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Validity of Flipped Classroom Based on Guided Inquiry in Chemical Bonding Materials Using Edmodo

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***Abstract* — The COVID-19 pandemic has affected the learning system, learning that is usually done face-to-face must be done online and face-to-face or can be called blended learning. Teachers can take this opportunity to advance the teaching capabilities. Students should be able to play an active role in learning even though it is done online. Guided inquiry is a student-center learning model, where students can build their own concepts, so that learning can be more meaningful. The flipped classroom approach allows teachers and students spend more time because by giving assignments before class will optimize the learning time, and at the star of each class period teacher can review the assignments before. By combining the guided inquiry learning model and the flipped classroom approach, active learning can be achieved, and the learning time will be more effective. In this study, media and material validation was carried out by experts. Students will be given videos and questions before the class period, using Edmodo and teachers and students will discuss it by face-to-face in class period. The type of this study is reseach and development, by using Plomp model to develop it. The media validation results obtained were 0.94 in the high category and for the validation from experts in the field of chemistry the results obtained were 0.86 with the high category. And for the practicality test the results obtained were 82.17% with the practical category.**

Keywords*— *Guided Inquiry; Flipped Classroom; Chemical Bonding;Edmodo.

I. INTRODUCTION

The COVID-19 pandemic requires that the learning system be turned online and face-to-face in Indonesia. With the implementation of online learning makes it difficult for teachers and students to carry out the learning process. Even so, active learning must still be carried out, where active learning increases student learning achievement compared to conventional learning (1). Guided inquiry is an active learning model, in which students can build their own understanding by connecting with prior knowledge (2). By understanding prior knowledge, students will find it easier to connect logic to understand new concepts (3). To reconstruct new knowledge, students must integrated with prior knowledge (4). Guided inquiry provide more direction for students without having a lot of explanation by the teacher (5). Learning in guided inquiry focus on the students' independence to search and to find (6).By using guided inquiry model student can developed their problem solving and critical thinking skill (7). These critical thinking skill abilities as identifying central issues, recognising underlying assumption, evaluation authority and drawing warranted conclusion (8). Guided inquiry stimulates, teaches and invites students to think higher in order to find concepts independently of various problems expressed (9).Guided inquiry is an effective learning model in chemistry learning, because it can encourage students to use learning resources and work in groups(10).

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Flipped classroom is a student-center approach (13). In short, flipped classroom can be interpreted as the transfer of learning content outside the classroom, usually using online technology. The flipped classroom approach which includes learning content presented in lectures (conventional) and also online is referred to as blended learning (1). In flipped classroom activities before class are more teacher-centered and active learning occurs during class period (14). In Herreid and Schiller (2018) study, learning using flipped classrooms improved student learning outcomes compared to conventional. The flipped or inverted classroom is an instructional model in which the conventional lesson is a student's homework and in-class time is spent on collaborative (16). The advantages using flipped classroom are increase the appeal of self-regulated capabilities, students can achieve deeper understanding of the learning material, they become more engaged, allow more classroom time to interact with their peers and teacher(17). In core, flipped classroom requires reversing instruction in the classroom, instead of focusing on explaining and exemplifying concepts, guiding students will help students in their learning (18).

Chemical bonding are material that is studied at the high school student. Chemical bonding in a substance will affect its physical properties (19). Chemical bonding is an important material, because it will determine the combination between atoms whether bonding occurs or not. Bond theories will determine the shape of the molecule which it turn determine many their physical and chemical properties (20). But in chemical bonding materials, problems are often found due to its broad concept (21). The components of active learning will occur when using the guided inquiry model and the atmosphere of a flipped classroom. Where the stages in guided inquiry will be carried out outside of the class and in the class period.

Students in the 21st century who are already familiar with social media, one of the social media networks is Edmodo, which provides an atmosphere like social media, but what distinguishes it is that edmodo is used only for learning. Edmodo is a tool that has multiple functions of a social network in a secure, controlled way by the teacher that will allow students to access it via the web or an application on a smartphone [20]. Edmodo as an online platform can encourage learning between teachers and students, so students can learn collaboratively, and this platform is easy to use. [21]. Edmodo is an education-based social network because the features provided support the learning process. All learning, assignments, providing materials, and evaluating are facilitated by features in Edmodo. Edmodo is also growing because it is widely used because of its ease of use [21]

II. METODOLOGY

This type of research is research and development. The development model used is the Plomp model, which consists of three stages, namely preliminary research, prototyping stage and assessment phase. This research will carry out a formative evaluation, self-evaluation, one two one evaluation, expert review, and small group. The function of expert review is to produce valid learning materials and learning media and small groups that will be tested on 15 high school students, useful for testing the practicality of the system being developed.

III. RESULT AND DISCUSSION

Result

Preliminary Research. At the preliminary research stage, consist of needs and context analysis, literature review and conceptual framework. At this stage, problem analysis at school, based on observations and interviews with teachers, and references to various literature to solve learning problems that occur during COVID-19 in Indonesia and also in various other countries affected by COVID-19. So that it produces a learning system based on guided inquiry model and flipped classroom. Chemical bonding is one of the lessons that has a broad concept, so the student usually found the problem when studying this material, then the material that has been prepared will be validated first by the experts.

Validation results will be calculated using the Aikens V formula, as follows:

$$V = \frac{\sum s}{n\,(c-1)}$$

And for the validity category can be seen in table 1.

And for practicality the following formula is used:

$$NP = \frac{R}{SM}\ x\ 100\%$$

For the practicality category can be seen in table 2

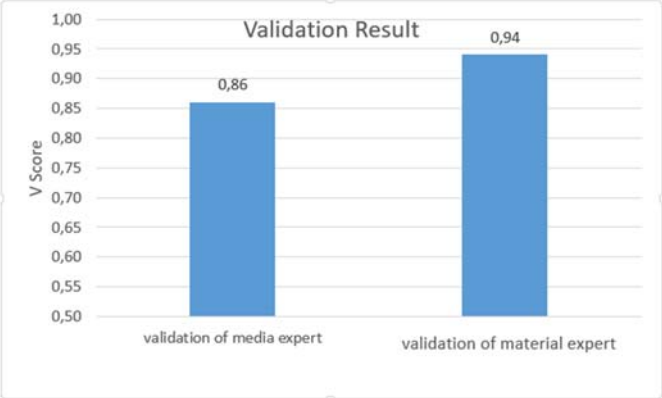
Table 1. Validity Category

No	Aikesn V score	Validity
1.	V ≤ 0,4	low
2.	0,4 < V < 0,8	moderat
3.	0,8 < V	hight

Table 2. Practicality Category

No	Score	Practicality
1	86%-100%	Very practical
2	76%- 85%	Practical
3	60%-75%	medium
4	55%-59%	low
5	≤54%	Not practical

Prototyping Phase. At this stage there are several stages and at each stage have a formative evaluation. First, the learning system is designed, based on a guided inquiry model and in a flipped classroom. After the material has been prepared by the teacher, a self-evaluation is carried out, where the self-evaluation is in the form of a checklist to see the components in the learning system are complete including learning material, this is what is called prototype I. In prototype II, an expert review was conducted from media expert lecturers as well as teachers and lecturers who were experts in the field of chemistry, and conducted one two one evaluation in the form of interviews with 3 students. The media validation was carried out by 3 information technology lecturers. From the results of data processing, an average of 0.94 was generated with the high validity category. And for the average validity of experts in the field of chemistry, it was obtained 0.86 with a high validity category, it can be seen in table 3.From the validation results,



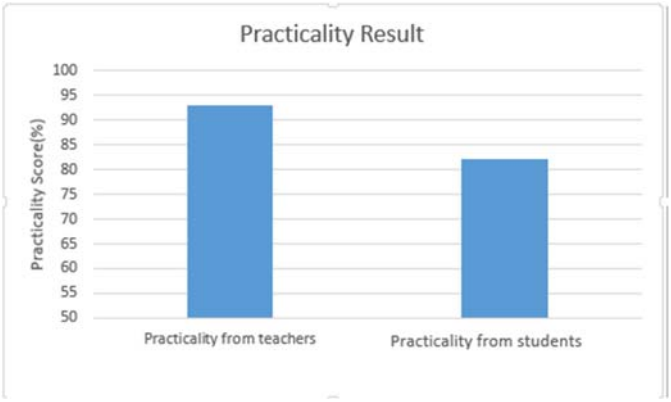
there were several revisions made, such as improving learning objectives, correcting key questions that were not suitable. At the time of one two one evaluation, it was found that the students' learning system was used to help students in learning.

After obtaining a valid learning system, prototype III is obtained, where at this stage a small group test can be carried out on 15 high school students. From the data obtained through the questionnaire, the practicality results were 82, 17% with the practical category, can be seen in table 4. and at this stage, 3 high school teachers were tested and the data was processed and the results obtained were 93.11% with the very practical category.

Discussion

The learning system based on guided inquiry model and flipped classroom on the chemical bonding material developed was tested for its validity and practicality. For validation it was carried out to 3 media experts and also 3 experts in the field of chemistry, namely lecturers and teachers. Validation and practicality tests are part of formative evaluation, which is useful for improving the resulting product.

In Plomp and Nieveen (2007), it is explained that the criteria for formative evaluation in development research consist of components that must be based on state of art knowledge or content validity and all components must be consistent with each other or can be called construct validity, is a condition of assessment so that it can be said to be valid. Another characteristic that indicates good quality for research is its applicability for teachers and students, taking into account that it is easy to use and suitable for use, when both of these exist, it can be said to be practical.



From the data in the table, it can be seen that the validation results of the media expert lecturers are 0.94, so that the media used can be said to be valid. The media used here is Edmodo, which is assessed in terms of appearance and ease of use. Edmodo has features that are quite complete and students can easily use it. In addition to Edmodo's assessment, the video that is included in Edmodo is also assessed in terms of sound quality and appearance.

Meanwhile, for the assessment of experts in the field of chemistry, the results obtained were 0.86 with high validity category. In terms of the content material included in Edmodo, it was assessed by two chemistry lecturers at Universitas Negeri Padang, and also a high school teacher. From the results of the assessment of these 3 experts, there were revisions to several sections such as the learning objectives section, and several key questions.

In the practicality test, students carry out the learning process according to what the teacher has designed, that is, outside the classroom and inside the classroom. When outside the classroom students can discuss with their group friends, through the small group feature on Edmodo. And students can ask questions through the firur comment on Edmodo, the teacher here acts as a facilitator. When in class students report the results of the discussion, and the teacher verifies the results obtained by students, and at the end of the learning the students will conclude the learning. From the results of the experiments conducted on students, the data were processed so that they could be processed, and the results obtained were 82.17% in the practical category. From the practicality test to the teacher, it was found that 93.11% were categorized as very practical. Weaknesses during discussion can be overcome by activating Whatsapp groups by teachers and students, because students are not used to using LMS in learning, because before the pandemic students always do face-to-face learning.

IV. CONCLUSION

This research was conducted to address the problems faced by schools in Indonesia. Where normal learning cannot take place effectively during a pandemic. The learning system developed is useful for helping teachers and students carry out the learning process. Teachers should be biased in using technology during learning, especially during this pandemic. In addition to effective learning hasu, learning must also be active.

Combining guided inquiry learning models with flipped classrooms is one solution that can be done, so that learning can continue well, students can learn actively and can learn anywhere, according to the desired time by using the flipped classroom approach. And student-centered learning will also be achieved with guided inquiry learning models. From the results of research conducted by a flipped classroom-based guided inquiry learning system, its validity and practicality have been tested. So it can be said that this learning system can be used by teachers and students in learning so that learning objectives can be achieved.

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