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Profile of the Implementation of Guided Inquiry-Based Interactive E-Module in Science Learning

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ABSTRACT

Research was conducted to describe and analyze the implementation of guided inquiry model of science learning in Indonesia. This research method uses qualitative methods with using secondary data. The sample in this research is 24 articles published in international and national journals. Based on the analysis of 24 articles on science learning using Interactive E-module with guided inquiry model in Indonesia, it can be seen that the guided inquiry model has a positive impact on student learning outcomes, it can improve students' critical thinking skills, students' science process skills, students' scientific literacy, aspects of problem solving skills, and also students' understanding of concepts. Based on that articles published exactly optimal it able combine with media or other methods example for interactive e-module, students won't be confused if they get the instruction from the teacher, and it require a lot of preparation and learning duration. Based on a literature review on the implementation of guided inquiry-based modules in 2016-2022 that has been implemented, it can be concluded that the guided inquiry model has a positive impact on science learning. Therefore, now researchers developed an interactive e-module based on guided inquiry in science learning to improve science process skills.

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INTRODUCTION

21st century learning includes learning that uses a renewable approach by positioning digital technology as one of the main indicators. Apart from focusing on digital technology, 21st century learning also emphasizes the development of skills and knowledge that are relevant to the real world and places students as active and communicative learners. In an effort to achieve maximum educational development targets in the 21st century, every individual must have at least four main skills, namely the ability to think critically, creatively, communicate, and collaborate. 4C competence has an important role for each individual in the current era. Among them are the skills of analyzing, evaluating, and interpreting information to make decisions, which is one of the characteristics of critical students. Through critical thinking, students will identify and manage emotions in their thinking processes. Students who think critically will be able to explore different perspectives, so that they can solve a problem by looking for evidence to support or reject an opinion (Markawi, 2018)

In reality based on the results of an interview with a science teacher at SMP Raudlatul Jannah Sidoarjo, it was found that the learning being carried out included making students actively involved, but it still needed to be developed due to the impact of the Covid-19 pandemic. The learning carried out by the teacher provides information through printed handouts and discussions. Students are still lacking in activities to find information on their own or determine

initial knowledge used in learning more complex material, causing this knowledge to be less meaningful in everyday life. The teacher also explained that in science learning there had never been any activities in the laboratory or only small practicums in class. Data on the learning outcomes of class VIII students on the material of heat and displacement shows that the scores obtained by students are quite low. According to the science teacher, one of the obstacles that causes low student learning outcomes is due to students' lack of understanding of concepts and activeness when the learning process is still low.

In line with the results of research regarding the analysis of science process skills of Indonesian students with other countries have 89% of the Program for International Student Assessment (PISA) questions about observing, predicting, applying concepts, and communicating (Ramadhan & Wasis, 2013). The facts obtained show that Indonesia's score in the science performance category held by PISA in 2018 has an average score of 396 with a rating of 9 from the bottom (71). It is above Saudi Arabia, which has an average score of 386, while first place is occupied by China with an average score of 590. This suggests that students' science process skills still need to be improved in learning science.

Based on the facts at school and the results of PISA it can be proven that the educational process is still far from the expectations of education in the 21st century by having 4C competencies. Where one of them is by mastering problem solving skills, students need science process skills as a procedure used to find and process information. Science process skills are divided into two, namely basic process skills and integrated process skills. Basic process skills include observing, classifying, interpreting, predicting, and communicating. Whereas integrated process skills include formulating problems, making hypotheses, planning experiments, using tools/materials, and applying concepts (Antrakusuma et al., 2017).

Rahayu et al. (2018) explained that one of the efforts needed by teachers is to carry out the learning process well, such as preparing teaching materials and developing effective learning models in class. A good learning process requires the right learning tools, such as interactive modules. A learning process that is able to foster students' curiosity about learning topics, motivates students to understand science concepts, and makes students able to prove existing concepts by investigating them so that existing concepts are not easily lost from their memory, understanding concepts will become more meaningful. This is in line with the research of Khairi and Ikhsan (2022) which concluded that guided inquiry-based electronic modules are feasible, practical, and effective for use in learning. The feasibility of the validation results from expert judgment shows that the product is feasible to use in learning, and practicality is included in the very good category. The product proved to be effective because the percentage of test results in the experimental class exceeded that of the control class, namely 66.5727 and 63.0557 respectively.

According to Sanjaya (2014) a learning model that emphasizes students in the process of seeking and finding answers to problems formulated is suitable using the guided inquiry learning model. Arantika et al. (2019) in a journal entitled effectiveness of guided inquiry-based modules to improve science process skills states that implementing guided inquiry-based modules has proven to be effective in influencing students' science process skills improvement. Therefore, researchers want to conduct a literature study on understanding concepts that influence science process skills on learning outcomes by developing guided inquiry-based science learning media that is interactive electronic modules.

RESEARCH METHOD

General Background

This research is an activity of collecting, processing, analyzing and presenting data systematically and objectively, to solve problems or test hypotheses. Research is also interpreted as an effort to find information to solve a problem with the scientific method (Mukhid, 2021).

This research uses a meta-analysis method with a literature reviews. This research is descriptive qualitative, this method is applied to describe how the implementation of the guided inquiry model in science learning in 2016-2022.

Instrument and Procedures

This study uses the Library Research approach. The study of documents or texts is a method of collecting data by understanding and studying theories from various literature related to this research (Sugiarto, 2015). In this study, data were collected from relevant research, such as the guided inquiry model and the use of interactive e-modules in science learning in Indonesia from various articles that support this research problem. The purpose of using this literature study method is to gain new knowledge that can be accepted and analyzed in more depth by researchers to explain the Guided Inquiry Model Sustainability Profile in Science Learning in Indonesia in 2016-2022.



Figure 1. The flowchart of research profile of the implementation of the guided inquiry model in science subjects in Indonesia.

Data Analysis

Analysis of qualitative descriptive data in this study used secondary data analysis which is a process of analyzing existing data without the need to conduct interviews, surveys, observations and certain other data collection techniques. Secondary data analysis is a research strategy that utilizes existing qualitative data to find new problems or test existing research results. (Heaton, 2008). In essence, this research uses data sources from various existing scientific works and is related to research discussions which are re-analyzed to solve the problems studied with data sources.

RESULTS AND DISCUSSION

Previous research by Bestari et al. (2022) obtained data on an average increase in science process skills and learning outcomes of students who were taught using the KPS-based LKPD were 0.106 and 0.215 and there were significant differences in the science process skills and learning outcomes of students before and after implementing the KPS-based students' worksheet. The result of this research is the guided inquiry learning model as a teaching approach in which the teacher gives students examples of specific topics and guides students to understand the topic. At this stage in the learning process students get guidance from the teacher to get answers to a problem. The inquiry learning model involves students in the learning process to try to find concepts or understanding on the topic given by the teacher. The inquiry learning model can accommodate students in practicing science process skills through their learning stages (Iswatun et al., 2017).

Guided Inquiry is a teaching approach in which the teacher gives students examples of specific topics and guides students to understand the topic. In addition, guided inquiry learning creates high effectiveness and time efficiency in teaching because learning is student-centered and the teacher's role is only limited to that of a facilitator and guide or mentor of students. Therefore, follow-up efforts are needed so that learning objectives can be achieved optimally. One such effort is the use of an appropriate learning strategy. Learning strategies that can improve science process skills and learning outcomes are guided inquiry learning strategies combined with e-modules not students' worksheet again.

Table 1. Literature study on the science studying implementation with Interactive E-Module based on Guided Inquiry Model in Indonesia in 2016-2022.

Authors (Years)	Sample Characteristics	Research Design	The Finding
(Endang Listiani et al., 2016)	The research samples were class X MIA 2 (experimental class) and class X MIA 4 (control class) in the academic year 2015/2016.	• The research method is Quasy Experimental Design. • The research design is nonequivalent control group. • Using guided inquiry model.	• The average KPS results of students who were taught using guided inquiry learning were higher than those who were taught using other learning models. • There is a significant difference between the results of students' science process skills taught using the guided inquiry model and not.
(Siti Mayang Mangurai, 2017)	The research subjects were students of class XI IPA Christian High School 1 Salatiga.	• The type of research used is classroom action research. • The research technique is data triangulation. • Using guided inquiry model and performance assessment.	• The results of the student's science process skills experienced an increase in each cycle. • Guided inquiry model able able to make students to play an active role in all learning activities and practicum.
(Jumadi et al., 2018)	The research subjects were students of class VII junior high school.	• The research method is Research and Development (R&D). • Using science module based on science process skills to improve critical thinking skills.	• Learning modules based on science process skills are effectively used to improve student's cognitive learning outcomes.
(Sri Mulyana et al., 2018)	The research subjects were 60 students of XI IPA 1 and 2 of SMAN 10 Pandeglang.	• The data were analyzed by two tailed Anova test. • The research method is quasi experiment. • Using guided inquiry learning model.	• There is significant influence of guided inquiry learning to the student learning result
(Ardiyana Pratono et al., 2018)	The samples are two classes using cluster random sampling technique for normally distributed populations and homogeneous in SMA Institut Indonesia.	• The type of research is conducted experimental research. • The study design used is modified comparison group pretest-posttest design. • Using guided inquiry e-module to know the science process skills of students.	• The application of guided inquiry assisted e-module contributes to improving student's science process skills.
(Arinta Rezti W et al., 2018)	The research subjects were 15 students of state senior high	• The research design is one group pretest-posttest.	• The guided inquiry model have a positive effect on training student's science process skills.

Authors (Years)	Sample Characteristics	Research Design	The Finding
	school 1 of Pasuruan (SMAN 1 Pasuruan).	• The data were analyzed using Anova, N-gain, and the paired t-test.	• The Guided-Inquiry Model to train science process skill which was developed is effective.
Nadziroh Af'idayani et al., 2018)	The sample of the research class of 25 students consisted 14 men and 11 women & the control class was 25 students consisted of 12 men and 13 woman.	• The research method is quantitative analysis. • The research design is pretest-posttest control group. • Using inquiry learning model.	• The result showed that the inquiry model had a significant impact on the skills of the science process and the learning outcomes of the learners.
(Joko Kuswanto, 2019)	The research subjects were 34 students of class VIII junior high school.	• The research method is research & development with stages of designing, production, evaluation, and analyzing data by percentage. • Using module interactive in scince learning.	• Learning media in the form of interactive modules that have been developed have several advantages, namely the presentation of material on media that is developed according to competence, this media is easily understood by users and is able to foster learning motivation for users.
(J. Arantika et al., 2019)	The research subjects were high school category as many as 63 students class XI is devided into 31 students in the experimental class and 32 in the control class.	• The research method used is the quantitative method. • Data were collected through the test. • Using guided inquiry based science learning.	• The application of guided inquiry based modules effectively provides an influence in developing student's science process skills. • The effectiveness of the application of the module in learning is also reviewed from the n-gain and te ercentage of achievement of the experimental science process skill indicator is greater than the control class.
(Artha et al., 2019)	The research subjects was a student of physics education amounted to 65 people, who were divided into 2 groups at random to obtain grade 35 students to 30 students to experiment and control class.	• The research used a quantitative approuch with experimental research methods. • The research design there are 2 groups of experimental and control groups. • Assessment instruments used were observation sheet science process skills.	• The result score of science process skills of students in the experimental class are higher than control class. • Students as expected have a media that e-module can train their science process skills anytime, and anywhere.
(Aziza Putri N et al., 2020)	The samples taken in this research were all physics education students who contracted two basic	• This research uses a quantitative approach with descriptive methods.	• Using the Guidebook for Basic Physics II practicum in the form of e-modules can improve students' science process skills.

Authors (Years)	Sample Characteristics	Research Design	The Finding
	physics subjects as many as 40 people.	• The instrument used in this research was the science process skill observation sheet which had been validated by an expert validator.	• The science process skills focused in this research are basic process skills which include predictions and conclusions. • The science process skills of students of physics education at the University of Jambi on refraction practicum material on convex lenses can be said to be quite skilled or good.
(Zinnurain, 2021)	The subjects in this study were 30 students of the FIPP UNDIKMA educational technology study program in semester III.	• This research was conducted for 1 semester, namely September 2020-January 2021. • This research is a Research and Development (R&D) using the Borg and Gall development model. • The e-module validity test was carried out by material experts, design experts, and media experts.	• The interactive learning e-module based on Flip PDF Corporate Edition has been effectively used to improve student learning outcomes in the learning process. • The interactive learning e-module based on Flip PDF Corporate Edition is more efficient, where the posttest scores are higher than the pretest.
(Risa Cornelia et al., 2022)	The research subjects were 30 students of grade eight junior high school at SMP Gresik Indonesia. That consist of 15 males and 15 females.	• The research design used is pre-experimental with one group without any comparison group. • The research instrument used are test, observation, and survey methods. • The results of the test are analyzed using the N-gain calculation . • Using science e-module based on guided inquiry.	• The significant increase in the science process skill of eight grade students junior high school in Gresik after the implementation of a guided inquiry based science electronic module with a flipped classroom strategy on vibration material. • The implementation a science e-module based on guided inquiry can effectively improve junior high school student's science process skills. • The students feel motivated and do not feel burdened by the existence of the electronic science module, and the learning model applied.
(Aprina Defianti et al., 2022)	The research subjects were 20 students who took the basic physics practicum course.	• The type of a research and development method is ADDIE model (Analyze, Design, Develop, Implement, and Evaluate). • The research instrument used an	• E-Module guidelines on basic physics practicum using the SIGIL application to practice student's science process skills during the Covid-19 has resulted considered very good. • The acquisition of process skills scores students in the skilled

Authors (Years)	Sample Characteristics	Research Design	The Finding
		expert judgment sheet, a science process skills test, and a student response questionnaire. • Using the SIGIL application for development stage the e-module.	category, and the response in very good. • The basic physics practicum guidelines using the SIGIL application is appropriate for practicing student's science process skills during pandemic.
(Siti Ulfayantik et al., 2022)	The research subjects were students of grades IV-A and IV-B, 25 students each at Elementary School Baratajaya Surabaya.	• The research used a One Group pretest-posttest design. • The development of the research used Thiagarajan's 4D model. • Using Microsoft Office 365 guided inquiry learning tool to practice student's science process skills.	• The Online learning devices in science subjects using the Microsoft Office 365 assisted inquiry learning model are feasible to improve students' science process skills on the materials themed ligt properties. • Students responses after participants in the learning of guided inquiry assisted by Microsoft Office 365 was 88,89% with an excellent category. Students response results are positive.
(Suantara et al., 2022)	The research subjects was the fifth grades from SD Negeri 1 Baler Bale Agung, totaling 27 students and 26 students from SD Negeri 3 Baler Bale Agung.	• The research used a quantitative research design. • Type of reseacrh is a quasi-experimental that has a control group. • The research design used was the pretest-posttest nonequivalent control group design.	• The result showed that the guided inquiry model with the think pair share approach could increase conceptual understanding with an average pretest score of 54.55 increasing to 85.19. • The effectiveness of this learning model is marked by the achievement of 3 indicators, namely mastery which exceeds 75%, the average value of process skills and understanding of concepts exceeds the control class and the value increases significantly.
(Putra et al., 2016)	The research subjects were 35 learners of PGMI (MI Teacher Education) 3rd semester who took science subject in the academic year of 2015/2016.	• The research was used one group pretest-posttest design. • The data collection using observation, testing, and questionnaires. • Using guided inquiry model science learning materials.	• The guided inquiry science learning materials were valid, practical, and effective to enhance science literacy skills.
(Kurniawati, 2021)	The research subjects were 31 students of SMP Negeri 1 Teluk	• The type of research is classroom action research.	• The application of the guided inquiry learning model can improve students' science process skills.

Authors (Years)	Sample Characteristics	Research Design	The Finding
	Kuantan with 13 man and 18 woman.	• The material studied in this research is science objects and their observation. • The instrument used in this research were observation sheets of student activity and questionnaires. • Using guided inquiry model.	• Student responses to learning were positive because the majority agreed with the application of learning using student worksheets.
(Dijaya et al., 2018)	The research subjects were students of SMA Negeri 10 Bandung class X IPA-IV.	• The method used in this study was classroom action research which previously identified problems experienced by chemistry teachers. • The instruments used in this research are learning descriptions, student worksheets, teacher and student observation sheets, and process skills tests science. • Using guided inquiry model.	• Student activity in the application of guided inquiry learning to the concept of electrolyte and non-electrolyte solutions has increased. • Students' science process skills after guided inquiry learning increase in each cycle.
(Suwardani et al., 2021)	Research articles showing an increase in the value of students' science process skills using the guided inquiry learning model in science subjects in junior high schools.	• The method used in this study is library research (literature review), namely by reviewing some of the literature that is relevant to the problem to be studied to be analyzed and conclusions drawn. • The method used for literature study is analysis of several sources in the form of national research journals.	• The guided inquiry learning model is effective for improving KPS in science subjects in junior high schools in the moderate category. • The guided inquiry learning model is effective especially when used to improve junior high school students' science process skills in the aspect of observing or making observations.
(Rafiah et al., 2018)	The research subjects were 20 students of class VIII A SMP Muhammadiyah 1 Banjarmasin.	• This type of research is classroom action research. • Data collection techniques in this study include results tests study learning outcomes, observation sheets of students' science process skills, and instrument sheets	• Science process skills and learning outcomes of class VIII A SMP Muhammadiyah 1 Banjarmasin are improved through the application of the guided inquiry learning model.

Authors (Years)	Sample Characteristics	Research Design	The Finding
		for science process skills.	
(Saidaturrahmi et al., 2019)	The research subjects were students of class XI IPA 3 and XI IPA 4 selected using purposive sampling technique.	• The research design used in the form of pretest posttest, control group design. • Using guided inquiry model.	• The average value of students' science process skills using guided inquiry-based student worksheets on salt hydrolysis material is classified as very good, namely 86%. • The developed guided inquiry-based student worksheets can improve students' process skills on salt hydrolysis material.
(Aulia and Andromeda, 2019)	The research subjects were 25 students of class X IPA 1 in SMAN 4 Pariaman.	• The research use research and development (RnD) and use a 4D model. • Using guided inquiry model and virtual laboratory.	• Guided inquiry-based e-module integrated multi-representation and virtual laboratory on electrolyte and non-electrolyte solution material for class X SMA/MA. • E-module based on guided inquiry integrated multi-representation and the resulting virtual laboratory has a level of validity and practicality very high.
(Nawfa et al., 2022)	The research subjects were students of class VII-A, Class VII-B, and class VII-C State Junior High School 1 Pamekasan.	• The type of research used is development research. • The learning tools developed are syllabus, learning implementation plans, student worksheets, student books and science process skills tests. • Data collection techniques in this research are observation, testing, and documentation.	• The feasibility of student worksheets based on the aspect of validity for practicing science process skills developed has valid and very valid criteria. • The students' science process skills before and after guided inquiry learning on environmental pollution material experienced differences, namely an increase. • Student responses to guided inquiry-based student worksheet learning on environmental pollution material that had been developed received a positive response in the very good category.

Characteristics of the Guided Inquiry Model

The guided inquiry learning model is a learning model that emphasizes students in the process of seeking and finding answers to the formulated problems, while the teacher acts as a facilitator and mentor for students to actively learn (Sanjaya, 2014). The guided inquiry learning model provides opportunities for students to learn how to find facts, concepts and principles through direct experience. Therefore, students do not only learn by reading and memorizing subjects, but also get the opportunity to practice developing the ability to think and act scientifically, and it is

possible to have a good knowledge construction process, so that students can improve their abilities and understand the material being studied. studied (Ibrahim, 2014).

The characteristics of guided inquiry model are: (1) Students develop thinking skills through specific observations to make inferences or generalizations, (2) Students learn the process of observing events or object then composes the appropriate generalization, (3) Teacher controls certain parts of learning such as events, data, materials and acts as a class leader, (4) Each student tries to build a meaningful pattern based on the results of observations in class, (5) Usually a certain number of generalizations will be obtained from students, and (6) Teacher motivates all students to communicate the results of their generalizations so that they can be utilized by all students in the class. It means that teacher-centered learning must be transformed into learner-centered learning. It showed the vision of 21st century education are: (1) learning for thinking is oriented to logical and rational knowledge, (2) Learning is oriented to problem solving, (3) Independent learning is oriented to character building, and (4) Learning to live together is oriented to tolerance and ready to work together (Winarni et al., 2020).

Student-centered learning and fun learning using the guided inquiry learning model. In this guided inquiry learning model the syntax is: (1) problem formulation, (2) formulate hypotheses, (3) design hypotheses, (4) conduct experiments to obtain data, (5) collect data and analyze it, and (6) make conclusions.

Advantages of the Guided Inquiry Model

Guided inquiry is a type of inquiry that focuses on planning and guidance starting from the teacher to improving students' skills to apply them in life. The advantage of the guided inquiry model is that the teacher does not just let go of the activities carried out by students, so that students who think slowly or students who have low intelligence are still able to follow the activities that are being carried out.

Not much different from other learning models, the guided inquiry learning model also has advantages when applied. The advantages of the guided inquiry learning model are as follows (Hamruni, 2012): (1) Helping students to develop mastery of skills and cognitive processes so that learning becomes more meaningful, (2) Provide opportunities for students to learn material according to their character or learning style, (3) Learner-centered learning, so as to increase their enthusiasm for learning, and (4) Increasing student self-confidence through a learning process that leads to changes in behavior through experience.

CONCLUSION

Based on a literature review on the implementation of the guided inquiry learning model in 2016-2022 that has been implemented, it can be concluded that the guided inquiry learning model has a positive impact on science learning. The application of the guided inquiry learning model can improve students' critical thinking skills, improve students' science process skills, increase students' scientific literacy, improve aspects of problem solving skills, improve students' conceptual understanding, and improve student learning outcomes.

Likewise with other learning models, the guided inquiry model also has advantages. But it is also necessary to have a more optimal impact then assisted by media or other methods. Because students will be confused if there is no instruction from the teacher, and requires a lot of preparation, and requires study time. The limitation of this research is that it is limited to 15 journal articles analyzed. In addition, this research does not focus on one thing of discussion, but various variables. Such as learning media, learning models, and levels of education observed. Recommendations for further research are the quantity and quality of the journals analyzed need to be increased.

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