

Flipped Classroom Learning System Guided Inquiry On Thermochemical Materials For High School Students Class XI

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Abstract— The COVID19 pandemic significantly affects numerous everyday issues all over the planet, one of which is in the space of education. Like different nations all over the planet, Indonesia is changing its schooling framework into e-learning as a careful step to forestall the spread of the infection. Internet learning has turned into another test for educators and understudies to track down the right learning in these circumstances. The point of this review is to create and find the legitimacy and common sense of the Flipped Guided Inquiry-based learning model produced for secondary school understudies. This exploration is innovative work (RnD) with the flomp advancement model. The subjects of this review were eleventh grade secondary school understudies, science instructors, and science educators at Padang State University. The devices utilized are legitimacy sheets for legitimacy tests and utility sheets for utility tests. The legitimacy test was completed on two educators and three instructors and three understudies in a singular evaluation. Down to earth tests were done on fifteen grade 11 understudies at SMAN 8 Padang. In light of the investigation, it got the legitimacy of 0.96 which shows that the learning framework is legitimate and 0.93 for the legitimacy and reasonableness score got by 93% of the instructor and the understudy in little gatherings who express that this review has a high common sense. The consequences of this review show whether the created model is substantial and functional for use in learning science in secondary school.

Keywords—Flipped Classroom, Guided Inquiry, Thermochemistry.

I. INTRODUCTION

At present the world has entered the period of the modern transformation age 4.0 which is set apart by expanded availability, collaboration and advancement of computerized frameworks, man-made consciousness, and virtual. With the undeniably concurrent limits between people, machines and different assets, data and correspondence innovation unquestionably affects different areas of life. One of them is affecting the instruction framework in Indonesia (Rahman and Nuryana 2019).

Education 4.0 is a reaction to the requirements of the modern transformation 4.0 where people and innovation are adjusted to set out new open doors imaginatively and inventively. Fisk (2017) clarifies "That the new vision of learning elevates students to acquire abilities and information that are required as well as to distinguish the source to gain proficiency with these abilities and information". As yet as indicated by Fisk (2017) as cited by Aziz Hussin, there are nine patterns or inclinations identified with education 4.0, which are as per the following. One of them is learning at various environments. Understudies will have more freedoms to learn at various environments. The Learning System works with promising circumstances for distance and autonomous learning (Cholily, Putri, and Kusgiarohmah 2019)

. The Covid-19 outbreak has hit Indonesia so that it has an impact on various sectors of life. Due to the continued increase in the number of deaths caused by the corona virus, the government issued a policy in the form of stay at home and physical and social

distancing which caused changes to learning. Where learning that was initially carried out face-to-face was transferred to online learning (Khasanah, Pramudibyanto, and Widuroykti 2020)

Covid-19 is considered dangerous not only because of its impact on total deaths or the number of infected. But also because of other impacts caused by Covid-19. For example, its impact on a country's economic growth, its impact on social life, its impact on tourism, and also its impact on education. In the field of education, Covid-19 also plays a big role. Many changes occurred because of this. For example, in a teaching system that is usually done face-to-face with students, it is replaced with an online teaching system. Initially the education system in Indonesia used a face-to-face system and was carried out in class. However, with this disease, the learning system is applied through face-to-face indirectly (Savira and Suharsono 2020)

Utilization of the internet as a learning medium is possible by providing online learning facilities. Online learning is defined as a type of learning that allows the delivery of teaching materials to students using the internet or other computer network media. Online learning can be done by providing LMS (Learning Management System) software that will support learning activities (Kurniawati, Santanapurba, and Kusumawati 2019)

LMS is software created to make it easier for a teacher to organize learning activities and interact with students without being limited by space and time. One of the LMS that can be used is Moodle (Herayanti, Fuaddunnazmi, and Habibi 2017)

One of the learning processes that can be carried out during this pandemic is using blended learning. Blended learning is a learning process that can combine synchronous learning (done at the same time) and asynchronous learning (can be done at the same time and place) (Chaeruman 2019).

According to Johnson (2013) Flipped classroom is a strategy that can be given by educators by minimizing the amount of direct instruction in their teaching practice while maximize interaction with each other. This strategy leverages technology that provides additional materials that support learning materials for students that can be easily accessed by online (Rohmah et al. 2019)

Flipped classroom changes what should be done outside the classroom by students in the form of assignments to be done in the classroom accompanied by the teacher and what should be done in the classroom in the form of teaching and delivering material by the teacher to be done outside the classroom by watching learning videos that have been prepared. In other words, the flipped classroom facilitates students to learn in a way that they think is easy to achieve the desired learning goals and provide convenience for lecturers to teach. The use of online learning is intended to make it easy for students to access learning materials and learn learning materials first before the scheduled meeting in class so that when face-to-face meetings in class students are ready and discussion of the topics being studied can also be carried out in more depth (Ridha, Setyosari, and Kuswandi 2016)

To make the learning system student-centered, a logical methodology can be utilized. The logical methodology has 4 kinds of learning models, to be specific disclosure learning, project based learning, issue based learning, and request learning. One of the learning models that can be utilized in this review is the Guided Inquiry learning model, the Guided Inquiry learning model is a model for fostering students' decisive thinking abilities in acquiring. This learning model expects students to be dynamic during the learning system while empowering students to streamline their abilities and abilities (Yeritia, 2017: 182) (Yuliana, Hikmawati, and Wahyudi 2020)

To support the learning of the Flipped Classroom Based on Guided Inquiry, in its implementation a Learning Management System (LMS), namely Moodle can be used. Moodle is one of the open source LMS that can be obtained freely through <http://moodle.org>. Moodle can be easily used to develop e-learning systems. Moodle is used in asynchronous activities and the available conference features can be used in synchronous activities with the Moodle e-learning portal can be modified according to the needs of educators (Surjono 2013)

To be able to see the application of the guided inquiry-based flipped classroom learning system, this learning system is applied to the Thermochemistry material studied in class XI SMA/MA. Based on the background that has been described, the researchers conducted a study with the title "Flipped Classroom Learning System Based on Guided Inquiry Using Lms (Learning Management System) Moodle on Thermochemical Materials for High School / MA Students in Class XI

II. METHODOLOGY

The kind of this examination is Research and Development (R&D). The improvement model utilized is the Plomp model, which comprises of three phases, specifically primer examination, prototyping stage and evaluation stage. This examination will do a

developmental assessment, self-assessment, one two one assessment, master survey, and little gathering. The capacity of master survey is to create substantial learning materials and learning media and little gatherings that will be tried on 24 secondary school understudies, valuable for testing the reasonableness of the framework being created..

All Of 24 students who are in grade 11 in one of the senior high schools in Indonesia are the subjects of this research. This 11th grade student has studied the similarity of the properties of the elements in the group and their periodicity at the previous meeting and also the electron configurations and patterns of outermost electron configurations for each group in the periodic table. All of the materials mentioned are material that was studied at the previous meeting and are located as prerequisites for studying this chemical bonding material.

Research data is not shared with other parties, student identities are disguised, and student permission for the data to be analyzed and published in academic journals is obtained. To avoid confusion, students were introduced to each stage in the Flipped Classroom Learning Model and then continued with the introduction of the Moodle LMS. Each stage of the assignment can be done simultaneously at home and when the day of chemistry class arrives, students make presentations on the conclusions that their groups get from learning each meeting this stages also called with Synchronous Stage. when several groups of students come forward in front of the class to explain the conclusions they get, the teacher can assess how far the students progress and also understanding of the concepts and models that provided through the LMS Moodle.

III. RESULT AND DISCUSSION

The development and research that has been carried out has resulted in a product in the form of a guided inquiry-based flipped classroom learning system on thermochemistry material for class XI SMA/MA. This research uses the Plomp development model. The steps that have been carried out are described as follows 1. Preliminary Research or Preliminary Research. This preliminary research stage was conducted to gain insight into educational issues. There are several stages carried out in this preliminary research, namely as follows.:

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a. Need and context analysis

At this stage, it is completed to see a portrayal of the conditions/circumstances identified with the issues that happen during the science learning process, particularly on Thermochemistry material at school, so what should be rectified is acquired from the depiction of the issue. At this stage enlightening information assortment is completed, the information is taken dependent on related diaries. From the thinking of the information completed, it was acquired that the Covid-19 pandemic caused many changes throughout everyday life, including the field of education. Learning in Indonesia before the spread of the Covid-19 infection was completed up close and personal. Later Covid-19, students and instructors were approached to consent to the Covid-19 convention in the learning system which brought about the learning system from a distance. In the progress from up close and personal figuring out how to web based learning, instructors should have the option to change the learning framework with the goal that the learning system keeps on running successfully and has the 5 M standards, to be specific noticing, posing inquiries, gathering data, thinking and imparting. As the specialists tracked down while taking an interest in the Field Introduction Program (PPL) in learning schools with the 5M guideline, to be specific noticing, posing inquiries, gathering data, thinking, and conveying not yet progressed admirably. Along these lines, to have the option to adjust web based learning as it is today, fundamental learning framework can be utilized in web based learning and furthermore upholds student focus learning.

b. Literature Review

This stage is completed by looking for and understanding data from sources/references either from books, articles, journals,theses or propositions with respect to the item, to be specific the directed request put together flipped study hall learning framework with respect to Thermochemistry material. From the writing survey that has been completed, it very well may be seen that web based learning can be done in a mixed learning way by consolidating the up close and personal learning process with learning exercises utilizing the web. Mixed learning is a learning interaction that can consolidate simultaneous learning (done simultaneously) and nonconcurrent learning (should be possible at various environments) (Chaeruman, 2013) Flipped study hall is one piece of mixed learning. Flipped study halls can be utilized in the learning system in light of the fact that as indicated by (Susanti and Hamama Pitra, 2019) flipped homerooms can make students dynamic in the learning system, support cooperating in groups

and class conversations, and students can change their learning speed and can utilize different methodologies learning. Not just that, to help the learning system in a logical methodology, a suitable learning model is required so students can develop their insight. The learning model that can be utilized is directed request (Aumi and Mawardi 2021). Not just that, to help learning with an internet based framework, it very well may be carried out utilizing a Learning Management System (LMS). The LMS utilized in nonconcurrent exercises is Moodle and simultaneous exercises utilizing the gathering highlight on Moodle.

c. Formation of conceptual framework

At this stage, the research framework is made by identifying problems and finding solutions to problems found in learning, namely the flipped classroom learning system based on guided inquiry.

2. Prototyping Phase (Development Stage)

This stage produces four prototypes that are completed over and again and followed by developmental assessments that are utilized to further develop item quality. This developmental assessment has 3 phases, to be specific self-assessment, master survey, and individual test (coordinated).

Prototype I is a prototype coming about because of the plan and acknowledgment of the fundamental examination stage. The consequence of this prototype I is a result of a directed request based flipped study hall learning framework. Then, at that point, the following stage is to complete self-assessment exercises, from this movement prototype II is delivered. The consequences of the self-assessment should be visible in the informative supplement.

To deliver prototype III, the following stage is to complete master survey exercises and coordinated assessment exercises by talking three class XI students. Master evaluation is an approval movement of prototype II to get the degree of legitimacy of the prototype that has been delivered. The master evaluation was completed by 10 validators comprising of 5 learning framework validators and 5 learning framework media validators.

At the approval stage, this is finished by requesting a group from experienced specialists to evaluate the item that has been planned. Master evaluation intends to get an experimentally substantial prototype. The evaluation of the validator on the directed request based flipped study hall learning framework should be visible in the informative supplement, and information handling in the reference section. The worth of the legitimacy of the learning framework acquired should be visible in the table.

Table 1. Learning System Validty Result according to expert review

No	Aspects Assessed	V	Validity Status
1	Content	1.14375	Valid
2	Serving	0.885714286	Valid
3	Language	0.90	Valid
4	Graphics	0.9	Valid
Overall Average V		0.96	Valid

Table 2. Media Validty Result according to expert review

No	Aspects Assessed	V	Validity Status
1	Visual	0.94	Valid
2	Easy to use	0.91	Valid
Overall Average V		0.93	Valid

In the next stage, one to one evaluation with the interview of three class XI learners. This stage is carried out to see the response of learners to the prototype II that has been produced. From the results of the interview it is known that the learning system has a

video display that can be seen clearly and easily in Moodle. The language used in videos and key questions is clear and easy to understand. The instruction given to learners is easy to understand and helps in the direction of learning activities. The models used in exploration activities and concept formation can be helpful in answering key questions. The use of a simple Moodle can make learners have no difficulty in their use. As well as the socialization to learners in the use of Moodle so that learners can use Moodle well.

In the next stage, small group trial activities are carried out that aim to find out the practicality of the guided inquiry-based learning system that has been produced. This small group trial was conducted on 3 educators and 24 learners. The average value of practicality by educators is 93% with very practical categories and the average value of practicality by learners is 93% with very practical categories

Table 3. Small Group Practicality Result

No	Aspects Assessted	Percentage	Practicality Status
1	Ease of use	92%	Very Practical
2	Time Efficency	94%	Very Practical
3	Benefits	94%	Very Practical
Overall Percentage		93%	Very Practical

Table 4. Teacher Practicality Result

No	Aspects Assessted	Percentage	Practicality Status
1	Ease of use	95%	Very Practical
2	Time Efficency	90%	Very Practical
3	Benefits	94%	Very Practical
Overall Percentage		93%	Very Practical

The results of prototype I that have been made formative tests in the form of self-evaluation. If there is a shortage, improvements are made to produce prototype II. To perfect the products that have been produced, formative evaluation activities are carried out with expert assessment. The instrument of assessment of the learning system flipped classroom based on the inquiry is guided to the thermochemical material used, namely validation sheets. Validation data was obtained from two lecturers in chemistry FMIPA UNP, one lecturer of the Faculty of Engineering UNP and three chemistry teachers of SMA N 8 Padang. Then the data that has been obtained will be processed using the aiken V scale. From the data that has been obtained, the validity value of the inquiry-based Flipped classroom learning system is guided to Thermochemical material with an average of 0.96 with a valid category. Validator gives valid value because the learning system developed by the author has met the criteria in accordance with the assessment tool (validation sheet)

For the average value of learning media validity by media experts obtained 0.93 with a valid category. From the value that has been obtained it is known that LMS Moodle can be used as a support for flipped classroom learning based on well-guided inquiry. The results of the expert assessment are called prototype 3.

The practicality assessment instrument of the guided-based inquiry-based flipped classroom learning system used is practicality questionnaire. The assessment of the level of practicality of a teaching material can be seen in terms of use, time efficiency and usefulness. With a very practical category can help educators and learners in the process of learning because it is effective and efficient to use, and learners are able to understand the material according to the speed of learning. To get an assessment of these three aspects, a small group test was conducted on 24 students of SMA N 8 Padang. This practicality assessment was also conducted on three educators. In the small group test obtained a practicality value of 93% with a very practical category. And for practicality

tests for educators obtained an average value of practicality that is 93% with a very practical category.

In the process of learning, learners carry out learning activities by applying the syntax of the guided inquiry with the presentation of flipped classrooms.

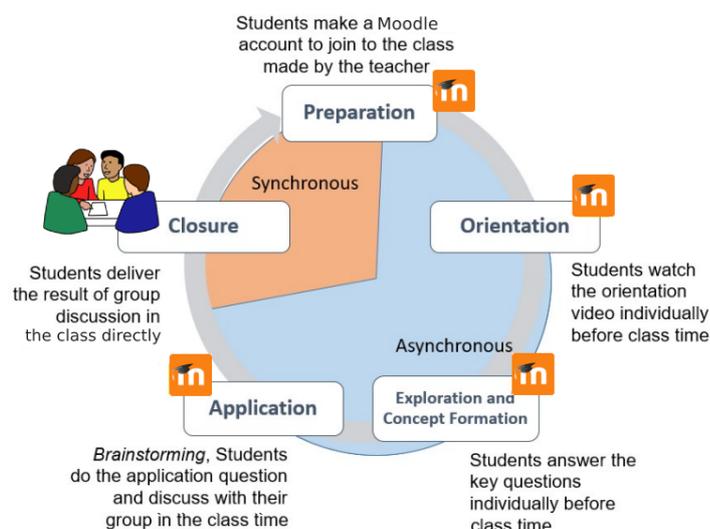


Fig 1. Flipped-guided inquiry learning model cycle

The following are the stages of learning the guided inquiry model with the flipped classroom approach:

1. Orientation (asynchronous)

The orientation stage is made in the form of a video uploaded to the Moodle LMS. Students are asked to watch the orientation video before the lesson takes place. At the orientation stage, the educator's activities that must be carried out are conveying learning objectives and providing motivation by providing an overview of chemical phenomena that occur in everyday life, so that students can be more motivated in studying chemistry. Giving this motivation can be done through a review of the previous week's learning material and/or giving questions to find out the students' initial knowledge related to the topics to be discussed and are events that are encountered in human life.

2. Exploration and Concept Formation (asynchronous)

In the exploration stage, students have the opportunity to collect and analyze data. At this stage, students explore learning models that represent concepts. The model can be in the form of images, videos, graphs, tables, etc. Students will carry out this stage with the help of key questions that lead to finding a concept. When students explore the model accompanied by answering key questions that can lead students to find the information needed, then students can find concepts and can achieve the learning objectives that have been set.

3. Application (asynchronous)

The application stage is the stage where students use the concept to carry out new activities or slightly different activities in which they apply the concept. The application stage will be carried out by students asynchronously and can be carried out by discussing in the comments column the quiz assignment feature with students divided into groups with the small group feature.

4. Closing (synchronous)

At the closing stage, students will communicate the results they have obtained and educators will confirm the truth of the concepts that have been obtained. The closing stage is the end of the stages of the inquiry learning model (Hanson, 2005). At this stage, learning activities are carried out directly based on synchronous learning in class and students at home can join using the conference feature on Moodle.

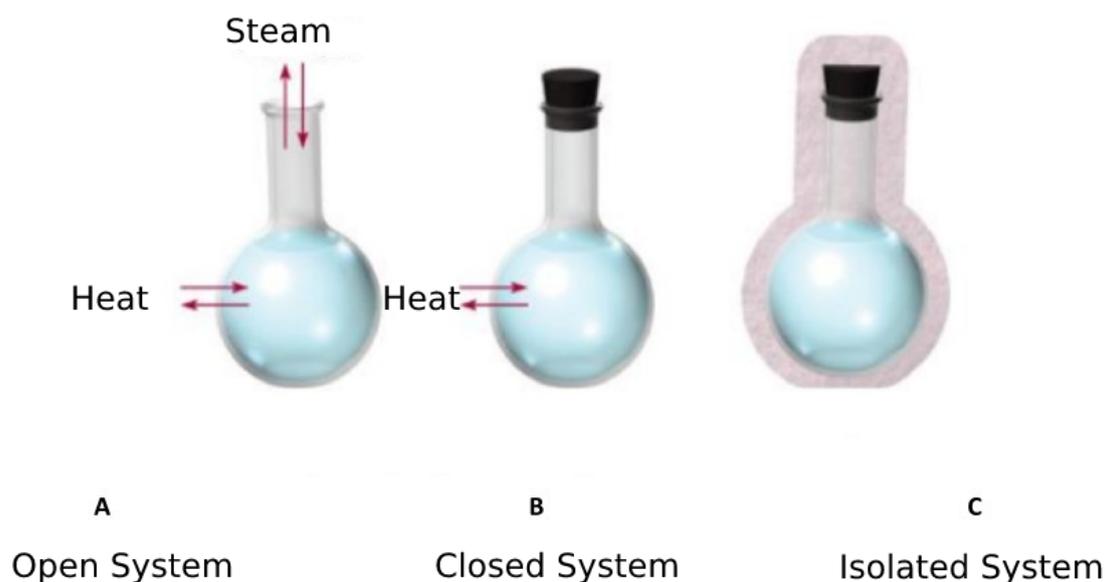


Fig 2. Type Of System Figure

One of the models in the key inquiries responded to by students should be visible in Figure 2. Where here students are relied upon to know the different kinds of systems. From interviews directed with students, it was tracked down that the sort of systems in thermochemistry is three sorts, they are open system, shut system and disconnected system, it very well may be seen from the sub-microscopic picture of the kind of system that hotness can't moving in light of the fact that the obstruction that covering them dependent on the image which is given in Figure 1. At the point when students are relied upon to respond to key inquiries accurately, not just by utilizing pictures that must be seen by the eye (naturally visible), yet additionally from the depiction of images and furthermore sub-microscopic portrayals. Since when given just naturally visible pictures, there were still students who addressed that the photos given were ice solid shapes, this shows that plainly visible data can't assist students with tracking down ideas Sub-microscopic data is additionally significant in light of the fact that by taking a gander at the construction of the substance, its properties not really set in stone. Furthermore the image or depiction of the compound is additionally significant, in light of the fact that when the naturally visible and microscopic portrayals have been given, students can just presume that the type of the substance is a strong, however students don't have the foggiest idea what compound is strong, this is the place where the capacity of the image is so the idea found by students is unblemished so an end right. The blend of the three parts of substance portrayal is the thing that assists students with tracking down ideas in the naturally visible, sub-microscopic and emblematic world without these three students will encounter misguided judgments, and with the assistance of synthetic portrayals, learning will be more significant

IV. CONCLUSION

Based on the development of a flipped classroom learning system based on guided inquiry in finding and understanding concepts in Thermochemical materials, the following conclusions were obtained:

1. The inquiry-based flipped classroom learning system is directed to thermochemical materials for class XI that has been created has a substantial classification with a normal learning system legitimacy worth of 0.96 and a normal worth of the legitimacy of the learning system media which is 0.93 with a legitimate class..
2. Based on the appraisal of small group explore it tends to be realized that the inquiry-based flipped classroom learning system is directed to Thermochemical materials that have been created has an extremely undeniable degree of common sense with a score for instructor reaction of 93% and for reaction from students which is 93%.

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