

The Development of Flipped-Guided Inquiry Based Learning System on Buffer Solution Material for Class XI SMA/MA

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Abstract— The outbreak of Covid-19 virus has impacted on school learning system that is transformed from offline learning to online learning. Online learning is designed to support a competent learning by utilizing informational and digital technology. This study is aimed to develop a Flipped-Guided Inquiry Based Learning System on the Buffer Solution material and to test how valid and how practice is this learning system. This research is conducted Research and Development (RnD) with the Ploomp development model. The validation result is 0.83 which is on valid category. Moreover, the practical result is 87% and it shows that it is on the very practical category. The results of this study is to indicate that this learning system is valid and practice so that it can be used as one of an alternatives of online learning.

Keywords— Guided Inquiry-based, Flipped Classroom, Learning Sytem, Buffer Solution.

I. INTRODUCTION

In the beginning of 2020, there was an outbreak of a new virus variant that shocked the world, Covid-19. The epidemic of the Covid-19 has impacted on school learning system that is switched from offline learning to online learning [1]. One of the solutions that is used in online learning system and applied in the Industrial Revolution 4.0 to face the challenges of the 21st century is the blended learning model. One of the blended learning models is flipped classroom [2]. Flipped classroom is also called as reverse classroom, because it is basically reverse a face-to-face classroom to be held online at home in a flipped classroom [3].

Flipped classroom can adjust learner-centered learning based on 2013 Curriculum. One of the relevant learning models of 2013 Curriculum is guided inquiry model [4]. Guided inquiry model is a learner-centered learning model, because the students is the main role in the teaching and learning process so that it can stimulate the students to be critical [5]. In inquiry-based learning, students are encouraged to engage and to conduct in a real investigations and create the best solution to the given problem [6].

The use of Flipped-Guided Inquiry Based Learning system gives positive impact on several chemistry materials including chemical bonds, molecular shape, salt hydrolysis, and colligative properties. Whereas, it shows valid and practical results [7]–[10]. Moreover, Flipped-Guided Inquiry Based Learning system can improve the interaction between teacher and student and can increase students' thinking skills [11]. Another study argues that Flipped-Guided Inquiry Based Learning system can overcome online learning problems by providing a pleasant learning experience and stimulating students mathematical critical thinking processes [12]. In addition, FGIL material on reaction rates for first year students shows valid and practical results and improves student

learning outcomes [13]. Besides, research on Flipped-Guided Inquiry Based Learning System on chemical equilibrium material also shows valid and practical results [14].

Buffer solution in chemistry is a material that requires students to be mastered at concepts and mathematical abilities. Because buffer solution material contains; the basic understanding of the concept of solution about chemistry equilibrium and the concept of acid base and stoichiometry. These materials are needed to understand the concept of a buffer solution correctly [15]. The concept of buffer solution material is a complex concept and many students get difficulties in understanding this material [16]. Therefore, Flipped-Guided Inquiry Based Learning system is needed to be applied since it is learnt not only inside the classroom but also outside the classroom.

To carry out online learning properly, we need a software for doing the learning, called as LMS (Learning Management System). The types of LMS that can be used during online learning are Edmodo and Zoom Cloud Meeting. Edmodo is a useful site for teachers to hold virtual classes [17]. Using Edmodo can support the success of Flipped-Guided Inquiry Based Learning System. At the same time, face-to-face learning can be held virtually by using the Zoom Cloud Meeting application.

Based on the explanation above, a research on a Flipped-Guided Inquiry Based Learning System on the buffer solution material can be implemented on online learning.

II. METODOLOGY

This research is conducted Research and Development (RnD) as the type of research. The development model that is used in this research is the Plomp model developed by Tjeerd Plomp which consists of 3 phases : 1) preliminary research (early investigation stage). In this phase, there are several analysis is done such as the analysis of needs and context, the literature of the studies, and the analysis of the conceptual framework. 2) the development or prototyping phase is the designing phase and the intervention realization phase (product). 3) the assessment phase is used to evaluate the results of the product that is used practically [18].

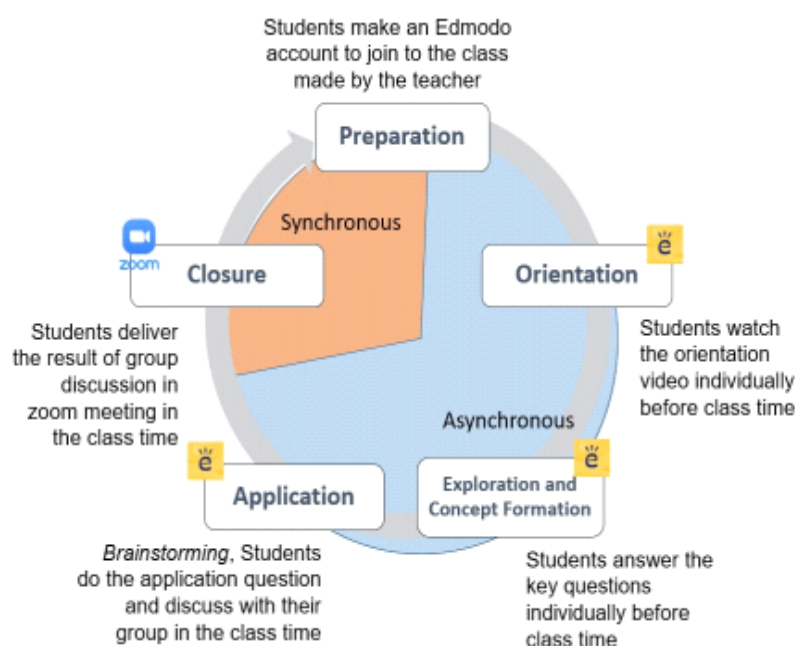
In this study, formative evaluations is conducted like self-evaluation, expert evaluation, and also individual and small group evaluations. The purpose of this evaluation is to evaluate the level of validity and practicality of Flipped-Guided Inquiry Based Learning System on Buffer Solution Material for class XI SMA.

III. RESULT AND DISCUSSION

Result

Preliminary Research. In this phase, there are several analysis is done such as the analysis of needs and context, the literature of the studies, and the analysis of the conceptual framework. These analysis are established to find out the basic problems experienced by teachers and students in the real life related to learning chemistry about the Buffer Solution material at school. Based on the studies, to solve the problems of learning during Covid-19, a student-centered learning is needed and can improve the critical thinking skills. Therefore, Flipped-Guided Inquiry Based Learning System can help to overcome these problems.

Prototyping Phase. Prototyping Phase. In this phase, each prototype is evaluated formatively. The activity that has established in the prototype phase is designing the development of Flipped-Guided Inquiry Based Learning System on the buffer solution material. Here are the steps : 1) designing learning in based on the procedure of Flipped-Guided Inquiry Based Learning System 2) determining the model based on the learning objectives of the buffer solution material. 3) creating the key questions as media for the students to apply the concepts that have been obtained and to measure the students' understanding about the buffer solution material. 4) after the learning design is created, then the next step is to change it in a digital version in the Edmodo application so that it can be applied in online learning. 5) learning is implemented asynchronous by using the Edmodo application and synchronous by using the Zoom Cloud Meeting application 6) after prototype I is produced, a formative evaluation is carried out to the next phase.



Picture 1. The Cycle of Flipped-Guided Inquiry Based Learning System

Prototype I has been self-evaluated and the revision result is called prototype II. In prototype II, the expert review is established by two chemistry lecturers and 1 chemistry teacher. This evaluation aims to determine validity level related to the material, the presentation, and the language. Furthermore, one-of-one evaluation is carried out by interviewing 3 students with different capabilities; high, medium, and low. The purpose of this phase is to find out how the students respond to the learning system that is being developed. The revision of prototype II aims to improve the quality of the prototype, then it can produce a valid prototype III which can be seen in table 1.

Tabel 1. Validation Result based on Expert Review

No	Aspects	Validity	Category
1	Material components	0,79	Middle
2	Presentation components	0,82	Valid
3	Language components	0,89	Valid
4	Graphic components	0,83	Valid
Average		0,83	Valid

Prototype III is tested into a small group evaluation to determine the practicality of the learning system. In this phase, it is carried out on 15 students in class XI SMAN 8 Padang. Based on the results of the practical of the small group evaluation, 87% of participants are categorized in the very practical category. Moreover, this practical phase is carried out on chemistry teachers. Based on the results of the practicality of teachers, 94% of participants are categorized in the very practical category.

Discussion

The learning system is an organized combination that includes elements of human being, organized, equipments and procedures that are interacted to each other to achieve a goal. The five components of the learning system in Flipped-Guided Inquiry Based Learning System are 1) students 2) Objectives 3) Conditions 4) Learning resources 5) learning outcomes. The phases of the learning system are carried out based on the procedure of Flipped-Guided Inquiry Based Learning System. At the orientation phase,

students watch the provided video which aims to give motivation, creates curiosity and new knowledge by linking it with previous knowledge [19]. Before proceeding to the next learning phase, students are divided into small groups.

In the exploration and formation of concept phase, the students are given a model, then the students are asked to analyze the model to get a concept by doing the key questions on the quiz feature in the Edmodo application. The application phase is established in the assignment feature on the Edmodo application. This applications are in the form of exercises and questions. Students answer the exercises in groups to increase the confidence of the concepts that they get together during the exploration and formation of concept in order to strengthen their concepts. In this closing phase, the students practice a zoom meeting with the teacher, and then representatives of each groups are asked to present the results of the group work and to conclude from the learning that has been done.

The results of the validation according to expert review are shown in table 1 with an average value of 0.83 in the valid category. It shows that the learning system developed is valid in terms of its material components, presentation components, language components and graphic components. From the feasibility of the material of the learning system has an average value of 0.79 in the medium category. It means that the orientation of the video and the model that are used is related with the material being taught, the model used is scientifically correct, the model used can be explored to answer key questions, the key questions found in Edmodo are sufficient to direct and guide to find concepts, model combinations and enough to train to find the concept. The exercises and questions given to Edmodo can strengthen and strengthen the concept.

On the presentation components of the learning system it has an average value of 0.82 in the valid category. It means the learning design is based on a guided inquiry cycle, the Edmodo application that has been given makes it easier for students to access the learning, the orientation of the video has good image quality and clear voice quality, the presentation of questions with a model makes it easier for the students at the exploration phase, the key questions that given are from simple to complex, the presentation of the application phase in the small group feature allows the students to conduct a group discussions, and the closing phase is using the zoom meeting application which allows the students to confirm the concepts obtained with the teacher directly.

On the language component, after doing the data analysis, the V value obtained is 0.89 with in the valid category. It means that the language used in the orientation video is communicative, the language used in giving the instructions is understandable and not ambiguous, and the language used in the key questions in Edmodo is a good and correct language according to Indonesian spelling rules. From the graphic component of the learning system, it has an average value of 0.83 in the valid category. It means that the model displayed on Edmodo can be observed clearly.

IV. CONCLUSION

The results of the research that has been done based on Flipped-Guided Inquiry Based Learning system and is developed by using the plomp model. The results of the validation of the learning system is 0.83 in the valid category and the practicality results is 87% in the very practical category. The results of this study indicates that this learning system is valid and practical. it can be concluded that it can be used as an alternative to implement online learning.

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