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Project-Based Learning Model in Improving Students' Learning Outcomes in Integrated Science Classroom

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Abstract

The teaching system and implementation carried out in the learning process sometimes create different interests and levels of understanding in each student. This study analyzed integrated science learning with the project-based learning (PjBL) model to improve student learning outcomes. The type of experimental research is designed using a one-shot case study design. The sample of this study involved 17 students of the Science Education Masters Study Program. They were selected by using total random sampling. The data collection method was observation by using an observation sheet instrument for students' abilities in producing integrated concept products between basic competencies in science studies that are compiled through the RPP device starting from designing products, compiling products, and the quality of the products produced. The research data was analyzed descriptively to assess students' abilities in designing product planning, compiling RPP products, and the quality of the product results. The results of the study showed that the project-based learning model was able to improve students' integrated science learning outcomes with very good quality. Students' abilities in designing and compiling products and the quality of the RPP products were very good. The implications of this study are expected to improve student learning outcomes by implementing an integrated learning model.

Keywords: Integrated Science, Project Based Learning, Learning Outcomes.

Introduction

Natural science is a compulsory subject taught by educators in elementary and junior high schools which combines physics, chemistry, and biology holistically (Nur Jannah, 2020; Putra & Wulandari, 2021). This subject learns an object by obtaining the phenomenon symptom holistically. The symptom and phenomenon are the object or problem in natural science in the form of inseparable concepts. It becomes the reason for teaching natural science in a holistic way (Çinar et al., 2016; Wan & Lee, 2017). The purpose is to build the students' mindset to be holistic. A holistic mindset can be a foundation for the student›s life skills in solving a problem in their daily life (Hanik, 2020; Maulidya et al., 2014). Through the natural science subject, students can gain a direct learning experience in strengthening their ability to find, save, and implement the concepts that they have learned. The way of designing the learning process significantly influences the meaning of students' experience (Linda et al., 2021; Yudiyanto et al., 2020). The learning experience shows a relation between conceptual aspects becoming an effective learning process. The conceptual relation that has been learned from the view of natural science forms a cognitive schema leading students to gain a complete natural science based on the real-life context and phenomenon reflected through an integrated natural science (Afriana et al., 2016; Astiti et al., 2020).

However, in reality, most of the students are less active and interested in the learning activities causing an unoptimized learning process. The teaching and learning processes that are conducted create different interests and understanding levels for each student (Permana P & Manurung, 2020; Sarini & Selamet, 2019). Another problem is the lack of interaction and cooperation between students leading to improper problem-solving skills in the natural science learning process. In addition, the level of activity is very low, only a few students actively participate in the learning process, and the rest are just silent (Bua et al., 2022; Sulistiani et al., 2022). This problem certainly affects the process and learning outcomes of the students if it still continuously happens. Therefore, lecturers as teachers are supposed to have effective learning

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strategies and models to foster motivation and science learning outcomes for students. An integrated science course is listed as one of the courses that is necessary to be studied by the students in the Science Education Master Program in the Postgraduate Program at Universitas Pendidikan Ganesha. It is a new course in the 2021 curriculum which is only conducted in the even semester of 2021/2022. The expected learning outcomes in integrated science courses are students' ability to integrate science through curriculum integration models in the form of integrated products. The integrated learning model is one of the curriculum implementation models that is recommended for application at educational levels (Eryani, 2021; Muliani, 2021). This learning model is an essential learning approach that allows students, both individually and in groups, to actively search for exploring and discover holistic and authentic concepts and principles.

Integrated natural science is implemented through project-based learning (PjBL) concerning the creation of a project covering the process of designing and creating the project into an integrated natural science product. There are ten integration models curriculum, such as; cellular, nested, connected, sequenced, shared, webbed, threaded, integrated, immersed, and networked. From those curriculum integration models, three integration models are relevant to be developed in the natural science learning process conducted in Indonesia. Those are connected, webbed, and integrated. Connected implements the basic competency relating to other's basic concepts. The webbed model teaches several related basic themes. The integrated model teaches several basic competencies that overlap or intersect (a specific theme or project is used if it is necessary). This recommended integration model is applied in integrated science learning through project-based learning. The resulting product is a lesson plan with integrated science through several basic competencies and their accessories such as students' worksheets, assessment instrument grids, and measuring instruments (Bock et al., 2018; Sukmasari & Rosana, 2017). The results of integrated science learning through project-based learning are obtained from students' ability to design products, compile products, and the quality of products produced in an integrated manner through integrated science integration with a connected/webbed/integrated integration model.

Several findings show that project-based learning assisted with virtual media is effective in improving physics students' creativity (Gunawan et al., 2017; Izzah et al., 2021). The learning media-based project-based learning is effective in improving students' science skills and creativity (Kusumaningrum & D, 2016). Project-based learning improves students critical thinking skills in solving the problem (Hanif et al., 2019; Jewpanich & Piriyasurawong, 2015; Nugraheni, 2018). Students' creativity is improved through the use of project-based learning models in creating natural science learning media in the form of pop-up books (Mustika & Ain, 2020; Yamin et al., 2020). Along with the curriculum implementation suggested for the educators in all educational levels particularly in natural science, it is appropriate to apply integrated science in the natural science in the learning process. Therefore, this study is conducted to find out the effect of project-based learning in improving students' learning outcomes in an integrated science learning process.

Method

Research Design

The current study adopted a quantitative approach in the form of an experimental research design by applying a one-shot case study design. This kind of model was also recognized as a one-group posttest-only design in which the research sample is only obtained in a group without any experimental group. This model is illustrated in Figure 1.

Treatment	*Observation*
X	O

Figure 1. One-Shot Case Study Design

Note:

X: a group of students treated with a project-based learning model

O: observation after the treatment

A group of students who were selected as the research sample was at first taught by using a project-based learning model in which it was a treatment given before they were observed. Then, the observation was conducted to find out students' learning outcomes.

Research Sample

A total sampling technique was used for selecting the research sample of this study since the population was less than 100 participants. The population of this study was the postgraduate students in the Science Education Master Program at Universitas Pendidikan Ganesha. There were only 17 students who were taken as the participants of this study.

Data Collection Method

The observation was conducted as a technique of collecting the data for the present study. The students' learning outcomes were gained from obtaining the students' skills in designing lesson plans, arranging the product, and the quality of lesson plans. Those were obtained by using an observation sheet. Product design ability indicators included students' ability to determine the material to be linked or integrated, create a matrix or relationship chart between concepts in basic competencies based on the theme; and formulate integrated science learning indicators. Students' ability to compile products was not observed directly because the learning process was conducted online. Therefore, students' ability to compile products was observed from indicators of students' ability to present products, master the lesson plan material that was compiled in an integrated manner; and the ability to convey scientific arguments to answer questions. By having these three abilities as a basis, students could compile the products.

Data Analysis

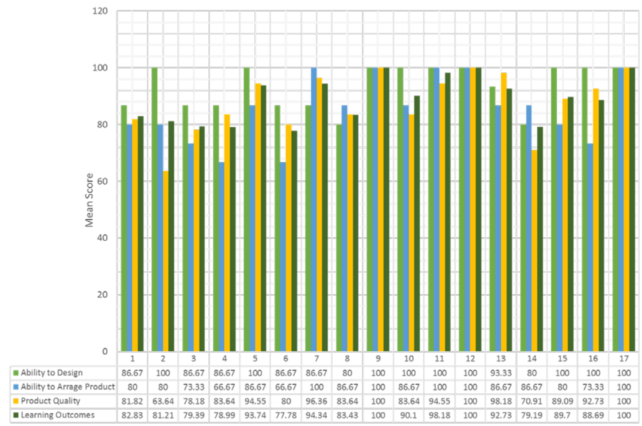
Data on student learning outcomes, student abilities to design products, compile products, and the quality of RPP products produced were obtained from observation data on product designs made, compiling products based on presentation results, and product quality for 17 students. Furthermore, the data obtained were analyzed descriptively. Scoring of each indicator with a range of 1 to 5, then converted to a scale of 100. Integrated science learning outcomes data were obtained by adding up the three student ability scores (design ability score, product composition score, and product quality score produced), and average analysis. Integrated science learning with the project-based learning (PjBL) model was stated to be able to improve student learning outcomes if the average score of student learning outcomes was in the minimum good category. The qualification of students' integrated science learning outcomes, the ability of each student to design products, compose products, and the quality of products produced were seen from the qualification criteria in Table 1.

Findings

The results of the descriptive analysis of the average integrated science learning outcomes of students in terms of the results of measuring the ability to design science learning tools, arrange products, and the quality scores of science learning tool products are presented in Figure 1.

Table 1.: The Kriteria of Learning Outcomes Qualification, Designing Ability, Arranging the Product, and Product Quality

No.	*Scale*	*Qualification*
1	85-100	Very Good
2	73-84	Good
3	61-72	Average
4	40-60	Poor
5	0-39	Very Poor



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ability to Design	86.67	100	86.67	86.67	100	86.67	86.67	80	100	100	100	100	93.33	80	100	100	100
Ability to Arrage Product	80	80	73.33	66.67	86.67	66.67	100	86.67	100	86.67	100	100	86.67	86.67	80	73.33	100
Product Quality	81.82	63.64	78.18	83.64	94.55	80	96.36	83.64	100	83.64	94.55	100	98.18	70.91	89.09	92.73	100
Learning Outcomes	82.83	81.21	79.39	78.99	93.74	77.78	94.34	83.43	100	90.1	98.18	100	92.73	79.19	89.7	88.69	100

Fig. 1: Average Score for Each Ability and Learning Outcomes

Figure 1 shows the results of the learning outcomes of the seventeen students. Student 1 achieves a score of 82.83. Student 2 achieves a score of 81.21. Student 3 achieves a score of 79.39. Student 4 achieves a score of 78.99. Student 5 achieves a score of 93.74. Student 6 achieves a score of 77.78. Student 7 achieves a score of 94.34. Student 8 achieves a score of 83.43. Student 9 achieves a score of 100. Student 10 achieves a score of 90.10. Student 11 achieves a score of 98.18. Student 12 achieves a score of 100. Student 13 achieves a score of 92.73. Student 14 achieves a score of 79.19. Student 15 achieves a score of 89.70. Student 16 achieves a score of 88.69. Student 17 achieves a score of 100. From the figure, it can be seen the lowest average is 77.78 and the highest average is 100.

The average of integrated science learning outcomes is categorized as very good qualifications with a score of 88.84. These results show that science learning integrated with the project-based learning model can improve student learning outcomes. The percentage of qualifications for integrated science learning outcomes for each student is presented in Figure 2.

Figure 2 shows that integrated science learning outcomes are in the good and excellent categories individually. These results show that science learning integrated with the project-

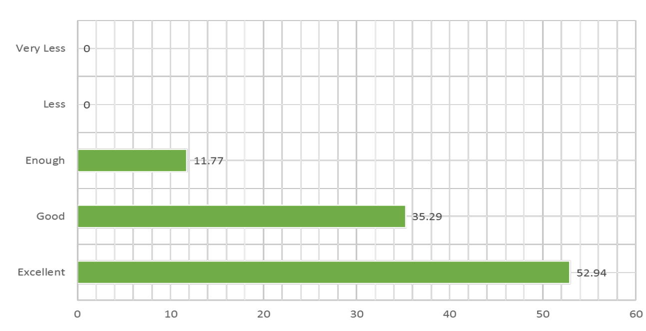


Fig. 2: Integrated Science Learning Outcomes

based learning model can improve the students' learning outcomes. Students' ability to design science learning products in an integrated manner through the connected/webbed/integrated model has three components to be assessed, including the ability to determine the material that will be linked/integrated, the ability to create a matrix or chart of relationships between concepts, in the basic competencies with a theme or topic under the model integration is applied, and the ability to formulate integrated science learning indicators under the integrated model that is applied. Based on descriptive analysis, the average ability of product design students is 93.33 with a very good qualification and the average for each student in designing science learning is presented in Figure 3.

Figure 3 shows the qualification percentage in designing products is 88.24% in the excellent category, and 11.76% in the good category. Then, the ability to design products in terms of each indicator measured is shown in Table 2.

Table 2 shows the results of the descriptive analysis, it shows that the results for indicators 1 (determining materials) and 2 (creating a relationship matrix) are very good for all students. However, for indicator 3 (formulating science learning indicators), there are 2 students (11.76%) in the poor category. A student's ability to compose a product is assessed by the student's ability to present the product, master the materials, and convey scientific arguments by answering questions. It is because by having these three abilities as a basis, students can compose a product such as a lesson plan. The results of the descriptive analysis show that the average ability of students to compose products is 85.49 with very good qualifications. Then, the average percentage of student qualifications for preparing integrated science learning products for each student is presented in Figure 4.

Figure 4 shows the percentage of student qualifications for composing products is 58.82% in the excellent category, 29.41% in the good category, and 11.76% in the fair/enough category. The ability to compose the products in terms of each indicator is presented in Table 3.

Table 3 shows that indicator 1 (determining materials) is 100% with an excellent qualification. For indicators 2 (creating a relationship matrix), and 3 (formulating indicators), the results are various in terms of the average they were included with an excellent qualification. The quality of lesson plans produced by students is measured from 11 indicators.

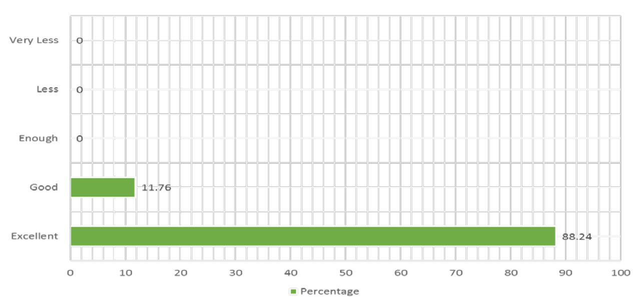


Fig. 3: Students' Ability to Design Product

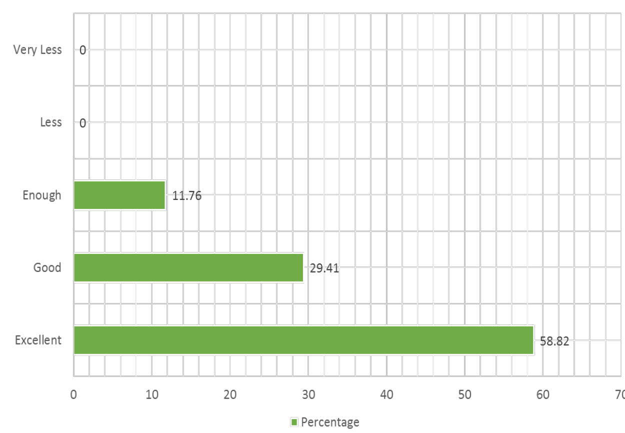


Fig. 4: Students' Ability to Compose the Science Learning Device Product

Table 2: Qualification Percentage in Designing Integrated Learning Device Product

	Indicators		
	Determining materials to be integrated	Creating a relationship matrix between concepts and themes in the basic competencies	Formulating indicators of science learning in an integrated manner
Qualification	(%)w	(%)	(%)
Excellent	100	100	52.94
Good	0	0	5.88
Moderate	0	0	29.41
Poor	0	0	11.76
Very Poor	0	0	0

The average quality of student science learning device products is 87.70 with an excellent qualification. The average percentage of student qualifications for composing products is presented in Figure 5.

Figure 5 shows that the quality of the product is 56.86% in the excellent qualification, 17.65% in the good qualification, 21.57% in the moderate (enough) qualification, and 3.92% in the poor (less) qualification. The quality of the science learning device products from each indicator is presented in Table 4.

Table 4 shows the overall quality percentage of learning products obtained, namely 58.82% with an excellent qualification, 29.41% with a good qualification, and 11.76% with a moderate qualification. There are 11 indicators for the quality of learning products, namely 1) the overall identity of 88.24% with an excellent qualification and 11.76% with a good qualification. This indicates that all students can write their identities correctly. The suitability of the competency achievement indicators with basic indicators and integration into these indicators is overall quite good but there are still 35.29% in the moderate category and even 11.76% in the poor category. The third indicator indicates that the majority of students can create learning objectives based on the indicators, namely 70.59% with an excellent qualification but there are still 17.65% who have sufficient qualification. It also indicates that there are still students who have not been able to write learning objectives correctly. The fourth is learning material, in this indicator, writing learning material must contain factual, conceptual, and procedural material. Based on the results of data processing on this indicator, there are still 35.29% of students who have a very poor qualification in writing learning materials. It shows that there are still many students who have not been able to write learning material referring to the indicators of the learning material.

Then, the fifth is the learning method. In this indicator, the average student can differentiate between approaches, methods, and models. It shows that 76.47% of students are in the excellent category, although there are still 5.88% of

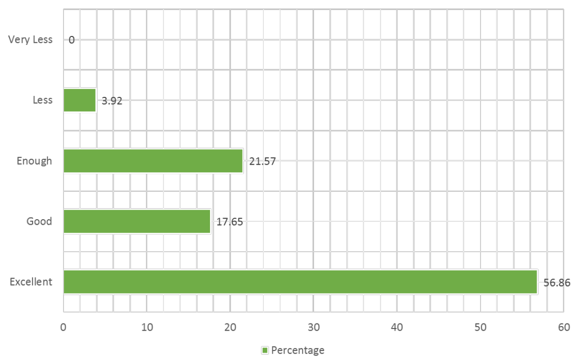


Fig. 5: Quality of Science Device Learning Product

Table 3: Qualification in Composing Integrated Learning Device Product

	Indicators		
	Determining materials to be integrated	*Creating a relationship matrix between concepts and themes in the basic competencies*	*Formulating indicators of science learning in an integrated manner*
Qualification	*(%)*	*(%)*	*(%)*
Excellent	100	35.29	35.29
Good	0	29.41	23.53
Moderate	0	29.41	35.29
Poor	0	5.88	5.88
Very Poor	0	0	0

Table 4: Quality of Science Learning Device Product of Each Indicator

	Product Quality of Each Indicator (%)										
Qualification	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Excellent	88.24	47.06	70.59	52.94	76.47	94.12	64.71	82.35	82.35	64.71	70.59
Good	11.76	5.88	11.76	5.88	17.65	5.88	29.41	11.76	11.76	0.00	0.00
Moderate	0.00	35.29	17.65	5.88	0.00	0.00	5.88	5.88	0.00	0.00	23.53
Poor	0.00	11.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.88	5.88
Very Poor	0.00	0.00	0.00	35.29	5.88	0.00	0.00	0.00	5.88	29.41	0.00

students in the very poor category. The sixth is learning media. Overall students are in the excellent and good categories. It shows that there are no problems related to the use of media among students. The seventh is learning resources, in this indicator, there are still 5.88% of students who do not have an understanding regarding the learning resources. The eighth indicator is learning steps, overall 82.35% of students are in the excellent category. This indicates that in the process of learning stages, students do not experience problems. In the ninth indicator, learning outcomes assessment grids, there are still 5.88% of students in the very poor category of the ten validation sheets, 5.88% of this indicator is in the poor category and 29.41% is in the very poor category. Although 64.71% is in the excellent category. However, seeing that the percentage of the very poor indicator is still very high, it shows that students still do not have an understanding of the importance of approval by the school principal or officials regarding learning tools. The eleventh is completed attachments totaling 5.88% are still in the poor category and 23.53% are in the sufficient category, although 70.59 are in the excellent category, meaning that there are still many students who don't care about attachments such as students' worksheets in the learning process.

Discussion

The first finding is students' ability to design integrated science learning products through integrated science learning with project-based learning. The ability to design products is reviewed from each component which is assessed, especially in the activity of determining the material that is linked/integrated (connected model), determining KD (Basic Competencies) as the main material, and KD that is linked to the KD of the main material. In the Webbed model: determining several KDs that are related through a unifying theme. In the Integrated model, determining intersecting topics/concepts seen from the KD which the concepts overlap), and the stage of creating a matrix or chart of relationships between concepts in the KD with themes or topics following the integrated model is applied in groups and then discussed through class discussion so that after the discussion is revised, students get the maximum score, namely very good (each individual's score is 5). Integrated-type science learning is an integrated science learning model that represents various scientific disciplines (cross-disciplinary) (Bua et al., 2022; Ramadhani et al., 2021). The characteristics of this integrated type are an integration model that can combine all disciplines in science by choosing priorities from each discipline, can find overlapping skills, concepts, and attitudes from all these disciplines, and requires a team that can develop a good and appropriate curriculum (Rahma & Agustin, 2021; Sidiq et al., 2021). This integrated type not only invites students to master concepts in an integrated manner but also develops skills and attitudes during learning. The integrated model teaches several KDs whose concepts overlap (if certain themes/projects need to be used).

The success of integrated learning will be more optimal if the plan considers the conditions and potential of students (interests, talents, needs, and abilities). Competency standards and basic competencies must be listed in the Competency Standards (SK) and Basic Competencies (KD) for science subjects. (Sidiq et al., 2021). Educators should develop SK and KD in combination with related material so that students gain meaningful concepts and understanding and gain direct experience. The findings show that the GPA described is lower than the KD requirements and the concepts have not been integrated. This shows that not all students can describe indicators of competency achievement in an integrated manner according to the integrated KD material. To overcome this, science learning should be presented in an integrated manner with themes that are interesting and not boring. Integrated learning presents applications/applications of the real-world experience in everyday life that are close to students, thus facilitating understanding of concepts and improving and increasing students' learning motivation (Albab, 2020; Persada et al., 2020; Taqiya et al., 2019).

This integration with project-based learning provides an opportunity to design the expected product. It is supported by Sastradiharja and Febriani (2023) in which the model provides challenging activities that can guide students in designing, solving, and making decisions during the learning process. It indicates that the model guides students to design the product properly in the learning process. Also, Halimatusyadiyah et al. (2022) and Khairi and Shava (2024) add that the learning model allows students to collaborate with their friends to solve problems. It shows that students can design their product in a team which can be effective for them to gain complex understanding. Furthermore, Guo et al. (2020) reveal that the model emphasizes knowledge construction. Students can construct their knowledge through active activities involving their participation in exploring more information from different sources. Thus, it has been proven that the integration of project-based learning leads students to have the ability to design the product in the learning process.

The second finding deals with students' ability to dev1zelop or compose integrated science learning products through integrated science learning with project-based learning. The results of student assessments in preparing products are assessed from the student's ability to present the product, master the material, and convey scientific arguments to answer questions because having these three abilities is the basis for students having the ability to prepare products. If it is further analyzed, students' abilities for each indicator of ability in preparing products, namely presenting the product, mastering the material, and conveying scientific arguments and answering questions, namely the ability to determine the material to be linked/integrated is in the excellent category, meaning that all students can determine and integrate the material very well. In the component of making a matrix of relationships between concepts in KD with themes, the results of student work are in the poor category, this indicates that not all students can make a matrix between concepts in KD and themes well. Mapping matrices should be made about each other, this can be made in the form of a chart or theme network matrix that shows the relationship between themes, basic competencies, and indicators for each subject (Khoirunnisa et al., 2020; Tiarini et al., 2019). In the component of formulating indicators for integrated science learning, some students are categorized into poor categories. It shows that some students still have not been able to formulate indicators for integrated science learning. Competency achievement indicators are used as markers of basic competency achievement marked by changes in behavior that can be measured. The development of competency achievement indicators is tailored to the characteristics of students, subjects, educational units, and regional potential and formulated using measurable operational verbs. GPA is formulated in sentence form using operational verbs. The operational verb referred to here is an activity carried out by students to demonstrate their competencies (Ariani, 2020; Depiani et al., 2019). Based on the basic competencies and sub-skills that have been selected, each indicator is formulated based on writing rules including the audience (students), behavior (expected behavior), condition (media/tools), and degree (level/number) (Rohmadheny & Laila, 2020).

The integration of project-based learning contributes to the ability of students to compose or develop the product since all students can determine the materials to be integrated and many students can create relationship matrices and formulate indicators. As stated by Nugraha et al. (2023), project-based learning requires students to have a project to be developed individually or in a team. It indicates that the learning model trains students' ability to develop the product through the provision of the project. In line with this condition, Nabanan et al. (2023) also, add that the learning model guides students to produce some products as the result of their learning. Furthermore, Arlina et al. (2023) add that the learning model of the project learning gives complex tasks to train students' ability to develop products since they follow the activities to finish the product. In short, the integration of project-based learning can influence students' abilities in developing the product.

The third finding is the quality of integrated science learning products produced through integrated science learning with project-based learning. Judging from the percentage of student qualifications for compiling the product as a whole, the percentage of learning product quality shows that the average data is 58.82% excellent qualifications, 29.41% in the good category, and 11.76% in the sufficient category. There are 11 indicators for the quality of learning products, namely the overall identity and how many are in the good category. This indicates that all students can write their identities correctly. The suitability of the competency achievement indicators with KD and integration into these indicators is overall quite good but there are still some in the sufficient category or even in the poor category. This is in line with the ability to design and compose products, but there are still problems related to students' ability to adapt KD to indicators. Basic competencies from several subjects that are possible to be taught are integrated according to a unifying theme (Diawati et al., 2019; Kurnia et al., 2021; Sudirman et al., 2020). Indicators are markers of achieving basic competencies characterized by measurable changes in behavior which include: attitudes, knowledge, and skills (Sudirman et al., 2020). Indicators are developed based on the characteristics of students, subjects, educational units, and regional potential and they are formulated in measurable or observable operational verbs. Indicators become a basis for designing the assessment tools (Yugakisha & Jayanta, 2021).

Learning objectives, in this indicator, the majority of students can make learning objectives based on the indicators, which are in the excellent category, but there are still some who are in the sufficient category. This also indicates that there are still students who have not been able to write learning objectives correctly. In making learning objectives, they must be formulated based on writing rules including the audience (students), behavior (expected behavior), conditions (media/tools), and degree (level)/amount) (Rohmadheny & Laila, 2020). The presented learning material must contain factual, conceptual, and procedural material. Based on the results of data processing on this indicator, there are still students who are in the very poor category in writing learning material. This indicates that there are still many students who have not been able to write learning material that refers to the indicators for writing learning material. On average, students can differentiate between approaches, methods, and models. There are no problems related to media use among students. Students who do not get an understanding of the learning resources. Learning resources deal with all sources to ease students by providing learning facilities. Learning sources include messages, people, materials, equipment, techniques, and environment/setting (Ghofur & Wahjoedi, 2018; Sumiharsono & Hasanah, 2017). There are still students who do not understand the importance of creating grids in assessing learning outcomes. In theory, grid writing functions to align the set of questions, so this will also make the evaluation process easier. A good grille must meet the requirements. The grid must be able to represent the contents of the syllabus/curriculum or material that has been taught accurately and proportionally. The components are explained clearly and are easy to understand. Questions about the material can be asked when students want to ask about it (Astuti et al., 2021). There are still many students who do not care about applications such as students' worksheets. Research results show that the learning process using a project-based student worksheet is better than without using a project-based student worksheet. By using project-based student worksheets, student learning is more effective and conducive. The increase in learning outcomes in the experimental class occurred because students had begun to show interest and enthusiasm when working on project-based student worksheets (Aisyah Aini et al., 2019; Aldilha Yudha et al., 2019).

The integration of project-based learning influences the quality of the product since the learning model provides space for students to think creatively and critically to solve the problem. It is supported by Anggraini and Wulandari (2020) and Astri et al. (2022) who reveal that the learning model leads students to have critical and creative thought. This is because students experience activities that require them to use their creativity and critical thinking. In addition, Paramita et al. (2023) and Zhou (2023) add that the provision of the project in the learning model leads to the student's creativity. Students are actively involved in finishing the project given in the learning process so that they can use their creativity in this condition. From the explanation above, it can be seen that creativity and critical thinking given by the learning model can create a qualified product.

Based on the discussion, the student's ability to design science learning tools, the ability to compose science learning products, and the quality of science learning tool products are excellent. Then, these results show that science learning integrated with a project-based learning model can improve student learning outcomes both in terms of the average and individually because the learning outcomes are in the good and excellent categories. This finding is strengthened by previous research findings stating that the application of the project-based learning model is effective in increasing students' learning outcomes. Its effectiveness has been proven by several previous studies. In 2020, Syakur et al. (2020) revealed that project-based learning improves students' learning outcomes in the TOEFL test. In addition, Suwarno et al. (2020) reveal that project-based learning positively impacts applied science learning outcomes. Further in 2023, Kowaas et al. (2023) show that the project learning model increases students' learning outcomes in graphic design. In addition, Listiani and Dirgantoro (2023) present that project-based learning increases learning outcomes in the educational research statistics course. Moreover, Hanisa et al. (2023) reveal that scientific works and the processing of statistical data are improved as well as Hassanah et al. (2023) students' learning outcomes on the topic of reaction rates were also increased by the implementation of project-based learning. Furthermore, Hakimah (2023) finds that science learning outcomes are improved and Setiawan et al. (2023) reveal that students' learning outcomes are improving. In the next year, Sa'adah and Wahyuni (2024) and Muhria et al. (2024) report that project-based learning significantly impacts student learning outcomes in English classes. Concerning social learning outcomes by Khairi and Shava (2024) and civics outcomes by Sati et al. (2024), positive results are obtained through project-based learning. The results of the previous studies have proven that project-based learning effectively improves students' learning outcomes.

Conclusion

The project-based learning model can improve students' integrated science learning outcomes with excellent quality. The student's ability to design products, compose products, and the quality of the lesson plan products are categorized as an excellent category. The learning model influences students' abilities through the provision of the project given to the students. These results implicate the education in which project-based learning is important to be implemented in the learning process to result in proper outcomes.

Suggestion

Further studies on project-based learning are suggested to be conducted. True experimental studies are suggested to be conducted in further studies to reveal the accurate effectiveness of project-based learning in the learning process.

Limitation

The study had some limitations. The study was conducted with only university students and it could be considered a limitation. The study limited the students' outcomes in terms of the ability to design products, compose products, and the quality of the lesson plan products.

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