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Procedures for Developing Inquiry-Flipped Classroom Models to Improve Argumentation Skills

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ABSTRACT

This research is research on the development of a learning model procedure that refers to the research developed by Lee J.L and Jang. The research type is F2-O1+O2-S1+S5+S6-A3. The resulting product is a flow of inquiry learning model-flipped classroom. The results of validation by experts on conceptual and procedural practitioners state that the product is feasible to be tested. The results of the small group trial showed that the inquiry-flipped classroom flow model was effective for use in the learning process. From the results of the study, it can be concluded that the flow of the inquiry-flipped classroom model has gone through the development stage and received a very good response from educators. The flow of the inquiry-flipped classroom model can be used in helping the learning process to improve the ability to argue on factors that can affect the reaction rate, which is characterized by making it easier for students to form initial concepts, saving time so that there is room for argument, increasing student participation.

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1. INTRODUCTION

The acquisition of knowledge is a multifaceted and ongoing process that occurs on a daily basis within educational institutions. Both the student and the teacher play vital roles in the educational process. Students engage in a dynamic process of acquiring knowledge and skills, responding to various instructional strategies implemented by their teachers. Educators have a pivotal role in enhancing students' cognitive, emotional, and physical capacities. According to Syah (2014), learning is an active cognitive process that plays a fundamental role in many forms and degrees of education. The extent to which students achieve their educational objectives is significantly influenced by their learning outcomes, both within and beyond the confines of the educational institution.

The success of the teaching and learning process can be observed through the process of changing behavior as a result of a relatively permanent experience leading to good, positive-qualitative change, so students must construct and seek as much information as possible so that the learning process can run well (Suyono dan Hariyanto, 2014). Students have difficulty learning chemical reaction material because they have yet to be able to construct the concept of chemical reactions that are close to real life, into the calculation of the order of the reaction rate material is difficult. After all, understanding concepts has not been able to analyze and apply them through experiments (Ramadani et al., 2023). The learning process should not require students to memorize a concept or just remember a material. Students are also expected to be able to link between concepts and argumentation. If a concept cannot be understood correctly, it will hinder understanding the next concept. Understanding the concept properly requires abstract, critical and analytical thinking skills. These skills are the ability to argue.

Argumentation is the process of strengthening a claim through critical thinking analysis based on the support of evidence and logical reasons. Argumentation plays an important role in developing thinking patterns and adding deep understanding to an idea(Ginanjar et al., 2015). According to Siswanto et al. (2014), argumentation skills play an essential role in building an explanation, model, and theory of a concept being studied. The ability to argue is the ability to think logically about the relationship between concepts and circumstances, explaining how the facts, procedures, concepts, and methods of completion are interconnected (Yogaswara et al., 2021).

Claims, evidence, reasoning, backing, assumptions, restrictions, qualifiers, and a disclaimer are the essential parts of a chemical argumentation according to Toulmin's Argumentation Pattern (TPA). Claims are the students' resulting opinions or hypotheses. In order to back up a claim, one needs data. The connection between evidence and assertions is to blame. Reasons presented are supported by theoretical assumptions. Students' right to "disclaim" (Devi et al., 2019) means they can ask or voice thoughts that might be deemed "inappropriate" or "controversial." According to (Effendy (2009), the first type of chemistry learning is characterised by a focus on abstract chemical concepts, the second type of chemistry learning is characterised by a focus on a simplification of the actual situation (analogy), and the third type of chemistry learning is characterised by a sequential arrangement of the material. Abstract ideas in chemistry content can be challenging to grasp. Due to the hierarchical nature of chemistry learning materials and the interconnected nature of chemical principles, even little misunderstandings might have catastrophic results. Cahyani and Azizah (2019) point out that faulty assumptions often contribute to misunderstandings. Low levels of idea mastery are indicative of poor reasoning skills, claim Eliana & Admoko (2020). The ability to argue is the capacity to formulate questions and answers supported by facts and rationale, and to persuade others to accept those answers.

Student argumentation skills are still at a low-to-moderate level, according to research by Devi, P.K. (2009). This is because students make claims without supporting them with facts or explaining how those claims relate to the data they submit. In today's classrooms, the instructor still plays a central role in the learning process. The lecture approach in class and homework assignments with practise questions to reinforce learning at home are examples of teacher-centered pedagogy, in which the teacher acts as a source of information with one-way communication and knowledge transfer. As a result, students don't get as much opportunity to practise using abstract thought to solve issues and put what they've learned into practise. This is consistent with the findings of (Hasibuan et al., (2019)), who found that the lecture model of teaching chemistry can lead to students developing weak reasoning skills. It is believed that the pupils' capacity to debate has not improved as a result of the implemented learning.

Students' reasoning skills are still lacking, according to observations of chemistry instruction in schools. This is because there is a dearth of productive debate venues where students can engage with one another. Teachers still spend class time clarifying concepts in order to control students' room for debate. Prasetyana et al. (2015) found multiple flaws in the way chemistry is taught and learned. 2) the degree of thinking, such as knowledge and understanding of concepts and facts, because learning in class is typically more focused on absorbing low-level information rather than developing higher-order skills Third, teachers assign homework as a way to keep students engaged with the topic. Students who are low-achieving and yet require extra support in class may view homework as a burden or an unnecessary activity. Because of this, many students require extra instruction to fully grasp the concepts being covered. However, this exercise encourages them to dig deeper into the content being presented to pupils with exceptional abilities.

Curriculum (long-term goals for learning), instructional design, and pedagogical practise can all benefit from learning models. The learning model can be utilised as a pattern of choice, allowing educators to select the most appropriate and effective method for accomplishing their pedagogical aims. The inquiry learning methodology may be traced back to the English term "inquiry," which means "to ask questions" and "to seek answers" in the context of science. Scientific questions can lead to investigative activity on the object of question. Simply said, inquiry is the act of asking questions and seeking answers in order to solve a problem or learn more about a topic (Suyanti, 2010). Students' abilities to think critically, grasp abstract concepts, and engage in the scientific method by asking questions and constructing hypotheses are all honed through the inquiry model's emphasis on discovery (Hasibuan et al., 2019).

The inquiry learning model is one of the learning models with a scientific approach to the learning process. This model has many advantages in its application but also has weaknesses and difficulties encountered in classroom learning, such as (1) the teacher's initial material before starting the experiment takes quite a lot of time, so the time used for the experiment is limited. (2) Students do not have a basic concept of the material to be taught by the teacher, so they do not dare to argue, and students do not have initial readiness before learning in class, so students will have difficulty making statements in arguing (3) the limited time students have for learning so that the teacher must teach the material at that hour cannot be carried out so that the range of material to be taught cannot be entirely taught, because, (4) students are only fixated on the material and books taught by the teacher. The weaknesses of this learning model can be minimized by increasing the ability of chemical argumentation as a more effective learning objective. They can increase students' self-confidence in arguing during the learning process by designing procedures for the inquiry learning model combined with the flipped classroom learning model.

The flipped classroom model encompasses interactive tasks, such as problem-solving assignments, which are intended to be performed during class time. This approach emphasises the collaborative efforts of both instructors and fellow students in facilitating the learning process. As a result, students are encouraged to take a more proactive role in their educational endeavours (Bates et al., 2017). Damayanti and Sutama (2016) propose that the flipped classroom learning model involves a reversal or swap of the traditional approach to learning, where activities often conducted in class are instead assigned as homework. In the past, students would attend class to get instruction from the teacher, thereafter engaging in independent practise of assigned questions outside of the classroom setting. Utilising this pedagogical approach, students engage in pre-class reading of instructional materials, afterwards convening in the classroom to actively participate in collaborative discussions, knowledge sharing, and problem-solving activities facilitated by both peers and instructors. The flipped classroom learning paradigm entails the distribution of assignments or homework by the instructor, wherein students are expected to independently engage with the subject matter through digital media, such as videos or e-books, supplemented with task instructions or practise problems. The learning paradigm referred to as student-centred has the potential to enhance learning effectiveness through the use of discussion content. Historically, educators commonly employed the lecture-based instructional approach, characterised by its teacher-centric nature.

Tiaradipa et al.'s (2020) study, Development of Scaffolding on Inquiry Models in Improving Science Process Skills for Acid and Base Solution Materials: Based on Expert Judgements, Practitioner Experience, and Student Responses to an Eligibility Assessment, can inform how learning models are incorporated into assessments of merchant viability. Wulandari (2015) A new learning model, IL-2TS, was developed by combining the syntax of the inquiry laboratory learning model with the two stays two stray learning model on excretory material. This model has been successfully implemented in classroom settings. Methods for creating inquiry-based, flipped classroom models to train better argumentation are the topic of this study.

2. METHODS

The research procedure for developing the learning design model developed by Lee., J.L., and Jang, S in Rusdi (2018) development procedure in this study uses the type of F2-O1+O2-S1+S5+S6-A3. This type of approach enables the development of a procedural instructional design model through the utilisation of a hybrid methodology. Furthermore, it has the capability to ascertain the origins of data from a theoretical perspective, followed by a practical approach, by incorporating the insights of experts and practitioners alongside heuristic design patterns. The theoretical processes encompass the identification of data sources, the acquisition of data, and the analysis of data. Conversely, the practical steps involve the generation of model ideas, the description of models, the validation of concepts and practitioners, and the provision of recommendations for model testing. The act of communication or correspondence is iterated, typically occurring in multiple iterations or rounds. During each iteration, the researcher has the opportunity to pose a variety of inquiries in order to enhance the comprehensive advancement of the many facets.

The validation process consisted of two distinct steps, specifically concept validation and practitioner validation. The process of concept validation involved the participation of two experts, specifically those with expertise in scaffolding design and learning. These experts conducted a conceptual evaluation to assess the practicality of the product. The practicality of the product was assessed by practitioner validation, which involved three educators conducting procedural testing. The data collecting instrument employed in this study consisted of an interview guide, sometimes referred to as an interview protocol, which utilised the Delphi approach as the data collection method. The interview instrument was developed in accordance with the guidelines set out by the National Education Standards Agency, the Kemp learning design model, and the Rustic product validation requirements. The study was carried out on a limited scale inside senior high schools to examine the effectiveness of an inquiry-flipped classroom approach in enhancing argumentation skills. The data collected can be classified as qualitative as it is derived from the perspectives and insights of experts and practitioners. In addition, the data were subjected to analysis using the modified spiral model, which is commonly employed in design and development research.

3. FINDINGS AND DISCUSSION

The steps for developing the inquiry-flipped classroom model are explained as follows:

3.1 Determining the Data Source

The initial step in ascertaining the data source involves establishing the prioritisation of the theory-driven approach above the practice-driven method. The identification of data sources involves the identification of data sources acquired from pertinent literature studies, books, and research journals in order to substantiate the formulation of processes for the Inquiry Flipped Classroom instructional approach. The essential data encompasses several elements such as curriculum, learning theory, inquiry learning models, argumentation abilities, and material qualities that have an impact on reaction rates and practical procedures.

3.1.1 Collecting data

The data collection stage is carried out by reviewing literature from books, journals, articles, and other relevant sources related to the development of the Inquiry-Flipped classroom learning model procedure.

3.1.2 Analysing data

The data analysis phase involves integrating the acquired data and afterwards examining it in order to establish connections between each strategy, as per the information required for the development of the syntax of the inquiry-flipped classroom learning model. The data analysis yielded findings that establish a correlation between the syntax utilised in the inquiry-flipped classroom and the development of argumentation skills.

3.2 Generating ideas

The search for integration patterns is a crucial stage in the process of generating ideas from collected data, which are subsequently translated into the syntax of the inquiry-flipped classroom learning model. These ideas are then transformed into tangible products that may be effectively utilised within the learning process. The integration of product creation into the learning process can be facilitated through the utilisation of algorithmic flow and student worksheets as instructional tools. The first step in the process of product development involves investigating the feasibility of integrating the Inquiry learning model and the Flipped Classroom learning model. This is achieved by identifying patterns of integration from collected data and subsequently converting them into a customised procedural learning compiler that takes into account the specific strengths and weaknesses of both the Inquiry and Flipped Classroom learning models. The developed learning paradigm aims to enhance students' capacity for argumentation. According to Toulmin's Argumentation Pattern (TPA), a chemical argumentation comprises several key elements, including claims, facts (evidence), reasons (warrants), assumptions (backing), limitations (qualifiers), and disclaimers. Subsequently, the development process persisted by encompassing the production of other items, specifically the creation of algorithms and educational materials in the form of student worksheets.

The flow of the inquiry-flipped classroom learning model syntax algorithm is made based on each syntax student's goals. The syntax flow of the inquiry-flipped classroom model is also explained in each syntax decision educators must make before finally entering the following syntax. Decision-making by educators is in the form of "yes" or "no" choices. The algorithm flow of the inquiry-flipped classroom model developed was modified from the Goldilocks assistance workflow (Yuriev et al., 2017).

LKPD in the form of procedures for implementing practical factors that affect the reaction rate and equipped with the material. With the aim that students have an overview of the material to be studied, making it easier for students to find relevant additional material. In the final stage, LKPD is also equipped with an evaluation using questions to test students' understanding after the learning process at school.

3.3 Describing the model

The stage of describing this model is done by creating a syntax design for the inquiry-flipped classroom and student worksheets with a pattern that has been designed. The syntax design of the inquiry-flipped classroom and student worksheets is the initial product of the development of the inquiry-flipped classroom model. Furthermore, the syntax of the inquiry-flipped classroom model is made in the form of an algorithmic flowchart with the activities and decisions of educators in each syntax. Two colors distinguish each syntax of the inquiry-flipped classroom to make it easier for educators to understand the syntax of the model which is done at home online and in offline class.

The next step at this stage is the creation of student worksheets. LKPD is designed using the Canva application. Part of the LKPD consists of cover, instructions, core competencies, basic competencies, indicators, objectives, concept maps, reaction rate material, inquiry-flipped classroom syntax activities using practicum methods, and evaluation using questions. The material on the LKPD provides an overview to students in finding references related to the material (Pratama & Saregar, 2019). The material contains the notion of reaction rate and the factors that affect the rate of reaction; catalyst, temperature, surface area, and concentration. Each discussion on the material is equipped with pictures, graphics, or illustrations that can support the explanation of the material, it is intended that students can be interested and more easily understand the concept of the material. The next stage after the product has been made is to validate the feasibility and usability. Validation of the feasibility is carried out by a team of experts while the applicability is to practitioners.

3.4 Doing Concept Validation

Concept validation aims to assess the product's feasibility theoretically and is carried out by two learning model design experts and one material and media expert. Validation data were obtained using interview sheets on each aspect of the feasibility assessment. The validation of the inquiry-flipped classroom design model was carried out by two learning design experts who are a master of learning technology lecturer and a PGSD master lecturer who already has some published journals related to the development of learning models so that the appointment of experts can be competent in their fields. Validation of the learning model design by providing a summary of the design that has been carried out, which contains rational development, inquiry model, flipped classroom model, development procedure design, learning design, model design, implementation design, and lesson plans. Based on expert judgment using the criteria for the inquiry-flipped classroom learning model "quite valid"(Pratama, A., 2018).

3.5 Doing Practitioner Validation

Practitioner validation on the flow of the inquiry-flipped classroom model was carried out on 3 chemistry teacher educators from SMA Negeri 1 Batanghari. This practitioner validation aims to determine the effectiveness of using the syntax of the inquiry-flipped classroom learning model in the actual learning process. This practitioner validation also aims to ensure that there are no more significant deficiencies in the flow of the inquiry learning model that has been validated by experts and is very suitable for use by educators in learning to improve argumentation skills on the material. Factors that affect reaction rates. This practitioner validation is done by asking for a response from the teacher using an interview sheet on the inquiry-flipped classroom model.

Figure 1 . Documentation of the Use of the inquiry-flipped classroom model.

3.6 Recommended Procedure

Every product resulting from development has provisions for its use. Likewise, the products resulting from this research and development. The resulting product in the form of an inquiry-flipped classroom and LKPD learning model syntax also has special provisions so that its use is effective in the learning process, including the following:

a) The inquiry-flipped classroom learning model is suitable to be applied to theoretical and practical chemistry. This learning model is not suitable for use in complex arithmetic materials.
b) Using facilities such as electronic media (smartphones) and internet access networks that can access material or videos sent by the teacher to be studied by students at home.
c) Not all school environments can apply this learning model because to study at home, students need media such as smartphones and good internet access networks so that students can access material or videos provided by the teacher.

d) Teachers who can apply media and applications such as google classroom that can support the online learning process.

4. CONCLUSION

This research has produced a product in the form of learning model syntax and LKPD. Based on the results of the research and discussion, it can be concluded that the syntax of the inquiry-flipped classroom and LKPD learning model was developed using a procedural model from Lee., J.L., and Jang, S which was modified as needed with the stages of determining data sources, collecting data, analyzing data, and generating data. Model ideas, describe models, validate concepts and practitioners as well as provide recommendations for testing procedures. The Inquiry-Flipped Classroom Learning Model can improve argumentation skills based on experts and practitioners before the implementation of level 1 was 66%, level 2 was 25%, and level 3 was 8 After the application of the inquiry-flipped classroom learning model, students' argumentation skills increased with percentages of 8% in level 1, 25% in level 2, 42% in level 3, and 25% in level 4. This research was carried out only in small groups with the theoretical validation of 2 people and the practical validation of 3 teachers, which was intended to improve argumentation skills. It is hoped that further research will apply the flipped classroom inquiry learning model with different variables and validate both theoretical and practice validators so that the data obtained is more concrete and many suggestions are obtained for improving each syntax.

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