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Preliminary Study: E-Module Inquiry-Based Online Learning Model to Improve Student Competence

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ABSTRACT

The era of revolution 4.0 requires students to master the competencies needed in the future. The results of SKL analysis, student analysis and analysis of learning activities are still low, and a solution is needed in the form of teaching materials equipped with a supportive learning model. The research method used is R&D with the development of the Plomp model. Based on the preliminary studies that have been carried out, the results obtained are the analysis of Graduate Competency Standards (SKL) in the pretty good category. The last aspect is the skills aspect, which has an average value of 61.67, which is in the good category. Then, the analysis results of students of learning styles, interests and motivation obtained an average value of students' learning styles (visual, auditory, kinesthetic), namely 55 with a pretty good category. The average score for students' interest in studying physics is 60 in the sufficient category. The average value of students' motivation to study physics is 46, which is sufficient. Then, analysing student learning outcomes, it was found that students' knowledge was still low. This research is essential to improve students' competence through e-modules because the e-module model of Inquiry-Based Online Learning that is being developed will be equipped with the integration of attitude values, material related to daily life, interactive questions and virtual practicum, which, of course, can improve students' skills.

INTRODUCTION

The presence of the Industrial Revolution 4.0 era affects many fields, namely industry, education and technology. One of the efforts to face the progress of the 4.0 revolution era is to improve human quality, such as human connectivity, building digital resilience and digital accountability (Shahroom & Hussin, 2018). Related to increasing human resources is building digital technology resilience through education. Education in the 4.0 revolution era has encouraged various developments in Science and Technology (IPTEK) (Liao et al., 2018). This is marked by the use of science and technology, which has become a necessity for humans, and one of the big things being faced is the Internet in the 4.0 revolution, namely the Internet of Things (Winata, 2020). Namely, most human activities

are dominated by internet use. Therefore, what needs to be prepared to face the era of revolution 4.0 in the education sector is to produce graduates who master technology (ICT) and various competencies that will support it in the future.

The era of Industrial Revolution 4.0 requires students to demonstrate excellence on a global scale. The era of Revolution 4.0 demands the production of graduates who master technology and can support the improvement of various competencies needed in the future (Lase, 2019). Another challenge teachers face in improving students' competence is the pandemic, which requires learning to run both face-to-face and online optimally. One of the subjects that can produce graduates with the competencies expected in the 4.0 revolution era is physics.

Humans need physics learning in everyday life to meet their needs through identifiable problem-solving. This was also conveyed by (Festiyed et al., 2020) that Physics can be defined as a science that deals with matter, energy, motion, and force. Then (Usmeldi et al., 2017), in their research, said that Physics is one of the subjects that tests natural phenomena using scientific methods. Physics lessons are about mastering knowledge in the form of facts, concepts, or principles and experience in the discovery process using scientific process skills. Therefore, learning physics is very important because it is contextual or related to phenomena in everyday life so that students' competence will increase.

Government Regulation No. 32 of 2013 states that competence is a set of competencies consisting of attitudes, knowledge and skills. These competencies must be possessed and mastered by students. It is hoped that after studying a range of learning, completing the level of a program or completing a competency education unit can be appropriately honed. Student competence is students' ability, consisting of attitudes, knowledge and skills acquired during learning. Students are said to have competence if there is an increase in knowledge, attitudes and skills after learning.

Based on preliminary studies that have been carried out, namely SKL analysis, student analysis and learning activity analysis. The first needs analysis is the SKL analysis, which consists of three aspects: attitudes (spiritual and social), knowledge and skills. Based on the results of the preliminary questionnaire analysis given to the teachers of SMAN 1 Koto Baru, SMAN 2 Koto Baru and SMAN 1 Koto Besar, it can be seen from the SKL analysis that 68.18, 49.17 and 61.67, respectively are in the less category. The attitude aspect (spiritual and scientific attitude) obtained an average score of 68.18 in the good category. The knowledge aspect obtained an average score of 49.17 in the sufficient category. The skills aspect obtained an average percentage of 61.67 in the good category. Based on these data, the achievement of graduate competence in attitudes and skills is good, but the knowledge aspect still obtains low results. This is supported by research from Increasing Graduate Competency Standards (SKL), which can be done by preparing and providing good facilities and infrastructure so Students can learn effectively, comfortably and safely (Rahman, 2022)

The second analysis of needs is the analysis of students, which consists of four aspects: learning styles (visual, auditory, kinesthetic), interest, motivation and independence. The average score for students' learning style aspects (visual, auditory, kinesthetic) is 55 in the sufficient category. The average score for students' interest in physics is 60 in the good category. The average score for the motivation aspect of students to study physics is 46, which is in the sufficient category. Based on this analysis, it can be seen that aspects of learning style and student motivation are in the sufficient category. Then, the aspect of interest in learning is in the good category. Thus, it can be concluded that a stimulus is needed to arouse students' learning styles, motivation and interest in physics.

The third analysis of needs is learning analysis, which consists of analysis of learning activities, teaching materials, and applying inquiry learning models. Based on the analysis

of learning activities, it was found that during the COVID-19 pandemic, schools implemented an online learning system. Online learning uses the WhatsApp and Google Classroom applications as learning media. However, it turns out that online learning is less effective because learning is monotonous. After all, students are focused on summaries of material and printed books provided by the teacher, and some students cannot understand the material provided. As a result, when face-to-face learning begins, the material has to be repeated so that all students understand the physics subject matter provided online.

Based on the problems described, the researcher intends to improve the situation by developing an e-module model of Inquiry-Based Online Learning to increase student competency. This research is essential to carry out to improve student competency through e-modules. The e-module model of inquiry-based Online Learning that is being developed will be equipped with the integration of attitude values, material related to daily life, interactive questions and virtual practicums, which, of course, can improve students' skills.

METHODS

The research that will be carried out is research and (Research and Development). Research and development is a method used to produce specific products and test the effectiveness of these products. The development model used in this research is the development model developed by Plomp. The development model used in this research is the development model developed by Plomp. The Plomp model consists of three phases: preliminary research, prototyping phase (development phase), and assessment phase (Plomp, 2013). In this research, what will be used is preliminary research.

The preliminary study conducted in the three schools aimed to identify the problems encountered during physics learning at SMA N 1 Koto Baru Dharmasraya, SMAN 2 Koto Baru Dharmasraya, and SMA N 1 Koto Besar Dharmasraya. By conducting a preliminary study, the research team or parties involved will try to understand the situation of learning physics in the three schools more deeply. This preliminary study may involve methods such as class observation, interviews with teachers and students, and analysis of documents related to school physics learning programs.

The stages carried out in the preliminary study are needs analysis, including analysis of SKL, students and learning activities. Needs analysis becomes a reference so that needs and competency demands develop products. This needs analysis plays an essential role in ensuring that the product to be developed is by the needs and demands of the competencies to be achieved. The needs analysis tool used is a questionnaire. Concept analysis is an activity to identify the materials that will be taught later. The materials are arranged systematically by linking related materials in a relevant way. This stage aims to ensure that the learning materials implemented through the products developed have a good structure and are logically arranged.

In this stage, various instruments are used to understand user needs related to the e-module, which will be developed using an online inquiry-based learning approach. These instruments are designed to collect comprehensive information regarding certain aspects, namely analysis of Graduate Competency Standards (SKL), student characteristics, learning activities, and analysis of material that will be integrated into the e-module. These instruments are used to collect data needed to understand user needs and context and assess the material that will be integrated with the e-module. Data collected from SKL analysis instruments, questionnaires, interviews, and material analysis sheets will be an essential basis for designing e-modules that are appropriate, relevant, and effective in supporting online inquiry-based learning.

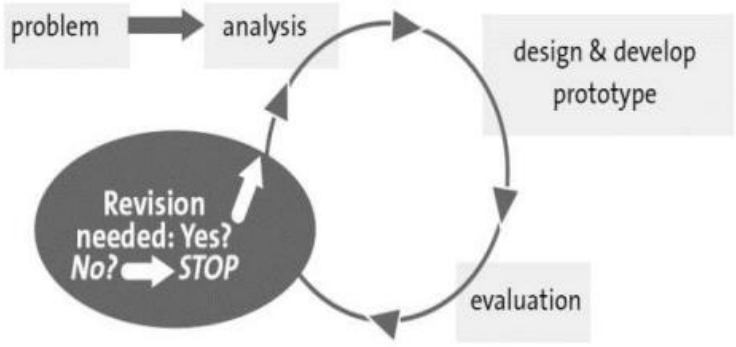

Figure 1. Stages of Systematic Education Design in the Plomp Model

RESULTS AND DISCUSSION

Results

Preliminary analysis is the initial stage in the development of the Physics E-Module. This preliminary analysis is carried out to obtain information about problems in education and possible solutions. This preliminary analysis consists of the Graduate Competency Standards (SKL) and the analysis of students.

Analysis of Graduate Competency Standards

Analysis of Graduate Competency Standards (SKL) plays a significant role in learning. SKL represents the primary goal of the process because it indicates the extent to which students have successfully achieved competency. The results of the SKL analysis obtained through a preliminary study show the level of competence graduates achieve in several aspects. In this analysis, the achievement of graduate competencies is assessed from several perspectives: aspects of attitude (spiritual and social attitudes), knowledge, and skills. Analysis of the attitude aspect involves an assessment of the spiritual and social development of students, which includes the moral values, ethics and social relations that they build.

Furthermore, knowledge refers to students' understanding and mastery of the subject matter. Finally, skills include practical abilities and applying knowledge in real situations. The results of the Graduate Competency Standards (SKL) analysis can be seen in Table 1 SKL analysis.

Table 1. SKL analysis

SKL Indicator	Value
Attitude	68,18
Knowledge	49,17
Skills	61,67

Table 1 shows the results of the Graduate Competency Standards (SKL) analysis. Aspects of attitude (spiritual and social) get an average value of 68.18, which is in the good category. Analysis of the attitude component is seen in the spiritual attitude and scientific attitude of students towards learning physics. In this attitude component, there are six assessment indicators. The assessment indicators are religious (S1), honest (S2), responsible (S3), tolerance (S4), discipline (S5) and cooperation (S6). The knowledge aspect obtained an

average value of 49.17, which is pretty good. The last aspect is the skills aspect, which has an average value of 61.67 in the good category. Overall, the analysis results provide a comprehensive picture of student achievement. The attitude aspect was found to be in the good category with an average value of 68.18, followed by the skills aspect with an average value of 61.67, which was also in the good category. Meanwhile, the knowledge aspect obtained an average score of 49.17, which is pretty good. This information will be an essential basis for designing improvement and development steps to increase student achievement in all aspects assessed.

SKL Analysis Results on the Student Attitude Component

The Graduate Competency Standards (SKL) analysis results also involve evaluating students' attitudes. The analysis of the attitude component focused on the student's spiritual and scientific attitudes towards learning physics. In this attitude component, six assessment indicators are used to measure these two aspects of attitude. These assessment indicators include: a) Religious (S1): Assessing the extent to which students have a religious attitude, including living and practising religious values. b) Honest (S2): Assessing the level of honesty of students in various situations, both in terms of actions and words. c) Responsible (S3): Measuring the level of responsibility of students towards the duties and obligations carried out. d) Tolerance (S4): Assessing tolerance and respect for differences and the ability to interact with various cultures and views. e) Discipline (S5): Measuring how students are disciplined in following the established rules and procedures. f) Cooperation (S6): Assessing the ability of students to work together and contribute in a social or group environment.

Through an evaluation of this attitude component, a more in-depth description of the attitude aspects possessed by students towards learning physics can be obtained. These assessment indicators help identify strengths and areas that require improvement in developing students' spiritual and scientific attitudes. The results of the SKL analysis on the attitude component are shown in Figure 2

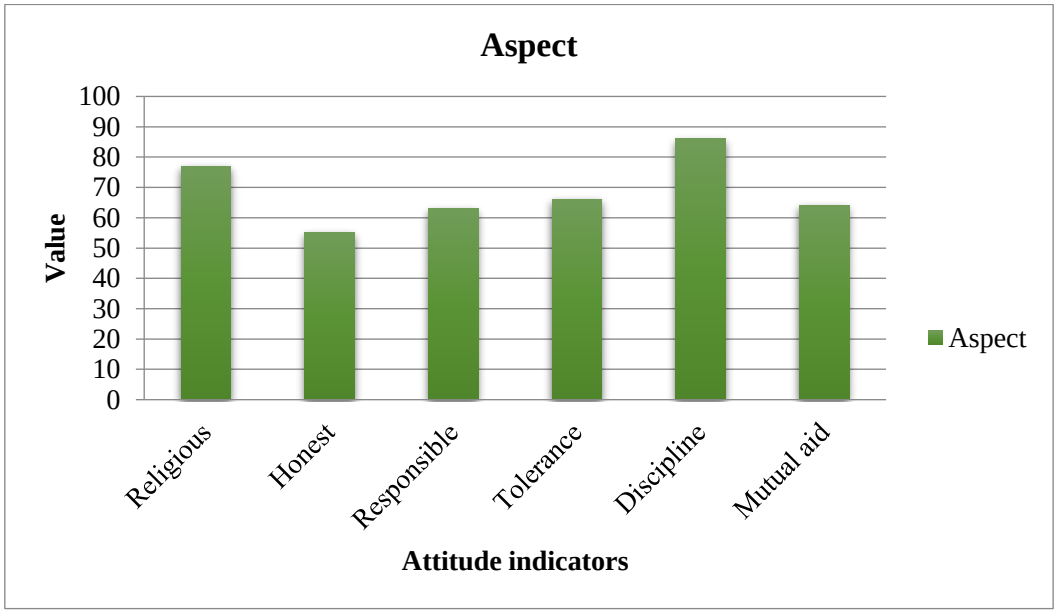

Figure 2. Value of Attitude Indicators

Based on the information provided in Figure 2, it can be identified that the religious attitudes possessed by students are in the "good" category with a score of 77. Furthermore, for scientific attitudes, which include indicators of honesty, responsibility, tolerance, discipline and cooperation, The average score obtained was 67.38, also in the "good"

category. The results of this analysis indicate that students' religious and scientific attitudes in the context of physics learning are at a reasonable level. This fact has important implications for the implementation of physics learning, which is in line with the goals set by the government. However, regarding Minimum Completion Criteria (KKM) scores, only the discipline attitude score succeeded in surpassing the KKM with a score of 86. Meanwhile, religious, responsibility, tolerance and cooperation values remained below the KKM. This shows the potential to continue developing and strengthening these attitudes through more focused interventions in the learning process.

SKL Analysis Results on Student Knowledge Components

The knowledge component plays a crucial role in the development of students. This competency can be measured through learning outcomes that are reflected in the results of tests or evaluations. In this knowledge component, four assessment indicators measure students' understanding and mastery of the subject matter. The four indicators are factual, conceptual, procedural, and metacognitive. By measuring these four indicators, we can get a more comprehensive insight into how students have developed knowledge competencies in the subject matter. These indicators help teachers and educational institutions assess students' level of understanding and ability and design appropriate learning strategies to develop knowledge competencies further. SKL analysis of the knowledge component can be seen in Figure 3 below

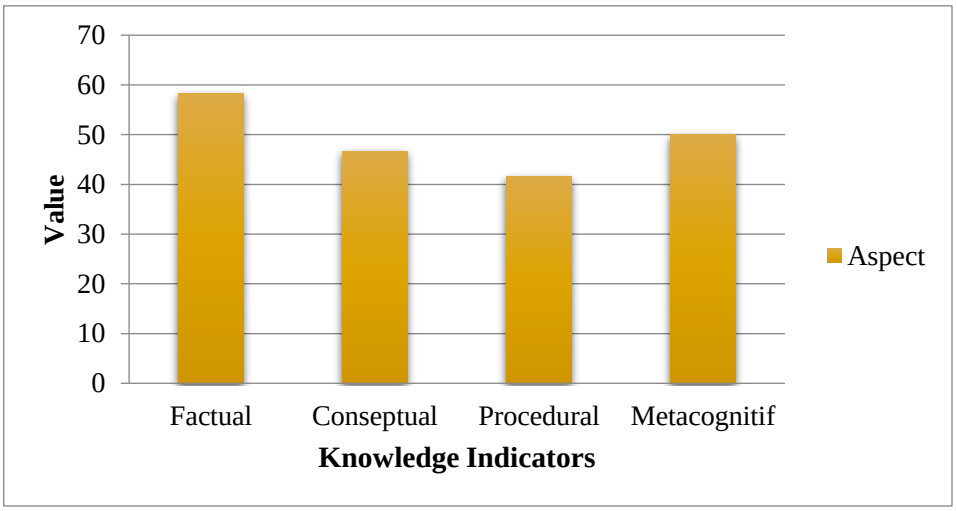

Figure 3. Value of Knowledge Indicators

From Figure 3, it can be seen that the results of the analysis of the component aspects of students' knowledge produced an average value of 49.25. This result falls into the criteria of being quite good. These findings indicate that students' understanding and mastery of the subject matter in the knowledge component still require improvement. Even though the average score is in the criteria of good enough, this information reflects the potential to develop further and enhance students' knowledge. The fact that these scores have not reached a higher level indicates the need for further action to address challenges and barriers to learning. Through the results of this analysis, it can be identified that there is a need to design learning strategies that are more effective and focus on increasing students' understanding and mastery of the subject matter. It also highlights the importance of learning approaches that can encourage active engagement and deep understanding so learners can better develop their knowledge. This effort will assist in improving the knowledge competence of students and lead to better results in the knowledge aspect.

Results of Analysis on SKL Aspects of Student Skills

Skill competence has an essential role in the development of students because this competency measures their ability in the psychomotor aspect. The skills component is analysed by considering several indicators that measure students' ability to apply practical skills. The results of the skill component analysis are displayed in visual form, as shown in Figure 4. The information obtained from this analysis provides an overview of the extent to which students have developed the practical skills needed in the learning context. Evaluation of these indicators helps identify strengths and areas that need improvement in developing students' skills. The results of this analysis become an essential basis for designing interventions and better learning strategies to improve students' competency skills.

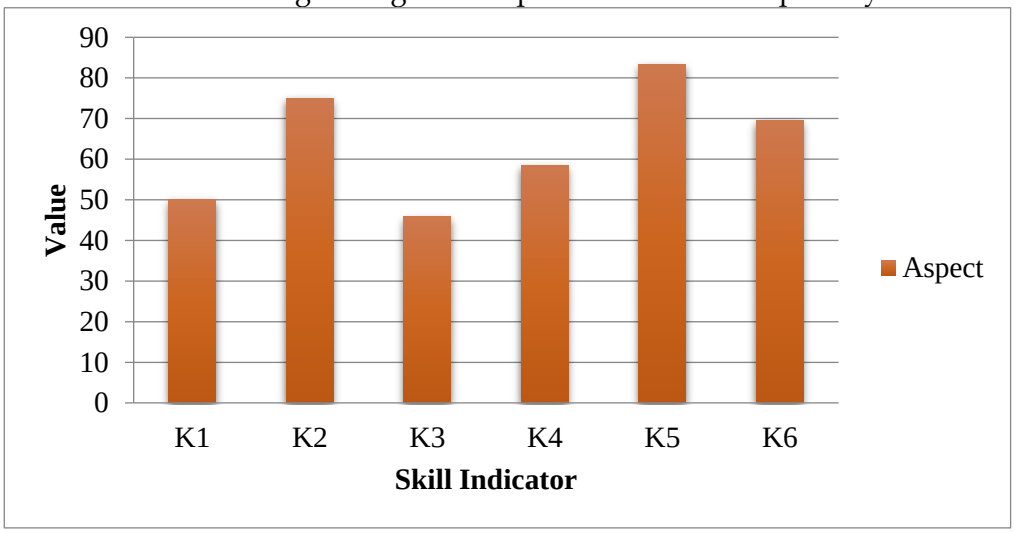

Figure 4. Value of Skills Indicators

Figure 4 shows that the K5 component, which measures students' timeliness in completing e-modules, is in the very good category with a score of 83.33. Furthermore, components K2, which measures students' ability to assemble tools, and K6, which measures the ability to present group reports, are in a good category with scores of 75 and 69.44, respectively. Meanwhile, indicators K1, which evaluates practical preparation, K2, which assesses how to read tools, and K3, which measures accuracy in carrying out procedures, are all in the relatively good category with scores of 50.46 and 58, respectively. These findings provide a clearer picture of the practical skills possessed by students in the learning context. The K5 component shows that students' ability to fill out e-modules on time is very good. However, there is potential to continue developing and strengthening skills in aspects K2 (how to assemble tools) and K6 (presenting group reports) to reach a more optimal level. Apart from that, the results that reached the quite good category in the K1, K2 and K3 indicators indicate the need for more attention to improving and honing skills. This information will be an essential basis for designing appropriate action plans and interventions to improve students' skill competencies in all indicators assessed.

Analysis of Students' Learning Interests

Analysis of the characteristics of students is related to the components of learning styles, interest in learning, learning motivation and students' independence in learning. The learning style component consists of twelve indicators, including visual, auditory and kinesthetic learning styles. The component of interest in learning consists of eight indicators, namely: a) I enjoy attending physics lessons, b) I feel happy to be on time to class in Physics subjects, c) I often read Physics textbooks outside of Physics class hours, d) I am interested if

physics lessons are associated with phenomena or natural disasters that occur, e) I ask for an explanation of physics material from the teacher if I do not understand it, f) I do the physics assignment given by the teacher, g) I listen seriously to the teacher's explanation in learning Physics, h) I feel learning Physics is very useful for me. The learning motivation component has six indicators, including a) I have a solid curiosity for understanding physics material, b) I have a desire to excel in physics subjects, c) Interesting physics learning makes me want to study physics, d) I study physics well because of a supportive learning environment, e) I manage my physics study time at home with my parents' encouragement, f) I want to sacrifice my time and opportunity to get good grades in Physics.

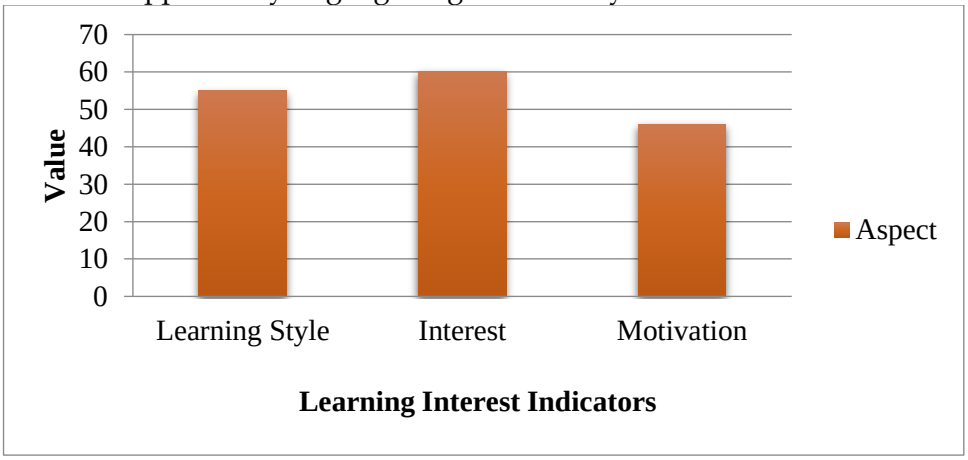

Figure 5. Value of Learning Interest Indicators

Figure 5 shows that the students' analysis results consist of four aspects: learning styles (visual, auditory, kinesthetic), interest, motivation and independence. The average value of students' learning style aspects (visual, auditory, kinesthetic) is 55, a pretty good category. The average score for students' interest in studying physics is 60 in the sufficient category. The average score for the motivation aspect of students to study physics is 46, which is in the sufficient category. Based on this analysis, it can be seen that students' learning styles and motivation are in the lower category. Then, the aspect of interest in learning is in the sufficient category. Thus, it can be concluded that a stimulus is needed to arouse students' learning styles, motivation and interest in physics to improve the competence of attitudes, knowledge and skills.

Analysis of Student Learning Outcomes

Student learning outcomes can be analysed by acquiring grade XI midterm exam scores for the 2022/2023 academic year. Learning during the COVID-19 pandemic was carried out online and offline. Midterm 1 exams are conducted face-to-face. The results of the analysis of the learning outcomes of class XI students at SMAN 1 Koto Baru, Dharmasraya Regency, are in Figure 6 below.

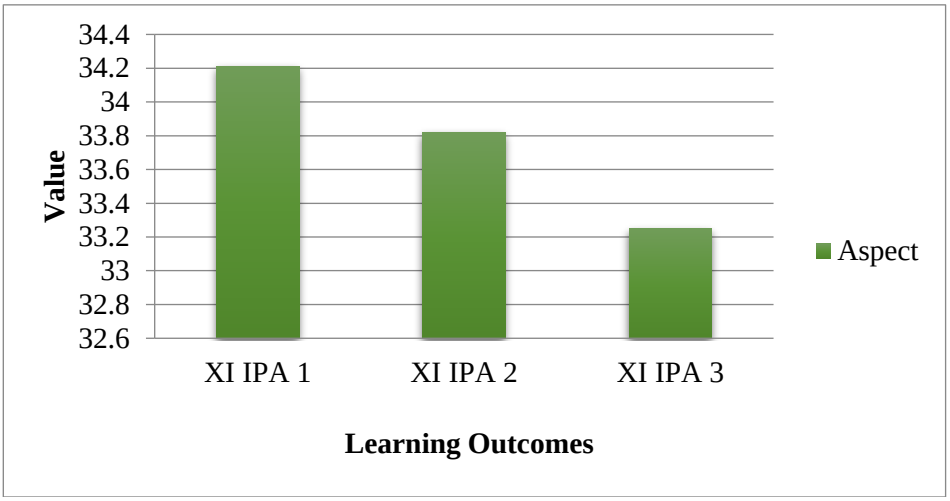

Figure 6. Value of Learning Outcomes

The data shown in Figure 6 indicates that student learning achievement is still low. These learning outcomes are measured based on the average score obtained by each class. Class XI IPA 1 has an average score of 34.2, indicating that the learning achievement of students in this class is still low. Class XI IPA 2 also showed similar results, with an average score of 33.8, indicating that the learning achievements of students in this class had not yet reached the expected level. Meanwhile, class XI IPA 3 has an average score of 33.2, which shows that the level of learning achievement is still low. This condition illustrates that there are challenges in the learning process in the three classes, and corrective steps may be needed to improve student learning outcomes. This data provides a basis for formulating more effective learning strategies to help students achieve better achievements in learning physics.

Discussion

Based on Figure 3, namely the SKL analysis of students, information was obtained that the religious attitudes of students were in a good category with a value of 77. Scientific attitudes, including honesty, responsibility, tolerance, discipline and cooperation, averaged 67.38 in the good category. The results of this analysis illustrate that students' religious and scientific attitudes in learning are good. This can be a driving factor in the implementation of physics learning as intended by the government. It can be seen that those who pass the KKM only score a disciplined attitude, which is at 86. Meanwhile, the values of religion, responsibility, tolerance and cooperation are still under the KKM. This result is in line with the study's results (Rijal & Bachtiar, 2015) that a positive relationship exists between students' attitudes and cognitive learning outcomes.

Based on Figure 4, the results of the SKL analysis of students' knowledge show that the analysis of the component aspects of students' knowledge has an average value of 49.25. This result is quite a good criterion. The results of this analysis illustrate that students' knowledge is still low, and solutions need to be found to increase students' knowledge. This grouping aligns with the study's results (Dacwanda & Nataliani, 2021), which state that three groups of achievements are produced based on academic scores: intelligent, moderate, and sufficient.

Based on Figure 5, information is obtained that the K5 component, namely the timeliness of students in filling out e-modules, is in the very good category, namely with a score of 83.33. Then K2, namely how to assemble tools and K6, presenting group reports, are in categories with scores of 75 and 69.44. Then indicators K1, namely practical preparation, K2, namely how to read tools and K3, namely accuracy in carrying out procedures, are in the

relatively good category with scores of 50,46 and 58, respectively. This is in line with research (Bahtiar et al., 2022) stated four reasons regarding the importance of science practicum activities: (1) it can raise students' learning motivation; (2) develop basic skills in conducting experiments; (3) become a vehicle for learning a scientific approach; and (4) supporting lesson material.

Thus, it can be interpreted that the attitude (spiritual and social) and skill aspects in achieving graduate competency are good. However, the knowledge aspect consisting of factual, conceptual, procedural and metacognitive indicators is still low. Therefore, it is necessary to develop learning resources that contain the phenomena of attitudes, knowledge and skills following physics material, namely the Physics e-module.

Analysis of the characteristics of students is related to the components of learning styles, interest in learning, learning motivation and students' independence in learning. The learning style component consists of twelve indicators, including visual, auditory and kinesthetic learning styles. The component of interest in learning consists of eight indicators, namely: a) I enjoy attending physics lessons, b) I feel happy to be on time to class in Physics subjects, c) I often read Physics textbooks outside of Physics class hours, d) I am interested if physics lessons are associated with phenomena or natural disasters that occur, e) I ask for an explanation of physics material from the teacher if I do not understand it, f) I do the physics assignment given by the teacher, g) I listen seriously to the teacher's explanation in learning Physics, h) I feel learning Physics is very useful for me. The learning motivation component has six indicators, including a) I have a solid curiosity for understanding physics material, b) I have a desire to excel in physics subjects, c) Interesting physics learning makes me want to study physics, d) I study physics well because of a supportive learning environment, e) I manage my physics study time at home with my parents' encouragement, f) I want to sacrifice my time and opportunity to get good grades in Physics. This study's results align with research (Yunitasari & Hanifah, 2020) that students' interest in learning is low, especially during the pandemic. This is because they do not meet their friends and teachers directly.

In Figure 7, it can be seen that the student learning results in the mid-semester one exam are in the poor category. Thus, treatment is needed to increase students' knowledge competency. The third analysis of needs is learning analysis, which consists of analysis of learning activities, teaching materials, and applying inquiry learning models. Based on the analysis of learning activities, it was found that during the COVID-19 pandemic, schools implemented an online learning system. These results align with research (Nurhasanah & Sobandi, 2016) that increased student interest in learning can improve student learning outcomes. This means that the better the student's learning interest will impact the better student learning outcomes with WhatsApp and Google Classroom as learning media. However, it turns out that online learning is less effective because learning is monotonous. After all, students are focused on summaries of material and printed books provided by the teacher, and some students cannot understand the material provided. As a result, when face-to-face learning begins, the material has to be repeated so that all students understand the physics subject matter provided online. Apart from that, the facilities for online learning are very adequate because most students have an Android or smartphone to study online. The learning models applied in schools are Problem-Based Learning, Project-based Learning and the lecture method. The inquiry learning model has never been implemented in schools due to many factors, including students' low interest and motivation to learn. So, teachers find it challenging to apply this model in classroom learning.

The inquiry model has several advantages. First, it balances cognitive, affective and psychomotor aspects to make learning more meaningful. Second, students are free to learn according to their respective styles. Third, this model adheres to the principle that experience

causes changes in behaviour due to the learning process, and this concept is included in the concept of modern psychology. Fourth, this model can facilitate students with above-average abilities (Husni, 2020). This aligns with research (Husni & Bisri, 2020) that inquiry model teaching materials have the advantage of creating a two-way learning atmosphere, meaning that the teacher is not the only source of information. Additionally, inquiry generally focuses on improving students' analytical skills to understand scientific concepts and processes through direct investigative activities (Yasin et al., 2021).

CONCLUSION

Based on the preliminary study that has been carried out, the results obtained are that the analysis of Graduate Competency Standards (SKL) on the attitude aspect (spiritual and social) obtained an average score of 68.18, which is in the good category. The knowledge aspect obtained an average value of 49.17, which is pretty good. The last aspect is the skills aspect, which has an average value of 61.67 in the good category. Then, the results of the student analysis consisting of learning styles, interests and motivation obtained an average score for the learning style aspects (visual, auditory, kinesthetic) of students, namely 55 with a pretty good category. The average score for students' interest in studying physics is 60 in the sufficient category. The average score for the motivation aspect of students to study physics is 46, which is in the sufficient category. Then, analysing student learning outcomes, it was found that students' knowledge was still low. This shows that the competency aspects of students and aspects of student's learning styles and interest in learning are still low. Therefore, developing a teaching medium that can correct these deficiencies is necessary. Then, the required solution is

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