



Developing a 3D-Integrated SEQIP Science Practicum Module to Enhance Elementary Students' Social Skills and Conceptual Understanding

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Abstract

The purpose of this study was to produce a valid, practical and effective science practicum module based on Science Education Quality Improvement Project (SEQIP) integrated with 3D visualizations to resolve abstract concepts in Solar System materials while fostering elementary students' social skills. Utilizing a Research and Development (R&D) approach with the 5-stage ADDIE model, this study executed a limited field trial involving 50 sixth-grade students selected via cluster random sampling in Lampung, Indonesia. During the Design phase, expert-validated observation rubrics for social skills and concept-integration tests were structured, which were subsequently tested during the Implementation stage through small-scale, 3D-assisted collaborative group experiments. Expert validation from material, media, and learning instruction specialists demonstrated exceptional validity, yielding averages of 94.87%, 96.21%, and 94.87%, respectively. Practicality assessments confirmed high field compliance during this limited trial, with a 90% product implementation score, 86% positive student responses, and 90% text readability. Empirical findings from the limited field trial revealed significant initial efficacy; normalized gain (N-gain) analysis showed substantial improvements in cognitive learning outcomes across experimental class 1 ($g = 0.59$) and trial class 2 ($g = 0.57$) in the moderate improvement category. Concurrently, students' social skills with particularly in sharing ideas and peer communication, which initially averaged below 60%, surpassed the high-quality threshold at 92.9% after the intervention. Paired sample t-tests confirmed statistical significance ($p < 0.001$). These preliminary results contribute to innovative learning media that elementary teachers globally can adopt to integrate 21st-century character education and social skills into abstract science subjects using scalable 3D technology.

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INTRODUCTION

Social skills are a fundamental element in the development of students, especially in the educational environment. The results of the study show that social skills not only contribute to academic success, but also to the emotional and social well-being of students (Seprianto & Kardina, 2024; Tazkia & Damayanti, 2024; Zuwirda et al., 2024). These skills help learners to manage emotions, empathize, and adapt to various social situations that learners face in school and outside of school (Tazkia & Damayanti, 2024).

In addition to social skills, another aspect that is no less important for students is the learning outcomes of students. Student learning outcomes are an important indicator that reflects academic achievement and skill development of students after participating in the learning process. In general, learning outcomes can be defined as changes that occur in students in cognitive, affective, and psychomotor aspects as a result of the learning experiences that students obtain (Nurfauzan, 2023). These learning outcomes include not only the knowledge acquired, but also the attitudes and skills developed during the educational process.

Students' learning outcomes and students' social skills have a close relationship and influence each other. Learning outcomes, which include academic achievement and skill development, can be influenced by the social skills that learners have. Social skills include the ability to interact, communicate, and cooperate with others, all of which are very important in the context of education (Dewanti et al., 2016; Ikah, 2023). Research shows that students who have good social skills tend to have better learning outcomes because students are able to collaborate with peers and actively participate in class activities (Sihombing et al., 2024).

The factors that affect student learning outcomes are very diverse. Learning motivation, learning style, and learning environment are some of the key elements that can affect how well learners can absorb and apply knowledge (Muslimah et al., 2024; Nurfauzan, 2023; Okta Rosfiani et al., 2023). For example, students who have high motivation tend to be more active in the learning process and are better able to achieve good learning outcomes compared to students who are less motivated. In addition, students' learning styles also play an important role; Students who learn in a way that suits the student's style usually show better learning outcomes (Muslimah et al., 2024).

The results of field observations at SD Negeri 8 Way Serdang in July 2024 show that the learning process used still uses a teacher-centered approach. Where 70% of the learning time is used by the lecture method, reducing the opportunity for students to be involved in collaborative activities so that students tend to be passive and lack interaction between peers in the learning process and only 30% of students are able to cooperate effectively in class. This is also in line with the findings in a study conducted by Chan (2020) that as many as 75% of teachers stated that teachers found it difficult to carry out practicum. One of the factors causing this is the unavailability of practicum instructions that can be used as a reference. In addition, the media used is also less innovative, such as printed books

and teaching materials so that students' social skills tend to be lower and also have an impact on students' learning outcomes.

The results of field studies on students also show that students still have difficulty in understanding abstract materials such as the solar system. Solar system material is often considered difficult by students, especially at the elementary education level. Some of the factors that contribute to this difficulty include conventional teaching methods, lack of interactive learning media, and the abstract nature of the material itself. Most students interact with solar system information through textbooks, which often display content in a two-dimensional format and are less able to describe the complexity and beauty of the astronomical object (Agnesa & Sari, 2024; Parmadi et al., 2023).

The findings in the results of the field study above are also supported by the fact that students' difficulties in understanding the material of the solar system are also exacerbated by the absence of teaching aids or media that can help students imagine and visualize the solar system in a more real format. Research shows that the use of 3D miniatures and augmented reality applications that display solar system objects in three-dimensional form can help improve students' understanding of difficult concepts (Kurniawan & Aryanto, 2024; Sari et al., 2024).

The results of the study by Sugiharto emphasized the need for better use of teaching aids in teaching the solar system to help students understand the structure and relationships between various planets (Sugiharto, 2020). By using modern technologies such as augmented reality, students can explore the solar system interactively, which increases their interest in these lessons. Research by Kurniawan and Aryanto shows that augmented reality applications can increase student engagement and make it easier for them to understand the solar system, which was previously considered difficult to understand (Fatimah et al., 2023).

In learning about the solar system, various problems also often arise that hinder students' understanding, especially at the elementary school level. One of the main problems is the conventional teaching method, where the learning media used is limited to textbooks, whiteboards, and visual aids that are less attractive (Prasetio et al., 2019). This causes students' low attraction to the material, thus impacting their understanding of the solar system. A study showed that 18 out of 48 students had difficulty understanding the material because the learning methods used were inadequate (Sari et al., 2024)

The lack of diverse use of learning media is also a significant problem. Students are often unable to visualize abstract objects, such as planets and solar systems, only through two-dimensional drawings in books. This makes it difficult for them to develop a better understanding of the concept (Susilaningsih et al., 2023). Therefore, it is important to develop more interactive and engaging learning media. Research shows that learning using media such as animated videos and augmented reality can increase students' motivation and understanding of the solar system (Darojat et al., 2022).

Innovations in learning media, such as augmented reality-based applications and interactive animations, have proven to be effective in making learning more engaging and facilitating a more active learning process (Kurniawan & Aryanto, 2024; Marsya &

Tamam, 2023; Trijayanti et al., 2021). This app helps students to interact directly with more realistic models of the solar system, making it easier for them to understand the structure and dynamics of the system. Research conducted by Kurniawan and Aryanto shows that augmented reality applications can help students understand the concept of the solar system more deeply, by encouraging them to actively participate in the learning process (Kurniawan & Aryanto, 2024). In addition, the use of educational games and other interactive media has also been shown to increase learning effectiveness by making the classroom atmosphere more dynamic and fun (Nuqisari & Sudarmilah, 2019; Santi & Astuti, 2020).

To overcome the low learning outcomes of students, a good learning approach and the use of attractive media are needed. Several approaches have been taken to improve learning outcomes and social skills, one of which is a project-based approach such as SEQIP (Science, Education, Quality, Improvement, Project). The SEQIP approach is an approach that integrates various important aspects of education to improve student learning outcomes. This approach emphasizes the importance of developing scientific skills, quality education, and continuous improvement in the learning process. In this context, we can see how the SEQIP approach can contribute to the improvement of social skills and learning outcomes of students.

The use of technology in learning can create a more engaging and interactive learning environment (Meirlin et al., 2021). The integration of technology in the SEQIP approach can help learners develop social skills and achieve better learning outcomes. Finally, the importance of collaboration between teachers, learners, and parents in the SEQIP approach cannot be ignored. Good cooperation between all parties can create a supportive and inclusive learning environment (Pujiningrum et al., 2021; Sudiartini et al., 2021). Research shows that parental support and parental involvement in their children's education can contribute to improved learner learning outcomes.

Learning media also has an important role in the learning process because media can help teachers deliver material more effectively and interestingly, as well as facilitate students' understanding. According to Arsyad (2017) learning media functions as a tool to improve the quality of learning through the delivery of more concrete, visual, and interactive information. According to Utomo (2023), the use of innovative and collaborative-based learning media can contribute significantly to the development of students' social skills.

Other research shows that the use of interactive media and technology in learning can significantly improve student learning outcomes (Hakim et al., 2022). For example, the use of game-based learning applications or visual media can make learning more interesting and effective, so that students can more easily understand the material being taught (Ekayogi, 2023; Rukmana & Fitrihidajati, 2022) Therefore, the role of teachers in this case is required to be more creative in utilizing technological advances as media, information and communication, to create active, innovative, creative, effective and fun learning. The goal is to improve the quality of learning in order to improve student learning outcomes from various aspects.

Based on some of the things that have been explained above, the use of Project-based practicum modules, such as SEQIP (Science, Education, Quality, Improvement, Project)

has the potential as one of the effective solutions to improve social skills and student learning outcomes. SEQIP-based practicum modules that integrate science, education, quality improvement, and continuous improvement through practical projects that allow learners to learn actively and contextual (Kolmos, 2019). SEQIP-based practicum modules provide opportunities for learners to be directly involved in projects that encourage cooperation and communication, which indirectly improves social skills (Tamim, 2022).

The practicum module based on the SEQIP (Science, Education, Quality, Improvement, Project) approach is considered to be an effective solution to overcome low social skills and student learning outcomes. This approach integrates elements of science, quality education, continuous improvement, and practical projects, all of which contribute to the development of learners' social and academic skills. SEQIP-based practicum modules that integrate three-dimensional (3D) elements provide significant innovations in the learning experience of students, especially in the context of Natural and Social Sciences learning.

The use of 3D technology in this module allows students to interact directly with abstract models of objects and concepts, such as the structure of the solar system, ecosystems, or other scientific processes. With a 3D software application or physical props that are in a three-dimensional format, students can see in real life and understand the spatial relationships between the various components they are learning. This not only makes learning more interesting, but also encourages students to be more active in the learning process, thereby increasing their motivation and overall understanding.

Furthermore, the implementation of modules with 3D features is not only beneficial for students' cognitive development, but also improves their social skills. Through cooperation in small groups while using 3D models, students learn to communicate, collaborate, and exchange ideas and solutions in solving practicum challenges. With this approach, students not only gain theoretical knowledge, but also essential social skills that can be applied outside of the school environment. The application of this 3D technology in SEQIP-based practicum modules aims to create an inclusive and interactive learning environment, promising better academic outcomes and positive character development among students.

So simply put, the practicum module based on the SEQIP approach has great potential to overcome low social skills and student learning outcomes by integrating collaborative learning, quality education, continuous improvement, and an inclusive learning environment. With the existence of a supportive module, it is hoped that students can not only improve academic achievement, but also have strong social skills, which is an important provision for the future (Panadero, 2017)

Based on the background explanation, the author conducted a research & development with the title "Development of SEQIP-Based Practicum Modules for IPAS Learning Oriented to Improving Social Skills and Learning Outcomes of Elementary School Students". The formulation of the problem is as follows:

1. How is the design of the SEQIP-based practicum module developed?

2. What is the feasibility of the SEQIP-based practicum module developed in terms of validity and practicality in its use?
3. How effective are SEQIP-based practicum modules in improving social skills and student learning outcomes?

METHOD

Research Design and Procedures

The method used in this study is a type of research and development or known as Research and Development (R&D). In this development, the ADDIE model development pattern is used, taken from the main book of R Robert Maribe Branch entitled Instructional Design: The ADDIE Approach. The ADDIE chart is shown in Figure 1 below.

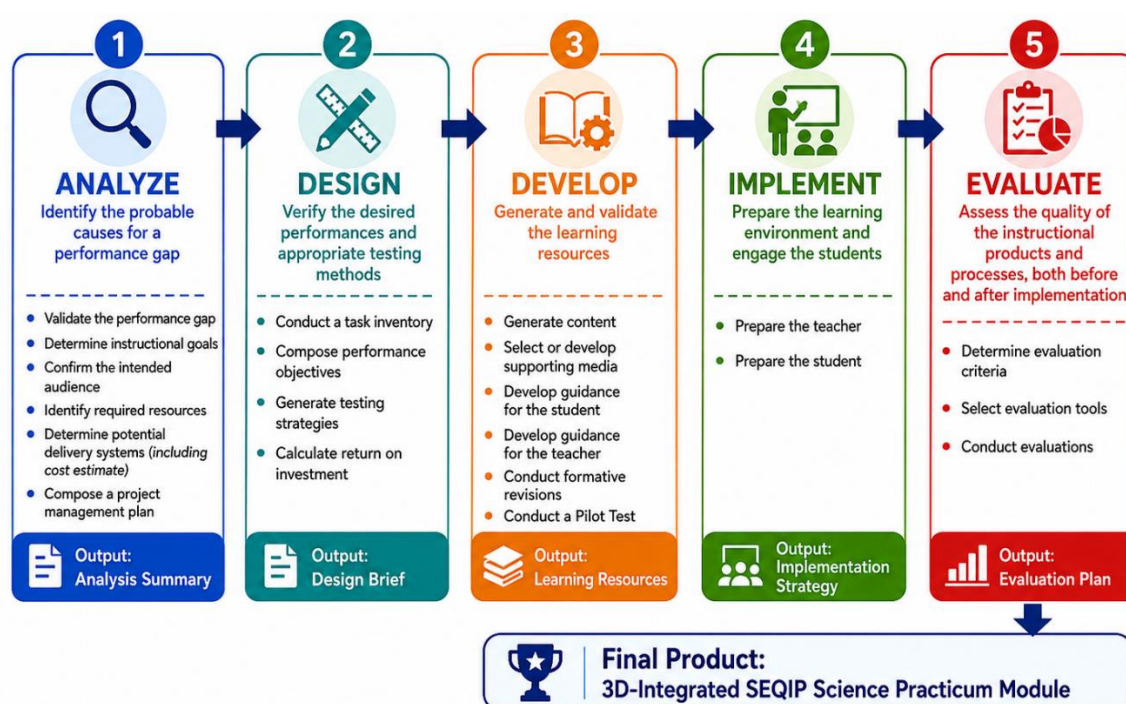


Figure 1. Research Procedure with ADDIE charts

Population and Sample

This study adopted a Research and Development (R&D) approach utilizing the ADDIE model. Within the Implementation phase, a limited field trial was executed to evaluate the module's preliminary practicality and effectiveness. The trial involved 50 sixth-grade students in Mesuji Regency, selected via a Cluster Random Sampling technique to ensure demographic representation within the local context. The sample was divided into two parallel small-scale cohorts (Experimental Group 1, $n=25$; Experimental Group 2, $n=25$). Rather than a single-group configuration, this study maintained a Multi-Class Pretest-Posttest Design across these two small groups. This methodological setup was deliberately chosen for the formative R&D trial phase to evaluate the replication and consistency of the module's initial instructional impact, thereby minimizing internal

validity threats such as history and maturation that typically undermine simple single-group evaluations.

Data Collection, Instrument and Data Analysis Techniques

The data analysis in this study was carried out through several stages to assess the validity, practicality, and effectiveness of the SEQIP-based practicum module. The validity of the modules is tested through assessments by material experts, media experts, and learning experts, which are analyzed using the feasibility percentage technique. Assessment of these aspects is very important, as explained by Reddy and Andrade, who argue that the use of evaluation rubrics in higher education can increase the transparency of assessment and ensure the quality of education (Reddy & Andrade, 2010). Each aspect is assessed based on the Likert scale, then the average percentage is calculated to determine whether the module meets the validity criteria.

The practicality of the module was analyzed through observation of learning implementation and student response questionnaires, where data was processed in the form of percentage of implementation and satisfaction level to see the extent to which the module could be applied effectively in learning. The same analysis was also carried out by Kubota et al., who emphasized the importance of practical assessment in modules to improve student learning outcomes (Kubota et al., 2021).

The effectiveness of the module is measured based on the analysis of learning outcomes and social skills of students. The improvement of learning outcomes was analyzed using the n-gain score method, which compares the results of the pretest and posttest to see the level of understanding of students before and after using the module. Furthermore, the paired sample t-test was used to determine whether there was a significant difference in learning outcomes before and after the use of the module, with a significance level of $p < 0.05$.

In addition, students' social skills were analyzed through observation based on the assessment rubric, which was then processed in the form of a percentage of achievement of social skills indicators. Social skills assessment in the context of education shows the importance of developing communication and collaboration skills, as explained by Eldredge et al., who emphasize that these skills are essential in education (Eldredge et al., 2021). The data collection instruments in this study are presented in Table 1 below.

Table 1. Data Collection Instruments

Data Types	Instrument	Subject	Analysis Techniques
Needs Analysis	Needs analysis questionnaire	Teacher Learners	Qualitative description
Product Validity	Expert Validation Test Sheet (Content, Media and Learning)	Lecturer/Expert Practitioner	Quantitative with quality interpretation

Data Types	Instrument	Subject	Analysis Techniques
Practicality	Student response sheet Implementation sheet Readability Sheet	Students, Observer (teacher)	Qualitative and quantitative descriptions with quality interpretation
Effectiveness	Learning Outcome Test Instrument Social skills observation sheet	Learners	n-gain, paired sample t test, and Effect Size Qualitative Descriptive

RESULT AND DISCUSSION

Development Results

Based on the results of the needs analysis, it is shown that the SEQIP-based practicum module is indispensable as a teaching material that not only improves the understanding of science concepts, but also develops students' social skills in the learning process. The design of the developed module refers to the results of the following needs analysis shown in Table 2 below.

Table 2. Initial design of the practicum module

No.	Results of Needs Analysis	Practicum Module Design
1	Learning methods used by teachers: lectures and discussions.	Integrate interactive and collaborative learning methods
2	73% of students have difficulty understanding the material of the solar system	Crafting more understandable material with a 3D animation-based multimedia approach
3	80% of students found the practicum modules useful	Develop practicum modules that include experimental activities and group discussions.
4	Students' social skills were low (score 75.4%).	Design activities that encourage collaboration, idea sharing, and communication between students.
5	The aspect of "sharing ideas" does not reach 60%.	Include assessment indicators for social skills in module evaluation.

The developed practicum modules require validation to ensure their quality and effectiveness before being implemented. In this context, the validation process of SEQIP-

based practicum modules involves three experts, namely material experts, media experts, and learning experts, each of whom provides an assessment of aspects of material content, media design, and suitability with learning methods. Hernawati et al. explained that the teaching materials that have been developed need to be validated by experts to ensure their quality, using the Likert scale to classify the results of the validation (Hernawati et al., 2023) In addition, Anggraini and Riskyka reported that the validation results from media experts showed a striking percentage of feasibility, which was 88.70%, which supports the claim that the results of the module's feasibility level are quite high. This encouraging result is also reinforced by other findings that show that the module with a ratio of 84% of media experts is in the very feasible category (Anggraini & Riskyka, 2023)

Based on the validation results, this SEQIP module obtained a very high percentage of eligibility, recording 94.87% of material experts, 96.21% of media experts, and 94.87% of learning experts. This shows that this module is very feasible to be used in social science learning in elementary schools, in accordance with the standards set by the education agency. According to research by Fadillah et al., the high validation results on module development show that revisions from each validator are essential before the product is tested in the field (Fadillah et al., 2022) When a module is declared to be very valid, it is ready to be implemented and provides the expected benefits (Indrasari et al., 2023)

The graph of the validation results is presented in detail in Figure 2, which largely supports the validation of each expert. As such, this module not only meets the eligibility standards but also has the potential to enhance the learning experience of students at the basic level. This kind of validation activity is in line with the approach described by Cruz and Rivera, which emphasizes the importance of thorough evaluation of teaching materials to benefit students and teachers (Cruz & Rivera, 2022).

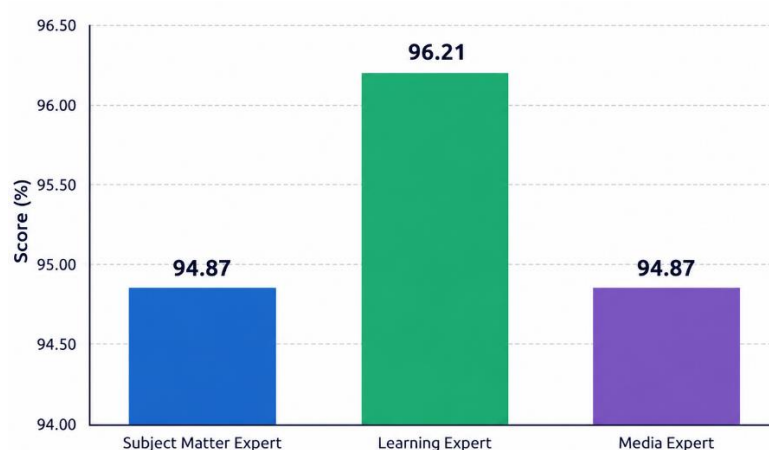


Figure 2. Expert Validation Test Average Results Diagram

Although the SEQIP-based practicum modules have met very satisfactory standards of feasibility and validity, some improvement suggestions are provided by experts to improve the quality of the modules. From the aspect of learning materials, experts

recommend the addition of acronyms that can help students memorize the names of the planets in the solar system. This is in line with the principle of content validity which states that teaching materials should be able to reflect and meet the needs of effective learning prototypes (Yusoff, 2019). In addition, observations regarding the structure and layout of the media show that some explanations of the solar system are still lacking and require improvements in punctuation, an adjustment indicated by previous research that underscores the importance of well-structured content in teaching materials for better learning. Adjustments in writing and formatting including adding periods to each answer are also indispensable to clarify the content and improve students' understanding, although there are no specific references that address this directly (Shoemaker et al., 2014)

In terms of design, validators call for improvements such as increasing the font size of the title, given that readability is one of the essential elements in the successful development of educational modules (Jamil et al., 2021) After the improvements are implemented, the SEQIP-based practicum module is declared valid and ready to use. This is in line with the study that suggests that modules that have been validated by experts show great potential in providing an active and meaningful learning experience for students (Zainudin et al., 2024). With this innovative module, it is hoped that students can be more active in learning about science and science and develop social skills that can deepen their understanding of science concepts more comprehensively (Govindasamy et al., 2024). After making improvements based on suggestions from experts, the SEQIP-based practicum module is considered valid and ready to be used in learning. With this module, it is hoped that students can be more active in learning science and science, develop social skills, and increase their understanding of science concepts in more depth.

After going through the validation stage by experts, SEQIP-based practicum modules are tested on a limited scale to assess their practicality, readability, and effectiveness in improving students' social skills and learning outcomes. This trial uses a one-group pretest-posttest design involving 10 students in grade VI of elementary school, where the learning outcomes before and after using the module are compared. Before the trial, students were given instructions on the use of the module by the teacher, then participated in SEQIP-based learning activities consisting of discussions, experiments, and reflections. The results of the limited trial are seen in Table 3 below.

Table 3. Limited trial results

Item	Components tested	Score	Criterion
1	Readability of practicum modules	90%	Very High
2	Implementation of learning by implementing practicum modules	90%	Very well executed Keep
3	n-gain trial class limited	0,57	
4	Social skills	90%	Very High
5	Student response	88%	Very High

In terms of module readability, a one-on-one test was conducted on five students to assess the ease of language, clarity of sentence structure, and harmony with good and correct language rules. The test results showed that 90% of students could understand the content of the module easily, which was categorized as very high. This is in line with research by Badarudeen and Sabharwal which emphasizes the importance of adapting educational materials for reading levels in accordance with students' abilities, in order to ensure the effectiveness of Badarudeen & Sabharwal's (2010) comprehension. In addition, in the context of readability assessment, Balakrishnan et al. also explained the existence of several measurement tools that can be used to assess the complexity of educational materials, including readability measurement tools (Balakrishnan et al., 2016) This assessment is very important to analyze the extent to which the content of a module is accessible to learners.

The implementation of learning is also observed through three main stages: introduction, core activities, and closing. The observation results show that 90% of the learning activities using modules are running very well. This achievement indicates that SEQIP-based practicum modules can be effectively applied in the classroom, as stated by Cherla et al. who show that the effectiveness of learning modules is not only measured from academic outcomes but also from how they are applied practically in the learning environment (Cherla et al., 2012).

The effectiveness of the module was measured through the comparison of pretest and posttest results as well as observation of students' social skills. Research by Fortman and Haines emphasizes that the measurement of learning outcomes must be carried out with valid tools in order to meet the needs of accreditation and justification of funding for educational programs (Fortman & Haines, 2011) The results of the analysis showed that there was an increase in learning outcomes with an n-gain value of 0.57, which was included in the medium category. Meanwhile, students' social skills also increased significantly with an observation score of 90%, which was categorized as very high. In addition, the students' response to this module was very positive, with 88% of students stating that they felt helped and more motivated in learning using this module. These results are in line with Wong and Levi's opinion that well-designed modules can increase student engagement and motivation (Wong & Levi, 2016).

After passing the limited trial stage, the SEQIP-based practicum module was tested in a major field trial to assess its effectiveness in improving learners' learning outcomes and social skills. This trial was carried out in two experimental classes at SDN 8 Way Serdang and SDN 9 Way Serdang, with each class totaling 25 students. The trial stage begins with the provision of a pretest to measure the initial understanding of students before using the module. Furthermore, students learn to use SEQIP-based practicum modules in discussions, experiments, and reflection activities that are arranged based on the SEQIP approach. After learning is complete, students are given a posttest to see the improvement of their learning outcomes. The results of the analysis showed that there was a significant improvement in students' learning outcomes after using the module. The average n-gain value in trial class 1 was 0.59 and in trial class 2 was 0.57, both of which were in the medium category. According to Anjani et al., the use of appropriate learning modules can

significantly improve learning outcomes and students' understanding of the material being taught (Anjani et al., 2018).

In addition to learning outcomes, the effectiveness test also looks at the development of students' social skills through observation. The observation results showed that the students in both experimental classes experienced an improvement in social skills, but the specific data on the average score of 3.72 and the percentage of 92.9% need further verification to support this statement. Padwa and Erdi emphasized that the modules developed can serve to improve students' motivation and interpersonal skills in the context of learning (Oksa & Soenarto, 2020) Improvements in aspects of groupwork, the courage to express opinions, and share ideas during discussions are also recognized as important elements in effective education (Alvi & Yerimadesi, 2022).

Based on the results of the hypothesis test using paired samples t-test, a significance value of 0.000 ($p < 0.05$) was obtained, which means that there was a significant difference between the pretest and posttest results. Thus, this SEQIP-based practicum module can be concluded to be effective in improving student learning outcomes. Overall, the results of the main field trials show that this module not only improves students' academic understanding but also develops their social skills, making it an effective and feasible teaching material to be applied in social science learning in elementary schools (Purwasih et al., 2022).

DISCUSSION

Science learning in elementary schools has its own challenges, especially in improving social skills and student learning outcomes. In this study, a practicum module based on SEQIP (Science Education Quality Improvement Project) was developed which aims to create more interactive, collaborative, and experiment-based learning. According to Freeman et al., the active learning approach is very influential in improving student learning outcomes in STEM fields, which includes improved test scores and better understanding of concepts (Freeman et al., 2014). This module is expected to be a solution to the low social skills of students and increase the effectiveness of Natural and Social Sciences learning. This is in line with research by Wadi et al., which noted that the application of collaboration in learning can provide a better experience in teaching and increase collaboration among students, although the focus is more on character education in a multicultural context (Wadi et al., 2020).

The results show that this module has been well validated by experts, proven practical in its application, and has high effectiveness in improving learning outcomes and social skills of students. Research by Lam and Siew shows that increased interaction between students and teachers in collaborative classroom settings positively affects students' attitudes towards science learning (Lam & Siew, 2024) In addition, experiment-based and collaborative learning is expected to increase student participation and involvement in the learning process. However, although Shaer et al. discuss collaboration and learning involving reflection, their research focuses on the exploration of genomic data and may not be fully relevant to the context of science education (Shaer et al., 2012).

Validity of SEQIP-Based Practicum Modules

Module validation is carried out by three experts covering aspects of content/material, language, and media design. The validation results show that the SEQIP-based practicum module obtained a very high score. According to Utami and Prodjosantoso, content validation by experts is very important in assessing the feasibility of teaching modules, which emphasizes that high validation results reflect the suitability of the modules with predetermined criteria (Utami & Prodjosantoso, 2024) Based on these results, the module is declared very feasible to be used in social science learning in elementary schools, in line with research by Novayana et al. which confirms that well-designed teaching materials can support the learning process (Novayana et al., 2021).

Validation of material aspects shows that the module has been in accordance with the applicable curriculum, with content designed to improve understanding of science concepts through hands-on experiments and interactive discussions. This is in line with the theory of constructivism, which states that students will understand a concept better if they are actively involved in the learning process (Setyadi & Saefudin, 2019) Seruni et al. also emphasized that the systematic preparation of materials, from concept introduction to social skills evaluation, strongly supports the strengthening of integrated aspects of education (Seruni et al., 2019).

From the language aspect, the module is considered easy to understand and in accordance with the level of cognitive development of elementary school students. The use of communicative language and the presentation of interesting information make this module more acceptable to students. Research by Doblack et al. shows that the presentation of information using a combination of text and visuals can improve students' comprehension, although the results focus more on the use of interactive media (Doblack et al., 2011). However, there are some suggestions from validators regarding the use of scientific terms, where it is recommended to add additional explanations or visual illustrations to make it easier for learners to understand, which is also related to effective module design methodologies.

Meanwhile, in terms of design and appearance, the module received a very high rating, mainly because of its visual, attractive, and interactive presentation. The use of illustration images, diagrams, and QR codes connected to digital media is an added value that makes this module more innovative compared to conventional teaching materials. This is in line with research that states that learning that uses a combination of text and visuals is more effective in improving conceptual understanding compared to text alone (Doblack et al., 2011).

Practicality of Use

The practicality of the module is tested through observation of the implementation of learning and student response questionnaires. The observation results show that 90% of the learning stages using this module are going very well, which means that teachers and students can easily use the module in teaching and learning activities. This is in line with research by Husein et al. which shows that the use of interactive multimedia can increase

the effectiveness of learning (Husein et al., 2017). In addition, students' responses to the use of modules were very positive, with 86% of students feeling helped and more motivated in learning. They stated that this module is easy to use, fun, and makes it easier for them to understand the concepts taught. Research by Hasnawiyah and Maslena also shows that the use of interactive learning media can increase student participation and understanding of concepts (Hasnawiyah & Maslena, 2024). This shows that the use of SEQIP-based modules not only increases student engagement in learning, but also makes the learning process more interactive and meaningful.

This research is also in line with the theory of active learning, which emphasizes that students will better understand concepts if they are actively involved in the learning process, either through discussion, exploration, or experimentation. According to Febriansyah et al., modules that integrate collaborative and exploratory activities provide opportunities for learners to think critically and work in groups, which are important social skills for their future (Febriansyah et al., 2023).

Effectiveness in Improving Learning Outcomes and Social Skills

The effectiveness of the module was tested through analysis of learning outcomes (n-gain test) and observation of students' social skills. The results of the paired sample t-test showed that there was a significant difference between the results of the pretest and posttest of the students, with a significance value of 0.000 ($p < 0.05$). This shows that the module is effective in improving student learning outcomes. Previous research by Dewi and Primayana supports this statement, where they found that the use of learning modules with context can significantly improve students' conceptual understanding (Dewi & Primayana, 2019).

From the results of the n-gain test, it is known that trial class 1 obtained an average of 0.59, while trial class 2 obtained an average of 0.57, both of which are in the medium category. This shows that the use of modules contributes positively to improving students' understanding of the material being taught, in accordance with the findings of Dewi and Primayana who noted significant differences in concept understanding between students who use learning modules with good context settings (Dewi & Primayana, 2019).

A critical novelty emerging from this formative evaluation is the rapid transformation of specific student social skill indicators through targeted instructional engineering. Baseline needs assessments indicated that students' capability in 'sharing ideas' was alarmingly low, stagnating below the 60% threshold due to conventional, teacher-centered routines that offered limited space for collaborative peer discourse. The introduction of the 3D-integrated SEQIP module during this limited trial successfully reversed this trend. Because abstract spatial dynamics of the Solar System cannot be fully resolved individually by elementary students, the module's 3D-assisted tasks inherently demanded collective visualization and peer consultation. Students were scaffolded to look at the 3D models together, negotiate spatial relationships, and coordinate group experimental steps. Consequently, post-intervention assessments captured an outstanding leap, with overall social skills surpassing the high-quality threshold at 92.9%. This empirical evidence from the limited trial demonstrates that science modules should move away from isolated

cognitive tasks and adopt socio-technological frameworks where concept mastery and collaborative character development are mutually reinforcing. This improvement in social skills may also be in line with research by Sintyah and Andromeda, which explains that the use of integrated inquiry-based e-modules can develop students' social skills through intensive interaction in learning (Sintyah & Andromeda, 2024). Students who were previously less active in discussions began to be more confident to speak, participate in group work, and dare to express their ideas during learning.

This improvement supports previous research that states that project-based learning and experimentation can improve learners' social skills because it involves more intensive interaction. This module not only focuses on academic improvement but also helps learners develop teamwork, communication, and problem-solving skills. The findings of Resy et al. suggest that a project-based approach can significantly improve groupwork abilities among students (Resy et al., 2021).

Based on the results of this study, it can be concluded that the SEQIP-based practicum module can be an effective alternative teaching material to improve students' social skills and learning outcomes in learning sciences. This module has proven to be valid, practical, and effective, so that it can be applied in learning broadly. For further implementation, it is recommended that this module be further developed by integrating more interactive digital technologies, such as experimental videos, digital simulations, or augmented reality. In addition, this research can be expanded by conducting trials on a larger scale in various schools with different characteristics of learners, to ensure the effectiveness of the modules in various learning contexts.

Several limitations must be acknowledged. First, the evaluation of the developed module was bounded within a limited field trial stage involving 50 sixth-grade students in Mesuji Regency, Lampung. Therefore, the quantitative findings regarding learning outcomes and social skills reflect preliminary efficacy rather than widespread generalizability across highly diverse urban school systems. Second, as an R&D study in its formative evaluation phase, a large-scale quasi-experimental implementation with an external control group was not yet conducted. Future research should transition from this limited trial into a full summative evaluation phase, employing large-scale Randomized Controlled Trials (RCTs) across broader educational jurisdictions to validate the longitudinal sustainability and global scalability of this 3D-integrated module.

CONCLUSION

This study shows that SEQIP-based practicum modules are valid, practical, and effective in improving students' learning outcomes and social skills. Expert validation shows a very high level of eligibility, with a score of 94.87% to 96.21%. This module is also considered practical, with 90% of the implementation of good learning and 86% of positive responses from students. In terms of effectiveness, there was a significant increase in learning outcomes, with n-gain values in the medium category (0.57–0.59), and an increase in social skills up to 92.9% (very high category).

However, this study has some limitations. The module was only tested on Solar System material and applied in two schools, so the results cannot be generalized more widely. The trial was carried out for a limited time, and did not consider the individual factors of students in depth. In addition, the module is still print-based with little integration of digital technology, and has not been compared to other learning methods such as PBL or flipped classroom. And then, for developing countries and global educational contexts facing limitations in high-cost laboratory infrastructure, this research offers a highly reproducible blueprint. It proves that standardized science toolkits (such as SEQIP) can be significantly modernized without expensive replacements by systematically fusing tactile group experiments with scalable, low-cost 3D visualization aids. Ultimately, this framework provides a practical model for elementary teachers worldwide to cultivate future-ready students who possess both strong scientific literacy and 21st-century social-collaborative competencies.

For further development, modules should be expanded to other materials, tested on a larger scale, and integrated with interactive technologies such as e-learning or digital simulation. Further research also needs to analyze individual factors of learners and compare this module with other learning methods. With further development, this module can become an innovative teaching material that has wider benefits in improving the quality of science and science learning in elementary schools.

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