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Developing Students' Worksheets based on the Inquiry-Flipped Classroom Learning Model to Improve Argumentation Skills

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ABSTRACT

This study aims to develop students' worksheets (LKPD) by the syntax of the inquiry-flipped classroom model to improve argumentation skills using the ADDIE development model (analysis, design, development, implementation, and evaluation). In blended learning, the teacher provides material through several platforms that support online learning. Accordingly, we need an LKPD to help students understand the material independently and improve students' argumentation skills. The research data was acquired by distributing questionnaires to validate design and material experts, teacher and student responses. The results of this study can be 85% per cent in the validation of the learning design with very valid criteria, and material validation got a score percentage of 86% with valid criteria. Based on the teacher's response test, the results obtained were 85.22% in the "practical" category, and the student's response test was 83.75% in the "practical" category. LKPD can improve the students' argumentation skills to levels 3-4.

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1. INTRODUCTION

Learning is a mental process that may be developed (Fathurrohman, 2015). It is valued when it is gained through experience and investigation between people and their surroundings. While learning is the process that people go through to acquire a new behaviour as a group as a result of their own experiences and interactions with the environment. In order to help students reach their full potential, teachers play a crucial role in the classroom environment. Teachers are trusted to influence their pupils to adopt new habits and acquire skills necessary to succeed in class. Because of the skills they bring to the classroom, teachers are in a prime position to help their students become self-directed learners who make effective use of a wide range of instructional tools. Students' knowledge and skill development,

as well as their progress towards and completion of learning objectives, can be aided by the teacher's provision of engaging and novel instructional resources in the form of worksheets. Worksheets for students are sheets that provide assignments for students to complete in the form of instructions and procedures to adapt an assignment to align with the essential skills that will be learned (Nasional, 2004).

Teaching materials are information, tools, and texts needed by teachers for planning and studying the implementation of learning. Teaching materials are all forms of materials used to assist teachers in carrying out teaching and learning activities in the classroom. The material in question is in the form of written or unwritten material (Ertikanto, 2016). Students have difficulty studying this material because they have not been able to construct the concept of chemical reactions that are close to real life into the calculation of the order and reaction rate and apply it through an experiment (Ristiyani & Bahriah, 2016). Abstract chemistry lesson makes teachers in the teaching and learning process need media in their learning (Palma, Saputra, Ulfah, Rasmawan, & Sartika, 2021).

The teaching and learning process will be active, effective, creative, interesting, and fun if the availability of teaching materials supports it, and one of the teaching materials that can be used is LKPD (Ulfah, Bintari, & Pamelasari, 2013). Teaching materials are information, tools, and texts needed by teachers for planning and studying the implementation of learning (Erifal, 2010). Teaching materials help teachers and students in the learning process (Titin, Panjaitan, & Widiyatmoko, 2022).

Chemistry is a branch of science that focuses on how students construct their knowledge. Understanding a chemical concept is not enough if it only comes from the teacher. Students must be able to construct their knowledge. According to constructivism theory, teachers provide students with the knowledge and must build their knowledge. Students can build their knowledge through teacher stimulation or teaching materials. One of the teaching materials that can be used is LKPD (Satura, Abdullah, & Rery, 2021). In line with this, Johnstone (2006) interprets knowledge and understanding of chemistry in three aspects: macroscopic, sub-microscopic, and symbolic. The macroscopic aspect includes phenomena that can be directly observed and described. The sub-microscopic aspect includes the depiction of particulate matter, and the symbolic aspect includes the symbols and chemical equations used to communicate chemical concepts. The characteristics of the first chemistry are that most of the chemical concepts are abstract, the second chemical concepts are generally a simplification of the actual state (analogy), and the three chemical concepts are sequential. Chemical material contains abstract concepts so it is difficult for students to understand. Misconceptions in chemistry learning will be fatal because chemical concepts are interrelated (Hasibuan, Harizon, Ngatijo, & Mukminin, 2019).

Printed teaching materials are teaching materials that are presented on paper, which serve to convey information or learning needs. One of the printed teaching materials that are often used is the Student Activity Sheet. This is because LKPD has several advantages over other teaching materials, including being more practical, economical, easy to use, not dependent on electricity, and saving time in learning(Mardeni, Azmi, & Linda, 2021). The use of LKPD in the learning process has a positive influence (Wahyuningsih, Saputro, & Mulyani, 2014). LKPD is printed teaching material in the form of sheets of paper containing instructions for carrying out tasks that students must do theoretically and practically. LKPD serves as teaching material that minimises the role of the teacher and activates students (Satura et al., 2021). LKPD is a student worksheet developed through an approach referring to discovery(A. Lestari, Hairida, & Lestari, 2021). Interactive worksheets can create a fun and not humdrum learning atmosphere in which students will be irrepressible and courageous to ask questions. The learning atmosphere will not affect tense students (Prianoto, Gulo, & Nawawi, 2017). Supporting LKPD, which involves working on a project, has also never been used (Ariana, Rasmawan, & Sartika, 2022).

According to Syamsurizal, Epinur, & Marzelina (2014), the LKPD used is the publisher's draft LKPD. The contents of the LKPD owned by students are more emphasised on a detailed explanation of a concept, followed by sample questions and some practice questions. Students generally use the LKPD to do practice questions. The use of LKPD in schools can be said to be not maximal. In addition, using LKPD in schools has not shown inquiry-based learning (Inquiry Learning), so innovation in

LKPD is needed. An innovation that can be used is to develop an inquiry-based LKPD that presents a problem provided by the teacher. Then students are guided to find their concepts for better understanding and skills that will be used in everyday life (Pratama & Saregar, 2019).

Students' arguments are classified into five levels. Level 1 shows the argument in the form of a superficial claim with the opposite claim. Level 2 shows the argument in the form of a claim accompanied by grounds, rebuttal, warrant, or backing but without rebuttal. Level 3 shows the argument contains a series of claims accompanied by grounds, warrant, or backing and occasionally weak rebuttal. Level 4 shows that the argument contains a claim accompanied by a rebuttal that can be identified clearly and precisely and contains several claims. Level 5 indicates the argument is broad but still related to the learning material, with more than one clear (Purba, Harizon, & Effendi, 2021).

Scientific argumentation is different from argumentation in general. Based on Toulmin's Argumentation Pattern (TAP) or Toulmin's Argumentation Pattern, scientific argumentation can be interpreted as an explanation of a scientific phenomenon that contains components of data-based claims, justifications that explain the relationship between data and claims and is strengthened by supporters of others. There is also a component of refutation or rejection of a certain situation (Erduran, Simon, & Osborne, 2004). Argumentation is a logical and rational conversation that aims to find a relationship between an idea and the evidence used to support the concept (Akili, Lukum, & Laliyo, 2022). The teacher, as a facilitator, must also use a learning method or model that follows the learning objectives and is attractive to students so that students are interested in participating in the learning process and understanding the essence of the material presented (Trianah, 2021).

According to Sihkabuden (2011), blended learning is capable of activating or provoking students according to the competencies achieved, material characteristics, student characteristics and facilities and infrastructure, both web and face-to-face, so that they can interact optimally. Argues that research on developing the syntax of inquiry learning models combined with the flipped classroom (online learning) results in a new learning model innovation to improve students' argumentation skills (Ramadani, 2019). The integration of guided inquiry models with the flipped classroom approach makes them both effective when combined (D. I. Lestari, Effendi-Hasibuan, & Muhammad, 2020; Silaban, 2017). This study develops students' worksheets based on the inquiry-flipped classroom learning model to improve argumentation skills. The inquiry model with the flipped classroom approach can indeed be applied in the chemistry learning process.

2. METHODS

The type of research used is research and development with the ADDIE model (Branch, 2009). The development of the ADDIE model has five stages: analysis, design, development, implementation, and evaluation. In the initial stage, analysing the needs and characteristics of students aims to determine the conditions in the field with the expected conditions. Analyse the needs of schools that can support or improve the quality of learning. The requirements are related to teaching materials. Therefore, it is necessary to determine the teaching materials that need to be developed to help educators and students in the teaching and learning process. The next stage is designing, determining learning objectives, searching for content references, determining content boundaries, and designing storyboards from LKPD integrated with the stages of the inquiry-flipped classroom learning model to improve students' argumentation skills. At the development stage of the learning media prototype, it will be validated to determine the level of validity. A limited response test was conducted using a revised prototype from the validator to teachers and students, aiming to see the responses of students and teachers to the developed LKPD (Rusdi, 2018). Then an evaluation is carried out to see whether the research procedure is being built by the initial expectations or not until this evaluation stage can occur at each of the stages above. The evaluation that occurs at each stage is above the beginning of the formative evaluation because the purpose is to revise the needs. Evaluation is a process carried out to provide value to the learning system (Pribadi, 2014).

Practical criteria are seen from the level of efficiency of teachers and students in using the product. According to Rusdi (2018), one-by-one evaluation is used to obtain the product's intrinsic aspects, including the ease of using the product, the order of use, and the completeness of the product. The evaluation of small groups depends on the actors after using the product.

The criteria for validating the material are coverage, accuracy, up-to-date, conformity to student development, readability, straightforwardness, motivating ability, coherence, the flow of thought, and the use of terms and symbols/symbols. Material validation was carried out twice with one revision. In the validation of learning designs using this inquiry model, assessing a series of learning processes from the preliminary, core, closing, and evaluation activities in one learning meeting contained in the LKPD. The criteria for validation of the learning design are recognising the need for learning, learning strategies, developing learning, and being practical and efficient. The validation of the learning design was carried out twice with one revision. Student responses were obtained from 12 students of the XI SMA MIPA class.

Data collection techniques carried out in this study used indirect communication techniques through validity test questionnaire sheets, student response questionnaire sheets, and teacher response questionnaire sheets. Each validator and respondent involved in filling out the questionnaire will provide an assessment of every aspect that you want to measure. In analysing the validation data, the LKPD expert used a Likert scale of 1-5 based on the validation sheet. The Likert scale is based on five points ranging in intervals (Setyosari, 2015).

The assessment of the feasibility results is then analysed in the following stages: calculating the frequency of the assessment scores for each statement, calculating the total score for each statement, calculating the percentage of scoring from each statement, and calculating the overall average percentage of eligibility.

3. FINDINGS AND DISCUSSION

The resulting product is in the form of LKPD, which is implemented at the stage of the inquiry-flipped classroom model to improve students' argumentation skills on the material factors that affect the reaction rate for SMA class XI MIA. The stages of this LKPD research are through the ADDIE stages (analyse, design, development, implementation, evaluation)

3.1 Analyse

At this stage, needs analysis, subject matter analysis, and student characteristics are carried out to see student needs. At this stage, information was obtained that the teaching materials used by the teacher were from textbooks, and the teacher had never given assignments outside the classroom. The teacher still explains the entire series of materials to be taught so that students only receive all the material provided. This analysis of student characteristics aims to determine the initial knowledge possessed by students, interests, and student responses to learning and student learning styles. At this stage, the researcher also asked students about the need for teaching materials in chemistry learning and how to teach students. Then, the researchers asked the chemistry teacher about the characteristics of students while studying in class.

One of the topics covered in chemistry class at the twelfth-grade level is the calculation of reaction rates. Collision theory, reaction rate determinants, reaction order, and rate equations are the core concepts that students will need to learn. Abstract concepts, chemical computations, and graphical representations are all part of the context of reaction rate material. Learners can be helped in comprehending the idea of reaction rate and its applications through the use of learning strategies that place emphasis on creating effective learning conditions by presenting authentic and meaningful problem situations to students. So, there is a demand for educational resources that use a problem or case from real-world phenomena as their basis for instruction. The material analysis results extract four elements that affect the reaction rate: temperature, catalyst, surface area, and concentration. Students need their lessons to make sense of the phenomena they see in their everyday lives.

This causes the students' argumentation skills to be weak because they are not trained during the learning process. The argumentation abilities of students are still at low-medium levels, namely levels 1 and 2. Students in class XI MIA in SMA have an age range of 15-17 years (Devi, VH, & Indriyanti, 2019). At this level, students have been able to think abstractly and logically by conducting experiments based on the hypotheses they made and then conducting experiments using the scientific method (Slavin, 2011).

3.2 Design

Design is to create something new that is more interesting to develop and improve learning programs (Prawiradilaga & Dewisalma, 2014). An initial design is carried out to determine the contents of the LKPD by the students' material, curriculum, and character. The steps that must be taken are determining the development team, determining the required resources, compiling a development schedule, selecting and determining the scope, structure, and sequence of learning materials, making storyboards, and determining product specifications. Determine the development team consisting of the main developer (researcher), expert team validator, namely instrument expert, material expert and design expert, and practitioner validator, namely teachers and students (module users), and create a development schedule aimed at confirming the stages/schedule will be conducted. The scope, structure, and sequence of learning materials in the development of LKPD are contained in the material concept map, the initial design in the form of the KD formulation, objectives, indicators, instructions, materials, and student activities that are adapted to the syntax of the inquiry-flipped classroom learning model. Tools such as laptops, smartphones, and internet networks are used in the development process. In developing LKPD uses Canva software. Making storyboards containing cover pages, instructions, concept maps, basic competencies, objectives, materials, and practice questions that follow the activities at the stage of the inquiry-flipped classroom.

Figure 1. LKPD Design

3.3 Development

The LKPD that has been designed is validated by material and learning design experts. Validation by material and design experts uses an instrument in the form of a questionnaire. This material and design validation questionnaire are suggestions for improvement regarding LKPD. LKPD is assessed based on the instrument that has been made. LKPD is assessed based on material experts with nine aspects, namely the scope of the material, the accuracy of the material, it is up-to-date, suitability for students, readability, straightforwardness, motivational ability, coherence and coherence in the flow of thought, and the use of terms and symbols/symbols. A learning design validator with 9 aspects, namely recognising the need for learning, analysing students and the environment, analysing tasks, objectives, sequences, strategies, message design, developing and practising, and efficiency (Morrison, Ross, S. M., Kalman, & Kemp, 2013).

After getting the results of the material and design assessment results, revisions are made according to the suggestions and inputs received. The teacher's response was assessed from the aspect of the appropriateness of the content, language, presentation, graphics, and the ape framework of the inquiry-flipped classroom. Small group questionnaires are assessed from aspects of learning implementation, messages, connectedness, procedures, impact on users, and suitability. The Student Questionnaire was conducted by asking the opinion of 12 students. Evaluation is carried out at the end

of each research and development stage, starting from product manufacture, design validation, material validation, and one-on-one evaluation (teacher assessment) so that at the evaluation stage, a final product will be produced. The final product, in the form of a chemical e-module, is a revised product that a team of experts has validated.

Information was gathered for this study by a combination of questionnaires, interview guides, and direct observation. The questionnaire takes the form of a series of statements with accompanying options for rating the LKPD as a whole. The study's goal is to collect information on how teachers and students receive the developed product. The practicality of any and all data collection tools shall be thoroughly investigated in advance. The results obtained on material validation were 86% with the "very valid" category and in the learning design aspect 85% with the "very valid" category. Based on the teacher response test, the results obtained were 85.22% in the "practical" category, and the student's response test was 83.75% in the "practical" category (Akbar, 2013). Based on the criteria of practicality percentage interpretation, the small group evaluation (student responses) was obtained with practical criteria or feasible/no need for revision. A product is said to meet the practicality criteria seen from the level of efficiency of teachers and students in using the product, where if the teacher considers the product can be used and it is easy for teachers and students to use the product. And there must be consistency between the intended curriculum and operations so the product meets the second criterion, practicality.

3.4 Implementation

The implementation phase was carried out for class XI students of SMA N 1 Batanghari, Jambi. Documentation of the implementation of the LKPD product implementation based on the inquiry flipped classroom syntax at SMA N 1 Batanghari can be seen in the following figure

Figure 2 . Documentation of the Use of LKPD

Based on the results of implementing student worksheets based on the stages of the flipped-classroom inquiry learning model in improving argumentation skills, students seemed enthusiastic about learning by applying the flipped-classroom inquiry learning model by increasing argumentation skills. Students can provide good arguments in the steps on the LKPD.

Based on the results of observations, students feel happy learning using LKPD as media and the Inquiri-flipped classroom as a learning model. Students can give their arguments. Learning can be followed both online at home and offline learning that is carried out at school. Of course, students understanding of learning using LKPD has been measured through the argumentation skills instrument of class XI high school students, while based on interview results show that the response of teachers and students is very positive so that they can declare LKPD with the application of a practical inquiry-flipped classroom model for use in learning in class XI high school.

3.5 Evaluation

The inquiry-flipped classroom model combines the inquiry learning model and the flipped classroom learning model, where the learning stages are carried out both at home (online) and at school (offline). This model starts with an introductory stage before class and formulates problems at home, followed by reviews, formulating hypotheses, collecting data, testing hypotheses and conclusions carried out in class, and the last is conducted an online post-test. By applying the results of the development of syntax-based worksheets, the inquiry-flipped classroom model can improve students' argumentation skills, which can be seen in the graph of students' argumentation abilities.

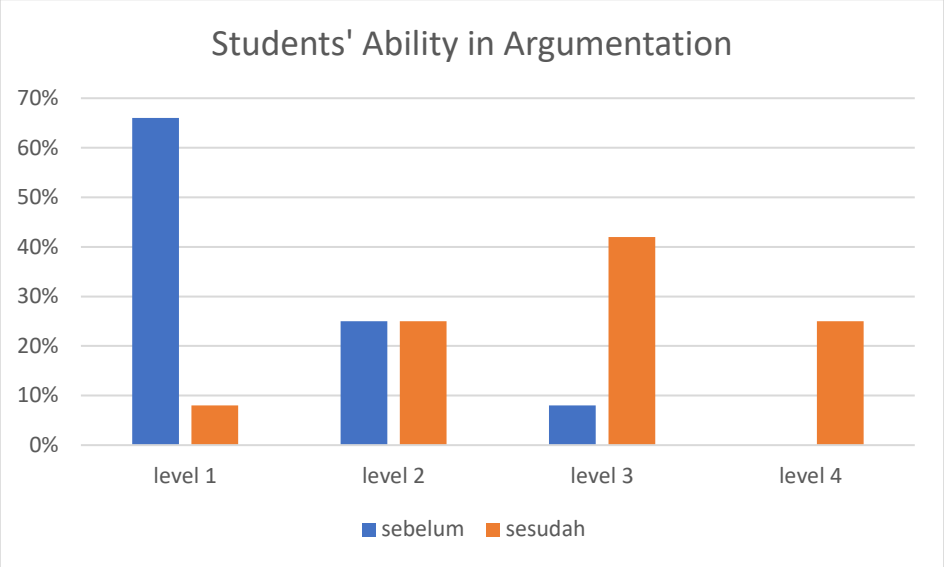

Figure 3. Argumentation graphic

There are five levels of argumentation ability in the assessment; namely, level 1 students can provide simple arguments in the form of simple statements or opinions, level 2 students can provide arguments consisting of opinions and are supported by good data, reasons or assumptions, but do not contain any objections, level 3 students can provide arguments with a series of 99 opinions or statements with data, reasons, or assumptions that are sometimes accompanied by weak rebuttals, level 4 students can provide arguments with an opinion with a refutation that can be identified. This argument may also have several claims and reasons, but it is not mandatory, and level 5 students can provide arguments composed of long statements with more than one rebuttal (Erduran et al., 2004). The argumentation ability of the previous students was at levels 1 and 2 with a percentage of level 1 at 66%, level 2 at 25%, and level 3 at 8% after being given LKPD in the Inquiry-Flipped Classroom learning model. Argumentation ability increased with a percentage at level 1 8%, level 2 25%, level 3 42%, and level 4 25%. So that the LKPD that is integrated at the stage of the inquiry-flipped classroom model can improve students' argumentation skills with factors that affect the reaction rate.

4. CONCLUSION

LKPD based on the inquiry-flipped classroom learning model on the material factors that affect the reaction rate to improve the ability to argue has fulfilled the aspects and was declared valid with a percentage of material expert validation of as much as 86% and learning design validation of 85%. Limited trials were conducted on teachers and students with practical criteria obtained with a percentage of 85.22% and student responses of 83.75% so that it can be said that it is feasible to use in learning. The LKPD developed can improve the argumentation ability of students at levels 1-2 and increase to levels 3-4, which continues to spread from levels 1-4. LKPD is designed by applying every syntax of the inquiry-flipped classroom learning model to increase argumentation. So that interested researchers can develop other materials, such as chemical compounds, with the purpose of argumentation.

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