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Improving Science Literacy Using a Guided Inquiry Learning Model Assisted by Interactive Modules on Elattice Materials

Halimah Al Hasanah[1,2] , **Fakhira Nursabrina**[1] **dan I Made Astra**[1]
[1]Program Studi Magister Pendidikan Fisika, FMIPA, Universitas Negeri Jakarta, Jl. Rawamangun Muka, No. 11 Kota Jakarta Timur, DKI Jakarta 13220.

[2]E-mail: halimahalhasanah@gmail.com

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Abstract. This research aims to improve literacy using a guided inquiry learning model assisted by interactive modules on elasticity materials. The study was carried out for three learning sessions, each carrying out a comprehensive cycle consisting of observation, reflection, design, and treatment. Data collection was carried out using evaluation instruments in the form of tests and questionnaires at the end of each cycle before the next cycle was carried out. The test instruments used contain indicators of aspects of science content, aspects of science context, and aspects of science processes. The results of the study were obtained in the third cycle with the highest increase in each science literacy indicator with a science content indicator of 69.7%, a science context indicator of 68.7%, and a science process indicator of 74.3%. Therefore, it can be concluded that the improvement of science literacy using a guided inquiry learning model assisted by interactive modules on elasticity materials results in an increase in a good category.

Keywords: guided inquiry learning model, interactive module, scientific literacy

1. Introduction

The development of Science and Technology has contributed to the world of education, especially physics education as part of education, in general, has a role in improving the quality of education, especially in producing quality Indonesia people [1]. Science literacy skills include the field of Natural Sciences (IPA), one of which is physics, which has an important role in the development of science and technology. The development of student's abilities in the field of physics is one of the keys to the success of improving their ability to adapt to the world of technology [2]. The guided inquiry learning model provides opportunities for students to actively participate in the learning process by carrying out investigations and solving problems independently, but teachers guide students to make it easier to master lesson concepts [3].

Based on PISA 2018 using reading as the main subject in the assessment, Indonesia gave unsatisfactory results in the PISA Assessment of Reading Ability ranked from the bottom with 79 participating countries [4]. Science literacy is the ability to engage with issues related to science and with scientific ideas, as a picture of society [5]. Science literacy can be defined as the ability to use scientific knowledge, identify questions, and draw conclusions based on evidence, to understand and make decisions about nature and changes made to nature through an activity [6]. There are three aspects of science literacy competencies carried out by PISA 2015 as shown in Figure 1 [5].

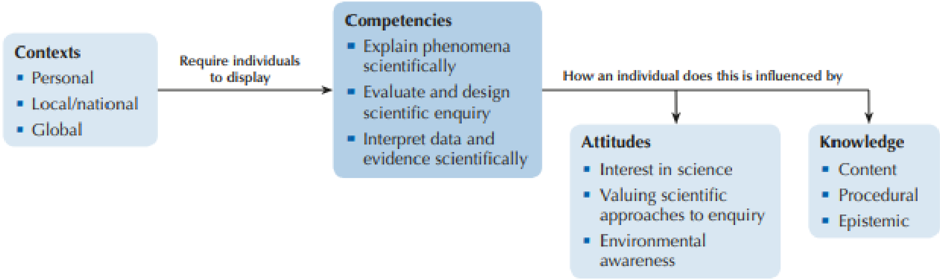

Figure 1. Science Literacy Competencies

Based on the low science literacy ability in Indonesia, some further research is needed related to changes in learning models, assessment instruments, and more advanced learning innovations. This situation is caused by the lack of student exposure to science questions such as PISA, the lack of development of science literacy teaching materials that utilize technology, and the low interest of students in reading [7]. Another cause of the low science literacy ability in Indonesia is the conventional learning model, so students are often asked to listen and work, as well as collect their work within the specified time [8].

Therefore, to fulfill several competencies of science literacy, one of which is in the aspect of context and knowledge, a learning model with high-level thinking skills is needed that requires reasoning, argumentation, and creativity of students in solving it [9].

Several types of learning models can be adjusted based on the needs, characteristics of students, and school conditions, as well as other supporting factors. One of the appropriate learning models to overcome the challenges that occur today is the guided inquiry learning model [10]. Guided inquiry-based physics learning models can provide problem-based learning models and train students in problem-solving [11]. The guided inquiry-based learning model has seven main components, namely, constructivism, inquiry, questioning, learning society, modeling, reflection, and actual assessment [12]. Based on previous research, the Inquiry learning model, various approaches can be used to help students understand the subject matter. This approach can be in the form of discussions in small groups to integrated learning. This method is more effective than just asking students to memorize material and facts. With this approach, learners can build their knowledge through the exploration of ideas, discussions with friends, and hands-on experience [13].

Interactive learning media is one of the important media in learning, functioning as an intermediary used by teachers to obtain information and encourage communication between students in the learning process. This media can be heard with feedback so that it can arouse the spirit of independence and reduce differences in understanding [14]. The modification of the guided inquiry learning model assisted by interactive modules is also a newness in physics learning in schools. Interactive modules can be designed systematically and attractively to achieve competencies that are by learning objectives [15].

Based on observations and interviews that have been conducted at SMAN 6 Tangerang Regency, science literacy in elasticity material in grade 11 is still in the poor category. According to observation data that has been carried out, the learning model used at SMAN 6 Tangerang Regency is still conservative, so the science literacy possessed by students is still insufficient. From some of the problems above, a study was conducted to improve literacy using a guided inquiry learning model assisted by interactive modules on elasticity materials.

2. Method

The research method used is Classroom Action Research (PTK). PTK is a research that aims to solve problems found by teachers in the classroom to improve the quality of learning. This research was carried out at SMAN 6 Tangerang Regency with 39 research subjects for grade XI Science 3 students for the 2023/2024 school year. The number of students in the class is 39 people, 22 women and 17 boys. Data collection occurred in the fifth week of May 2024 to the first week of June 2024.

This study uses classroom action research and is divided into three cycles, namely: (a) A pilot study using interviews and observations with students and teachers to identify problems that need to be addressed with action research, (b) using innovative action planning techniques to influence the teaching and learning process of students and (c) Supporting teaching with collaborative clinical supervision, making classroom teachers and students innovative [16]. The research design was designed with the approach of the classroom action research model by Kurt Lewin in Figure 2 [17].

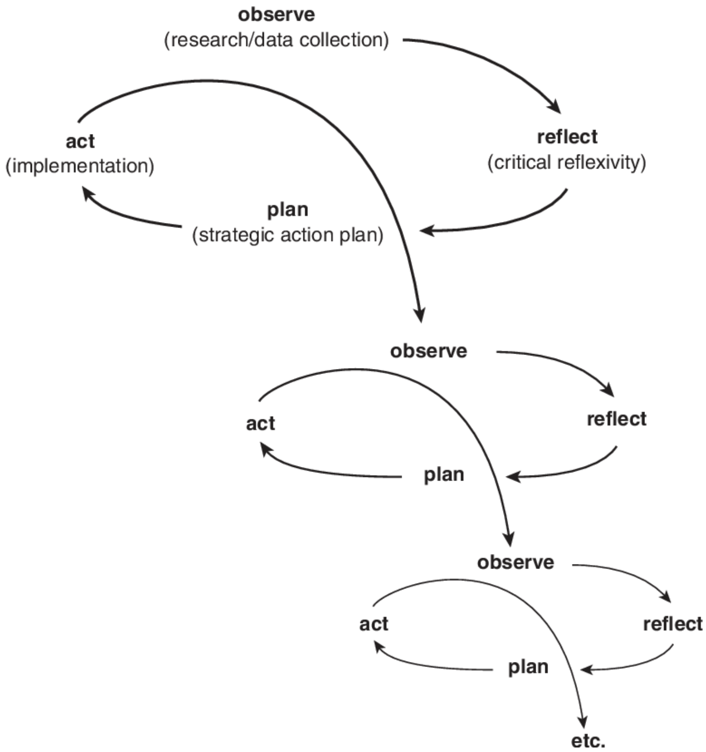

Figure 2. Classroom Action Research Cycle

The research was carried out for three learning sessions with each learning carried out a comprehensive cycle consisting of observation, reflection, design, and treatment. In this study, the independent variable is the application of the interactive module-assisted guided inquiry learning model and the bound variable is science literacy on elasticity materials. The development of a guided inquiry learning model assisted by interactive modules on elasticity materials is designed using teaching material development steps through the ADDIE (Analyze, Design, Development, Implement, and Evaluate) approach [18]. At the analysis stage, data was collected to analyze the needs needed by SMAN 6 Tangerang students regarding learning with what kind of model is liked and needed by students. At the design stage, interactive modules are designed based on the steps of the guided inquiry learning model, namely providing questions, making hypotheses, designing experiments, learning more experiments from various other references, analyzing relevant data, making conclusions, and implementation [19]. At the development stage, the interactive module that has been designed is tested for media validation by media experts. At the implementation stage, the interactive modules that have been validated are applied by the implementation of the PTK (Classroom Action Research) cycle at SMAN 6 Tangerang. The evaluation stages are carried out according to the results obtained through evaluation instruments in the form of tests using questionnaires.

Data collection is carried out at the end of each cycle before the next cycle is carried out. The final test instrument carried out at the end of each cycle is also used as data to see the improvement of students' science literacy. The data collection instruments in this study are questionnaires and science literacy questionnaires. The questionnaire was used to measure the quality of interactive modules based on the guided inquiry learning model on the subject of elasticity developed, while the student literacy improvement test was used to measure the improvement of student literacy before and after using the interactive module based on guided inquiry in learning. The test instruments used contain indicators of aspects of science content, aspects of science context, and aspects of science processes. The percentage data obtained is divided into four categories in Table 1 based on previous research procedures [20].

Table 1. Science literacy criteria.

Score	Criterion
21% - 40%	Less
41% - 60%	Enough
61% - 80%	Good
81% - 100%	Excellent

The test instruments used for data collection are also carried out for the validity and reliability of the instrument. The validity of the test instrument was carried out by conducting a validity test consisting of content validity, criterion-related validity, and construct validity and tested on media experts [21].

3. Results and Discussion

Each cycle carried out contains 4 important stages, namely, observation, reflection, design, and treatment. In Cycle I, the observation stage was carried out by interviewing physics teachers related to student backgrounds, classroom conditions and models and teaching methods carried out in teaching and learning activities. At this observation stage, the researcher also saw the process of teaching and learning activities directly. The next stage of reflection is carried out to see the shortcomings and problems that arise in the teaching and learning activities that have been carried out. In the design stage, the researcher designed an interactive module with syntax on the guided inquiry learning model. The interactive module that has been designed has the following syntax of the guided inquiry learning model: 1) problem orientation, 2) formulating a problem, 3) proposing a hypothesis, 4) collecting information, 5) testing a hypothesis and 6) concluding. The use of the guided inquiry learning model aims to improve science literacy skills in students.

In the treatment stage, learning will be carried out using a guided inquiry learning model assisted by interactive modules. So, at the end of learning in cycle I, a final test will be carried out to see the improvement in science literacy. After obtaining the results of the first cycle, the stage enters the observation for the second cycle by asking the teaching teacher regarding the learning used using the guided inquiry learning model with several interactive modules that have been created previously. In the reflection stage of cycle II, some difficulties or shortcomings in the module are noted. Furthermore, re-planning was carried out in cycle II by correcting several parts of the module that were not by the learning syntax. At the implementation stage of cycle II, learning was carried out again with several parts of the guided inquiry learning model assisted by interactive modules that had been improved, and a final test was carried out again in cycle II to see the improvement of science literacy. This process is repeated until the final test is obtained in cycle III. So that the data on the final test results in each cycle is obtained as shown in Table 2.

Table 2. Results of science literacy indicators.

No.	Science Literacy Indicators	Results of Cycle I	Results of Cycle II	Results of Cycle III
1.	Science Content	49.7%	55.3%	69.7%
2.	Science Context	55.3%	55.3%	68.7%
3.	Process Science	49.2%	65.1%	74.3%

Based on the results in Table 2, it can be seen in the first indicator, namely science content, showing an improvement in each cycle carried out. The highest result was obtained in cycle III of 69.7% in the good category. Science content indicators refer to the key concepts necessary to understand natural phenomena and the changes made to nature through human activity on elastic matter. The second indicator, namely the context of science, shows that the third cycle experienced the highest increase of 68.7% in the good category. Science context indicators are needed to understand situations in daily life that are grounds for the application of processes and understanding of science concepts. Meanwhile, the last indicator, namely the science process, shows a more significant increase compared to the other two indicators. In the third cycle, 74.3% was obtained in the good category.

The results of science literacy obtained in cycle I and cycle II for all indicators are still in sufficient intervals and the increase is not significant judging from the results obtained. This can be caused by the adaptations made by students regarding the learning model used. Previously, students used a conventional learning model, so when given a guided inquiry-based learning model assisted by interactive modules, students still had to adapt and adjust to learning based on the syntax of the learning model given, especially in the part of formulating problems. Students still have difficulty connecting events in daily life with science content, especially in elasticity materials. In the results of science literacy, the science context indicators in Cycle I and Cycle II did not change in terms of categories and magnitude. This happens because the interactive modules provided are still lacking in terms of depiction or procurement of objects. So that students still have difficulties if they only see virtually. In another study, a solution to this problem is given, namely, teachers can present these objects in real life both in the classroom and in structured assignments outside the classroom so that later students can apply the knowledge gained through real objects in daily life [22].

However, the final results of science literacy in cycle III provided an increase in results that were categorized as good for each science literacy indicator. This is because, with the guided inquiry learning model assisted by interactive modules, students can better understand and interpret experiences in personal, social, and global contexts. As in previous research, learning with a guided inquiry model leads to contextual learning. Contextual objects can make it easier to understand concepts and make learning more meaningful [23]. In addition, the interactive module-assisted guided inquiry learning model can also help students solve problems through the use of authentic problems and relate to the evaluation of students' experiences in the learning process to build understanding [24]. The use of an interactive module-assisted guided inquiry learning model that uses a combination of colors attracts students' attention, uses images that can motivate students, and also animations that can focus students' attention on the material to be learned [25]. The interactive module-assisted guided inquiry learning model makes it easier for students to learn without being limited by space and time so that students can also relearn anytime and anywhere [26].

Based on the explanation above, the improvement of science literacy including science content, science context, and science processes can be done by using a guided inquiry learning model assisted by interactive modules on physics materials.

4. Conclusion

Based on the three cycles that have been carried out, and the final test in each cycle to see the improvement of science literacy. Cycle III was obtained with the highest increase in each science literacy indicator with a science content indicator of 69.7%, a science context indicator of 68.7%, and a science process indicator of 74.3%. Therefore, it can be concluded that this research can be used by educators and policymakers as teaching materials to improve science literacy skills using a guided inquiry learning model assisted by interactive modules on elasticity materials. Based on the limitations of the research that has been carried out, this research still needs continuous research to see improvements in other student ability categories as well as in other physics materials.

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References

[1] Turnip B, Wahyuni I and Tanjung Y I 2016 The Effect of Inquiry Training Learning Model Based on Just in Time Teaching for Problem Solving Skill *Journal of Education and Practice* **7** 177–81
[2] Indrawati I 2018 Pembelajaran Group Investigasi Meningkatkan Hasil Belajar Siswa *JEKPEND: Jurnal Ekonomi dan Pendidikan* **1** 17–26
[3] Hanafiah N and Suhana C 2009 *Konsep strategi pembelajaran* ed H Sofiyanto (Bandung: Refika Aditama)
[4] Anon 2019 *Education at a Glance 2019* (OECD)
[5] Anon 2017 *Starting Strong 2017* (OECD)
[6] Budiarti* I S and Tanta T 2021 Analysis On Students' Scientific Literacy of Newton's Law and Motion System in Living Things *Jurnal Pendidikan Sains Indonesia* **9** 36–51
[7] Saptaningrum E, Nuvitalia D, Kurniawan A F and Putri N E 2023 Profil Penguasaan Literasi Sains Berdasarkan Kerangka PISA (Programme for International Student Assessment) Pada Siswa SMP Negeri Se-Kota Semarang Tahun 2022 *Jurnal Penelitian Pembelajaran Fisika* **14** 240–50
[8] Suyidno, Fitriyani, Miriam S, Mahtari S and Siswanto J 2022 STEM-Problem Based Learning: Pembelajaran Inovatif untuk Meningkatkan Literasi Sains Siswa di Era Industri 4.0 *Jurnal Penelitian Pembelajaran Fisika* **13** 163–70
[9] Purba R Y 2023 Pengembangan Instrumen Penilaian Kognitif berbasis Keterampilan Proses Sains Pada Materi Elastisitas dan Hukum Hooke di Kelas XI SMA Swata GKPI Padang Bulan Medan *JURNAL IKATAN ALUMNI FISIKA* **9** 89
[10] Al Mamun M A, Lawrie G and Wright T 2022 Exploration of learner-content interactions and learning approaches: The role of guided inquiry in the self-directed online environments *Comput Educ* **178** 104398
[11] Nasip A M and Ong T E 2021 5E Inquiry-Based Teaching Module for Primary School Science Teachers: A Need Analysis *Review of International Geographical Education Online* **11**
[12] Karmila, Hamzah H and Mutmainna 2020 Penerapan Model Pembelajaran Inquiry Based Learning Untuk Meningkatkan Keterampilan Pemecahan Masalah Fisika Peserta Didik *Phydagogic Jurnal Fisika dan Pembelajarannya* **2** 55–60
[13] Gunardi 2020 Inquiry Based Learning dapat Meningkatkan Hasil Belajar Siswa dalam Pelajaran Matematika *Social, Humanities, and Educational Studies (SHES): Conference Series* **3**
[14] Herdila P, Herlina K and Anggreini 2024 Development of Problem Based e-Module to Train Higher Order Thinking Skills on Temperature and Heat Material *Jurnal Penelitian Pembelajaran Fisika* **15** 293–300
[15] Mellita S A and Rosita L 2019 Pengaruh Model Pembelajaran Inquiry Based Learning Terhadap Kemampuan Berpikir Kritis Siswa Pada Mata Pelajaran Geografi *Jurnal Kajian Ilmu dan Pendidikan Geografi* **3** 70–9
[16] Ridwan S and Dr. Kardiawarman 2007 Action Research To Improve Student Teachers ' Ability To Use Innovative Instruction In A Physics Classroom In Indonesia *The Ontorio Action Researcher*
[17] Adelman C 1993 Kurt Lewin and the Origins of Action Research *Educ Action Res* **1** 7–24
[18] Branch R M 2009 *Instructional Design: The ADDIE Approach* (Boston, MA: Springer US)
[19] Juniar A, Fardilah R D and Tambunan P M 2021 The Distinction of Students' Science Process Skill and Learning Activities between Guided Inquiry and Conventional Learning with Experiment *J Phys Conf Ser* **1788** 012043
[20] Arikunto S 2010 *Prosedur Penelitian Suatu Pendekatan Praktik* (Jakarta: PT RINEKA CIPTA)
[21] Budiastuti D and Bandur A 2018 *Validitas Dan Reliabilitas Penelitian dengan Analisis dengan NVIVO, SPSS dan AMOS* (Jakarta: Mitra Wacana Media)

[22] Jofi Kuswanto, Muh. Nasir and Ariyansyah A 2021 Pengaruh Model Pembelajaran Guided Inquiry terhadap Kemampuan Literasi Sains Siswa Kelas X pada Materi Keanekaragaman Hayati di SMA Negeri 1 Wera Tahun Pelajaran 2021/2022 *Jurnal Pendidikan MIPA* **11** 175–80

[23] Millenia S H and Sunarti T 2022 Analisis Riset Penerapan Model Pembelajaran Inkuiri Terbimbing Berbasis Literasi Sains dalam Pembelajaran Fisika *EDUKATIF : Jurnal Ilmu Pendidikan* **4** 1051–64

[24] Yanti P N 2019 *Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Literasi Sains Siswa Di Mtsn 2 Aceh Barat* Skripsi (Banda Aceh: Universitas Islam Negeri Ar-Raniry)

[25] Yuliana D and Hufri 2019 Validasi multimedia fisika berbasis konstruktivis dalam pembelajaran inkuiri pada hukum newton gravitasi dan getaran harmonik sederhana untuk meningkatkan literasi sains siswa kelas X SMA *Jurnal Berkala Ilmiah Pendidikan Fisika* **12** 833–40

[26] Temur A, Durukan A and Artun H 2022 The Relationship between the Pre-Service Science Teachers' Self-Efficacy towards Science Teaching and Tendency to Use Technology in Classes *Mimbar Sekolah Dasar* **9** 367–80