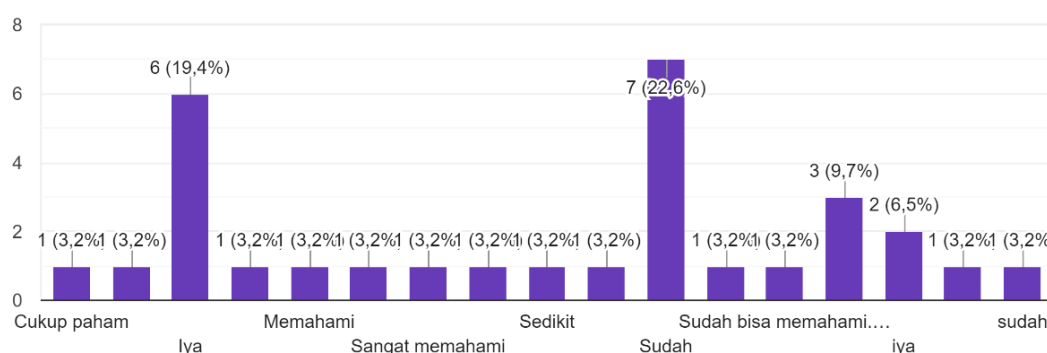


Figure 1. Understanding the "DEVAR" application

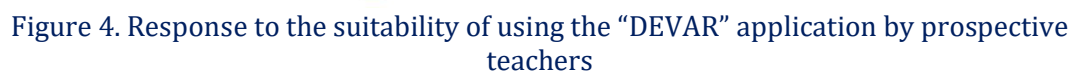
b) Is this "DEVAR 4D Augmented Reality" application simple and easy to use for learning at the Elementary School?



c) Can this "DEVAR 4D Augmented Reality" application create a fun learning atmosphere?



d) I like to use the "DEVAR 4D Augmented Reality" application to carry out learning activities"



The Figure 4 shows that 59.4% agree that they like the "DEVAR" application to be used in the learning process and 40.6% state that they strongly agree. So it can be concluded that the "DEVAR" application is very suitable when used in the learning process in the industrial era 4.0 which requires technology for all areas of life, especially in the field of education.

- e) Using the "DEVAR 4D Augmented Reality" application according to the learning of Human Movement Organs

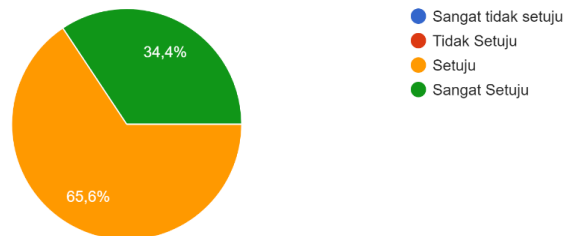


Figure 5. The suitability of learning materials with the "DEVAR" application

Based on figure 5 shows that 65.6% agree and 34.4% state strongly agree about the suitability of learning materials with the "DEVAR" application. The "Science" learning material "Human Movement Organs" is in dire need of teaching materials that can be directly seen as real by students. So with the "DEVAR" application which is designed for four-dimensional (4D) learning, it is very suitable when used in the "Human Movement Organs" material. So it can build fun learning.

- f) "DEVAR 4D Augmented Reality" application allows me to study anytime and anywhere

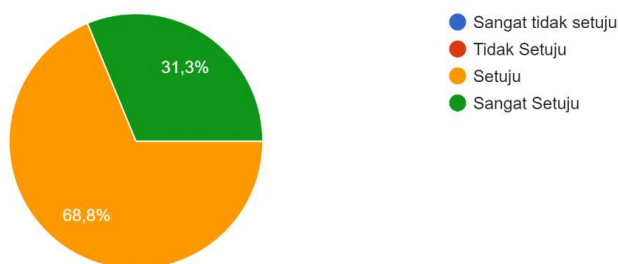


Figure 6. Flexible learning

In diagram 6 shows 68.8% agree and 31.3% strongly agree with the statement that the "DEVAR" application allows learning anytime and anywhere. This means that the "DEVAR" application can create flexible learning.

- g) The "DEVAR 4D Augmented Reality" application facilitates the needs of the learning process that I need

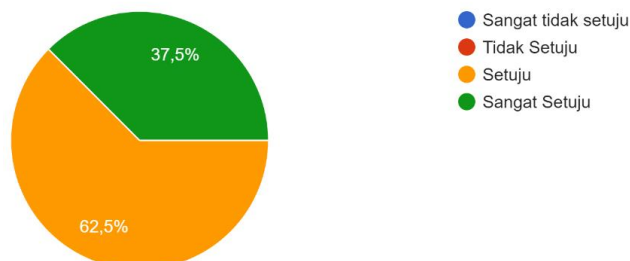


Figure 7. "DEVAR" Facility

Figure 7 shows that 62.5% agree and 37.5% strongly agree with the statement that the "DEVAR" application can facilitate the needs of the learning process required by prospective teachers. This "DEVAR" application greatly facilitates the four-dimensional (4D) "Science" learning process so that it is quite helpful in carrying out learning activities.

h) I intend to use the "DEVAR 4D Augmented Reality" application during teaching practice

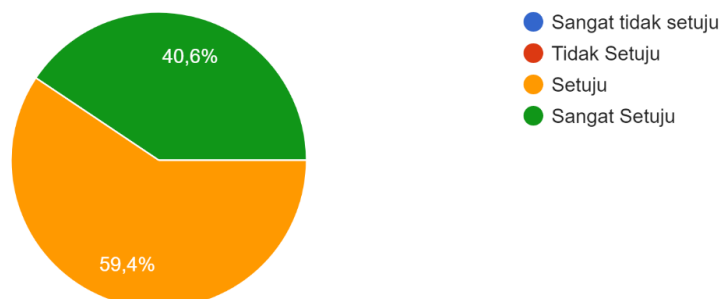


Figure 8. Use of "DEVAR" application for teaching practice

Figure 8 shows that 59.4% agree and 40.6% strongly agree with the statement that prospective teachers want to use the "DEVAR" application in the implementation of teaching practice. On average, prospective teachers intend to use this application because it is quite helpful.

2) Discussion

The satisfaction obtained by prospective teachers after studying the "DEVAR" application is an important point in the implementation of this research. Prospective teachers who want to carry out this teaching practice already quite understand the use of the Augmented Reality "DEVAR" application which is based 4D. Learners must be given the opportunity to apply (practicum) the skills they have just learned, so that they get learning satisfaction. This study agrees with the research conducted by Pipattanasuk & Songsriwittaya (2020) which explains that student satisfaction with the Augmented Reality teaching and learning model is very high due to the application of 4D through modern technology (mobile phones).

Here's how to use the 4D-based Augmented Reality "DEVAR" application: (1) Download the DEVAR application on the play store and App Store; (2) Scan and click Barcode Scan the barcode for the book "Devar 4D Encyclopedia" that you want to use in the application of the "DEVAR"


application; (3) Click the "Watch" menu then wait for the DEVAR icon  to appear; (4) Point your camera at the drawing surface of a bright book until the image appears 4D; (5) If you see a blue box, tap the device screen until a description of the image appears (the name of each part of the object); (6) In certain sections, you can tap the word "interact" to be able to see and understand in more detail the object you are observing ; (7) Swipe left or right on the bottom bar to explore new characters and experiences with 4D view.



Figure 9. Description of the structural parts of the human skeleton

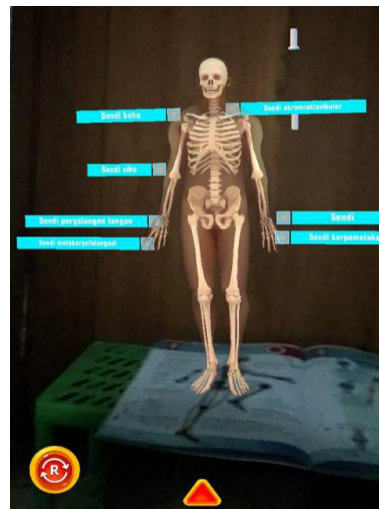


Figure 10. Description of the parts of the joint structure

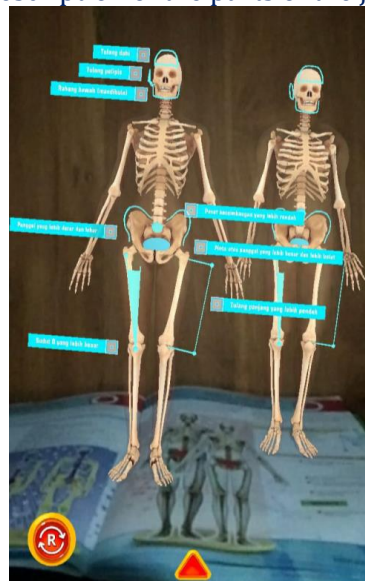


Figure 11. Description of the structural parts of the male and female skeleton



Figure 12. Description of the structural parts of human bones

D. CONCLUSION

"DEVAR" is an application that utilizes technology in the learning process on a 4D basis. With the trial class on the "DEVAR" application, it is very helpful for prospective teachers in making learning materials and methods for the implementation of teaching practice. So that prospective teachers can be more innovative and creative in managing learning so it is fun. They find it very helpful with the "DEVAR" application. Learning is more effective and fun when using the "DEVAR" application because prospective teachers can be displayed in 4D so that it looks like real. When a teacher can bring learning to be fun, that is where students' interest in learning grows, this interest in learning affects the results obtained in learning. With this, learning about "Human Movement Organs" is easier for students to reach.

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