

Validity of the Flipped Classroom Learning System Based on Guided Inquiry on Molecular Forms Using Augmented Reality for Class X SMA/MA Students

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Abstract— The era of the industrial revolution 4.0 or the era of disruption caused many changes in people's lives, including in the field of education. The Covid-19 pandemic is one of the characteristics of the era of disruption, namely volatility and uncertainty where the Covid-19 pandemic occurred and caused changes that were fast and unpredictable (volatility) and there was uncertainty. Changes that occur in education are the learning process from face-to-face in class to online learning. This research develops a learning system and learning media that can be used in certain situations such as the Covid-19 pandemic. This learning system combines flipped classroom learning with guided inquiry learning models. And the development of learning media based on augmented reality to visualize 3D objects in molecular shapes. The research method used Educational Design Research with a Plomp research model. The validity were carried out with the values obtained for the validity of the learning system of 0.83 and the value of the validity of the media at 0.87 in the high valid category. And for the value of the validity of learning media materials BEMO-AR 0.82 and the validity value of learning media 0.86 with high valid categories.

Keywords—*Guided Inquiry; Flipped Classroom; Learning System; Augmented Reality; Molecular Forms*

I. INTRODUCTION

Today we have entered the era of the industrial revolution 4.0. According to Kasali in Risdianto [1], the era of revolution is also known as digital disruption or the era of disruption. Disruption is a fundamental change in innovation. In the era of disruption, there were changes in the use of technology in people's lives. Kemenristekdikti explained that the characteristics of the era of disruption are Volatility, Uncertainty, Complexity, Ambiguity (VUCA). With volatility is change that is fast and unpredictable, uncertainty is change that is fast and there is no certainty, complexity is the complexity of the factors that cause change, and ambiguity is the lack of clarity of change that causes ambiguity.

In 2020-2021 it can be said that there has been an era of disruption with the Covid-19 pandemic because of changes in life that are fast and unpredictable and there is no certainty as to when the Covid-19 pandemic will end. So that it disrupts various community activities, including in the field of education.

In the field of education, the government issued a policy to reduce the spread of Covid-19, which is based on a circular from the Ministry of Education and Culture Number 4 of 2020 concerning Implementation of Education Policies

in an Emergency for the Spread of Corona Virus Disease (Covid-19) which states that the learning process is carried out at home as learning long distance and the National Examination is canceled [2].

In online learning, the teacher must be able to adjust the learning system and media properly. According to Karim (2020) [3] learning that can be done in certain situations such as Covid-19 is Blended Learning, where blended learning is a combination of face-to-face learning with e-learning using video conferencing. Technology has the potential to revolutionize education. Technology has the power to connect with and communicate to learners at the same time. Mobile technology and the Internet are very important to be used as media in learning in the 4.0 era. So that learning can be done anytime and anywhere. (Samala, A., Fajri, B., & Ranuharja, F., 2019) [4]. According to Powell, et. al., (2015) [5] blended learning has 4 types of learning models. One of them is the rotation model. The rotation model also has 4 submodels, namely station rotation, lab rotation, flipped classroom, and individual rotation.

In this study, a flipped classroom submodel is used because according to Tucker in Susanti & Hamama Pitra [6], flipped classroom can make students active in the learning process, support teamwork and class discussions, students can re-watch learning videos anywhere and anytime, encouraging to think, and students can adjust the speed of learning.

In the 2013 curriculum, it is hoped that the learning process can be centered on students so that the learning model is used. One of the learning models that can be used is guided inquiry. According to Piawi in Damaianti et al., [7] guided inquiry learning requires students to be able to observe, ask, conclude, associate and communicate and be able to guide students in finding concepts from answering key questions.

With online learning during the Covid-19 pandemic, learning media are needed that can help teachers in the learning process and are used by students independently at home so that the online learning process can be effective (Samala, A., Fajri, B., Ranuharja, F., & Darni, R., 2020) [8]. The use of good technology is able to make learning as effective as possible, one of which is the use of Augmented Reality (AR) technology.

AR is an integration of digital elements that are inserted into the real world in real time (real time) which can be applied in mobile devices [9]. According to Kravtsov & Pulinets [10] the use of AR technology can visualize 2-dimensional into 3-dimensional shapes. Thus, AR technology can help visualize chemistry learning from 2 dimensions to 3 dimensions as in molecular form material. The purpose of this study was to determine the the flipped classroom learning system based on guided inquiry and BEMO-AR learning media based on augmented reality.

II. METHODE

The development model used in this research is the Plomp model. The plomp development model consists of 3 stages, namely Preliminary Research, Prototyping Phase, and Assessment Phase. At the Preliminary Research stage, activities were carried out to analyze the context, study literature and develop concepts. Whereas in the prototyping phase, activities were carried out to design and evaluate learning models that would be tested for validity by lecturers and teachers as a team of experts with 2 lecturers and 3 teachers, and individual interviews with 3 class X high school students were carried out [11].

III. RESULT AND DISCUSSION

At the preliminary research stage, context analysis was carried out by observing the learning process carried out in schools. It can be seen that due to the Covid-19 pandemic the learning process was carried out online. Then carried out literature study activities. From literature studies it is known that online learning can be carried out by blended learning where the learning process is carried out by combining face-to-face and online learning [12].

According to Hartanto [13] there are two types of online learning, namely synchronous and asynchronous. This learning process can help learning in the Covid-19 pandemic and support learning in the era of the industrial revolution 4.0. According to Ahmad [14], blended learning is one of the government's efforts in learning the industrial revolution era 4.0 through the SPADA system (Indonesian Online Learning System).

One of the blended learning submodels that can be used is the rotation model, and from the rotation model, the flipped classroom submodel can be used. According to Jacob and Lase [15], the flipped classroom learning process is a reverse

learning process with generally learning with students doing assignments first and during class hours students can discuss and the teacher as facilitators and mediators so that the learning process can be student-centered.

In the learning process, a scientific approach is needed so that students can construct their knowledge. The learning model that can be used is guided inquiry [16].

In the Covid-19 pandemic, which requires online learning to prevent the spread of Covid-19, a learning process can be applied by combining flipped classrooms and guided inquiry using edmodo's Learning Management System (LMS) in the asynchronous learning process and zooming cloud meetings for synchronous learning. With the stages of learning can be carried out by cycles [17]:



Picture 1. Cycles FGIL (Vika Aumi & Mawardi, 2021)

In this study, application activities are carried out asynchronously because the learning time at school is reduced by 30 minutes per lesson so that the discussion learning process can be effective, synchronous learning process is only the closing stage.

And in online learning, it takes media that students can use easily and effectively and can be used anytime and anywhere, namely by utilizing augmented reality technology. Augmented reality technology can help the learning process, one of which is chemistry learning because it can visualize objects in 3 dimensions (3D) and can be used by students via smartphones [18].

In this study, the BEMO-AR (Molecular Shape Augmented Reality) media was designed. This media can be used in molecular shape material that can display molecular shapes in 3D and has text and sound displays that can help students learn independently.

The result of preliminary research activities is prototype 1. Then carried out the Prototyping Stage activity. Self-evaluation activities were carried out, from this activity a prototype 2 was produced. Then carried out the activity of one to one evaluation by interviewing three class X students and assessment by experts with two lecturers and three teachers. Validity data processing was used by Aiken V. The validity value for the guided inquiry-based flipped classroom learning system was 0.83 with the valid category. That means, the flipped classroom learning system is in accordance with the core competencies 3 and the depth of the material presented is in accordance with the basic competencies, and the learning process is in accordance with the guided inquiry learning process and synchronous and asynchronous learning activities can be carried out, models (in the form of pictures, tables, graphics, etc.) used are in accordance with science and make it easier for students to understand concepts and the key questions given are able to guide students to find concepts because of the preparation of key questions from simple to complex.

The validity value of learning media by media experts was obtained 0.87 with the high valid category. This value states that edmodo can be used as a learning tool that supports the flipped classroom learning system based on guided inquiry properly.

The validity value of the material for BEMO-AR learning media is 0.82 with a high valid category. The BEMO-AR

media is in accordance with science. And the validity value of BEMO-AR media is 0.86 with high valid category. BEMO-AR media is easy to use and able to operate properly, the display is simple and easy to understand, the font size of the application can be read well and the application provided is attractive. The results of the expert test are referred to as prototype 3.

IV. CONCLUSION

Based on the research results obtained, it can be concluded that:

1. This research on the development of learning systems and learning media has produced a flipped classroom learning system based on guided inquiry on molecular form material for class X students and valid BEMO-AR learning media.
2. The validity value of the flipped classroom learning system based on guided inquiry on molecular form material for class X students is 0.83 and 0.87 for the validity value of the learning system media, namely edmodo.
3. The validity value of the BEMO-AR learning media material is 0.82 and 0.86 for the validity value of the learning media.

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