The Effectiveness of Integrating Jayapura's Local Wisdom to Students' Science Process Skills and Conceptual Understanding of Physics

Putu Victoria M. Risamasu* & Jan Pieter
Physics Education Study Program, Cenderawasih University, Indonesia
*Corresponding Author: putuvicka@gmail.com

Received: 8th May 2024; **Accepted**: 1st June 2024; **Published**: 15th June 2024
DOI: https://dx.doi.org/10.29303/jpft.v10i1.6839

Abstract *- Students who live in dominant customs and culture in their daily lives sometimes experience obstacles when studying physics at school. This research aims to integrate local wisdom and local potential that exist in the Jayapura community in physics lessons and see its impact on students' science process skills and conceptual mastery. The research method used in this research is quantitative with a Quasi-Experimental research type with a Non-equivalent Control Group Design. Data collection techniques used test instruments and learning observations. The instrument used in data collection was test. Data analysis used N-gain analysis and Manova test using SPSS program. The subjects in this research were class XI students from three public high schools in Jayapura City who were selected using purposive sampling technique. The research results showed that the integration of local wisdom and local potential of the Jayapura Community had a positive impact on the experimental class and there was a significant increase in N-gain. Furthermore, the Manova test results showed that there were differences in science process skills and concept mastery between the experimental class and the control class. Furthermore, educators can develop E-LKPD based on the local wisdom of the Jayapura community to accommodate the use of technology in learning and preserve the local culture of the community.*

Keywords*: Integration; Local Wisdom; Physics Learning*

INTRODUCTION

Education is the gateway to an individual's success; by preparing a good education, one paves the way for a bright future, and this also applies to the journey of a nation and state. This awareness is expressed in the government's efforts to provide equitable and quality education services for every Indonesian citizen. Physics education also has a big impact on the Indonesian nation.

Physics education, hereinafter abbreviated to Physics, is a subject that provides provisions to students in the form of knowledge, concepts, and skills. However, it is unfortunate that currently, Indonesia is ranked 68th in Programme for International Student Assessment (PISA) results which was announced on December 5, 2023, scoring 379 in mathematics, 398 in science 398, and 371 in reading. Such condition shows things are not going well in Indonesia in regards to education (Media Indonesia, 2023).

Physics learning is basically the same as science learning which essentially includes four main elements, namely attitude, process, product, and application. These four elements are characteristics of a complete natural science that cannot be separated from one another. In the science learning process, these four elements are expected to emerge, so that students can experience the learning process, understand natural phenomena through problem solving activities and scientific methods, and imitate the way scientists work in discovering new facts (Kemendikbud, 2013: 212).

The essence of physics as a process, product and scientific attitude can be

realized when teachers apply scientific process skills to their students. Physics offers a good opportunity for students to improve these skills, because there are many concepts that students must recognize through the processes they work on, not just concepts that can be read briefly. But students must gain and obtain this knowledge from a process, one of which is practicum. The teaching and learning process of physics in schools is tied to the nature of science. Physics learning is often controlled by teaching methods that are tied to things such as lectures and real-world practice.

However, Physics learning in high schools in Jayapura City is still far from expectations. The results of the author's initial observations found that physics learning was still carried out in conventional and monotonous ways; teachers still implemented learning using the lecture method and students took notes on the teacher's explanations. Initial observation results found that teachers were not optimal in developing students' science process skills; this had an impact on students' low conceptual mastery.

In fact, learning Physics with an emphasis on science process skills supports children to be able to discover and develop their own facts and concepts as well as grow and develop the attitudes and values required (Wahyuni & Lia, 2020). In this way, these skills become the driving force for the discovery and development of facts and concepts, as well as the growth and development of attitudes and values (Sunuraya et al, 2019). So, it could be said that the learning that emphasizes scientific process skills will have a more positive impact on students' achievement of conceptual mastery.

Physics lessons in the border area between Indonesia and PNG in Jayapura City still emphasize the use of textbooks or conventional teaching materials, which are somewhat difficult to understand for children who are still strongly attached to customs and culture in everyday life. It was found that students had some difficulty using the teaching materials.

Several studies on the development of teaching materials have been carried out and obtained very good validation results from education experts and practitioners Pieter et al (2023). It was found that the Jayapura local wisdom-based teaching materials that have been produced have the advantage of integrating the local wisdom of the community so that students are very interested and can easily understand the materials because they suit the context of their daily lives. Integrating local cultural wisdom in science/physics teaching material development activities makes learning appropriate to daily life and the real world, making learning meaningful because it fits the socio-cultural context of the people in Jayapura (Risamasu et al, 2023).

On the other hand, local wisdom is a policy that relies on traditionally institutionalized philosophy, values, ethics, and behavior to manage resources (natural, human, and cultural) sustainably. Culture and local wisdom values can be seen in skills values such as mutual trust, ability to work together, belief (religious), responsibility, solidarity, deliberation, togetherness, cooperation, love of the country, equality, caring, independence, and pantetheine values (Sumiati et al, 2020). This can be seen in each region, that local wisdom has positive values for the development and character of children so that it can foster a love for their regional culture. Apart from that, through folklore, teachers can introduce Indonesian culture to students and take advice as part of character education (Sumayana, 2017).

Based on the explanation above, researchers feel it is necessary to see how the integration of the local wisdom of the Jayapura Community is implemented in Physics learning at school and see the impact on students' science process skills and conceptual mastery.

RESEARCH METHODS

The research method used in this research is quantitative with a Quasi-Experimental research type with a Non-equivalent Control Group Design (Sugiyono, 2014).

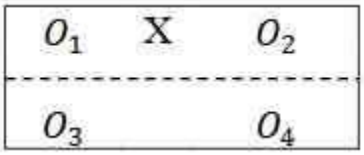

Figure 1. *Non-equivalent control group design*

This research was conducted at three public high schools in Jayapura City, in the even semester of the 2022/2023 academic year. The population in the study were all class X students in three public high schools in Jayapura City. The sample used in the research consisted of six classes consisting of 3 (three) experimental classes who studied using Jayapura local wisdom and three control classes who studied using conventional learning. The sampling technique used in this research is the saturated sampling technique.

Data on students' conceptual mastery were obtained from the results of the pretest and posttest conducted in the experimental class and control class. Meanwhile, to find out whether there are differences in students' science process skills, the researcher used the Manova test using the SPSS 23 data processing application. The instrument used is a test instrument in the form of multiple choices with 4 answer options.

Data analysis was carried out in two types, namely descriptive data analysis to see how the concept was mastered by looking at the calculation results of the average and the standard deviation, determining the score percentage, and looking at the N-gain score (g).

$$g = \frac{S_{Post} - S_{Pre}}{S_{Maks} - S_{Pre}} \quad (1)$$

The high and low normalized gain scores can be classified by Hake (1999) in Table 1 below.

Table 1. Normalized N-gain Score Category

G Score	N-gain Category
g > 0.7	High
0.3 ≤ g ≤ 0.7	Medium
g < 0.3	Low

Next, Manova analysis was used with the help of SPSS 23 to see the comparison of students' science process skills and conceptual mastery between the experimental group and the control group, using a significance value of 0.00, considering the initial requirements for suitability of the results of the normality test and homogeneity test. The hypothesis used in this research is as follows:

H0 = There is no difference in KPS mastery and concept mastery between the experimental and the control class

RESULTS AND DISCUSSION

Results

Based on the research results, the results of the science process skills of high school students in Jayapura City are presented as follows:

Table 2. Results of Students Science Process Skills

Description	Students Science Process Skills			
	Experimental Group		Control Group	
	Pre Test	Post Test	Pre Test	Post Test
Mean	4.46	7.65	4.23	5.57
Highest Score	6.0	9.0	6.0	7.75
Lowest Score	2.0	4.5	2.5	3.75

Standard Deviation	1.086	1.156	1.058	1.123
Standard Gain	0.56		0.24	
Category	Medium		Low	

From Table 2, it was found that the average score of the science process skills of the experimental group who studied physics by integrating Jayapura local wisdom in the pre-test was 4.46 and that it increased to 7.65 in the post test. It was found that there was an increase of 0.56 in the science process skills, which falls within the category medium.

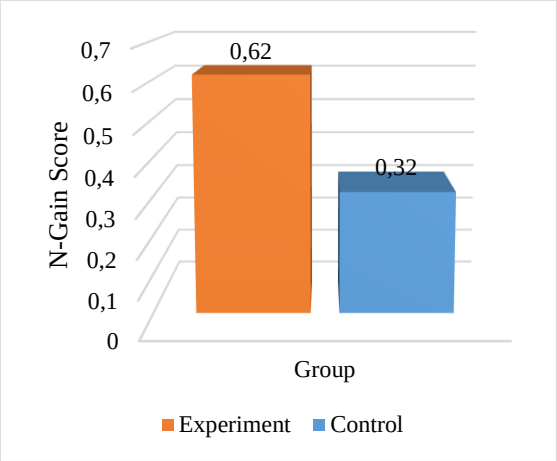

Figure 2. Science Process Skills N-gain betwen exsperiment and control class

Furthermore, in the control group who studied using conventional learning, it was found that in the pre-test they got an average score of 4.23 and at the end of the learning (post-test) they got an average score of 7.75. It was found that there was a 0.32 increase in their science process skills, which fell within the category low.

Overall, in the aspect of students' science process skills, it was found that learning by integrating Jayapura local wisdom results in better improvement; the N-gain in the experimental group was higher compared to the control group (0.56 > 0.24). The N-gain in the experimental group was 0.56, which fell within the medium category, and in the control group, the N-gain was 0.24 which fell within the low category.

It was concluded that as regards the skills aspect of the science process, learning by integrating Jayapura local wisdom had better impact on students' mastering science concepts than conventional learning.

Research data related to the students' conceptual mastery of physics learning in the experimental class and control class are presented in Table 3 below.

Table 3. Students' Conceptual Mastery

Description	**Students' Conceptual Mastery**			
	Experimental Group		**Control Group**	
	Pre Test	Post Test	Pre Test	Post Test
Mean	4.38	7.55	3.52	5.79
Highest Score	6.5	8.75	4.0	6.25
Lowest Score	3.0	5.5	2.0	3.5
Standard Deviation	1.06	1.18	1.058	1.123
Standard Gain	0.62		0.34	
Category	Medium		Medium	

In the data from Table 3 above, it was found that the experimental group who studied using the integration of Jayapura local wisdom into physics learning obtained an average score of 4.48 in the pre-test and 7.55 in the post-test. Furthermore, the change in the conceptual mastery after implementing the integration of Jayapura local wisdom was 0.62 which fell within the medium category.

In the control group who studied using a conventional learning approach, the following data was obtained; for the pre-test results, the average score was 5.52 and after completing the learning, the average score was 5.79. The increase in learning using conventional learning (N-Gain) was 0.34 which fell within the medium category.

From the description of conceptual mastery in Table 3, it is found that learning by integrating Jayapura local wisdom results in a better change in students' conceptual mastery when compared to conventional

learning which only relies on textbooks from the government. It was found that the change in conceptual mastery (N-Gain) in the experimental group was 0.62, which was better than the control group which got a gain value of 0.34. A comparison of the N-Gain of the experimental group and the control group is shown in Figure 3.

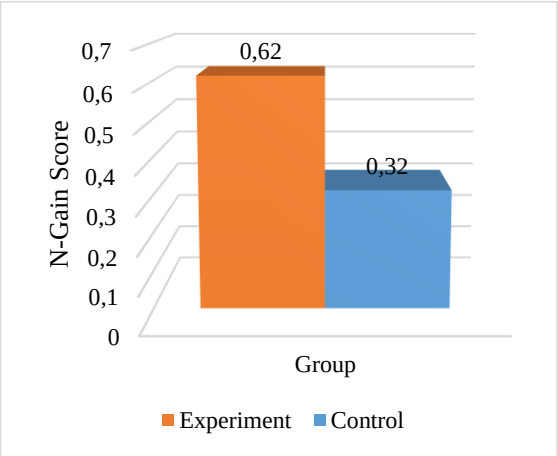

Figure 3. Comparing the Increase in Conceptual Mastery (N-gain) between experimental and control groups

Furthermore, the data from the comparison of conceptual mastery between the experimental class which studied by integrating Jayapura local wisdom into Physics learning and the control class which used conventional learning methods, that is, the results of the Manova test, are presented in Table 4 below.

Table 4. Result of Data Analysis Using Manova

School	Test	Sig.	Conclusion
Public Senior High School	Hotelling's Trace	0.000	Reject Ho

Based on the results in Table 4, the Sig value is obtained. 0.00 is less than 0.05 which shows that integrating Jayapura local wisdom into Physics learning significantly influences students' process skills and mastery of concepts. So, according to research conducted on State High School students in Jayapura City, it is known that the application of Physics learning using local potential has a significant effect on student performance in the experimental class. These results are in accordance with the results of research conducted by (Wildan et al, 2019) which state that utilizing local potential is an effective key to utilizing the integrated science learning process.

Discussion

Science process skills are one of the skills needed by 21st century teachers. Science process skills are skills that are useful for understanding phenomena that occur in everyday life. These skills are needed by students to acquire, develop, and apply concepts, principles and laws applied in science learning (physics). The activities included in science process skills consist of observing, classifying, measuring, predicting, explaining, and concluding. From this explanation, Physics learning places more emphasis on the application of process skills.

The results of data processing in Table 2 found that students who studied using teaching materials that integrated Jayapura's local potential got better Science Process Skills results compared to those who studied using conventional teaching materials using textbooks. It was found that the increase in KPS results (N-Gain) was higher in the experimental group who studied with teaching materials integrating Jayapura's local potential, amounting to 0.53 (in the medium category) compared to the control group with an N-Gain score of 0.24 (low category).

This success resulted from the integration of local wisdom and local potential of the Jayapura Community in physics learning which shows science process skills activities such as (1) observing, (2) comparing, (3) classifying,

(4) measuring, and (5) communicating which is basically carried out in students' daily activities. The science process skills approach is an approach to learning Physics which explains that these skills are formed and developed through a scientific process that is developed in students as a meaningful experience that can be found in their daily activities. The Science process skills approach emphasizes how students learn and manage their learning, so that it is easy to understand and use in life in society. In the learning process students can gain their own experience and knowledge, conduct scientific investigation, and train their intellectual abilities.

Developing skills with an emphasis on science process skills supports students to be able to discover and develop their own facts and concepts as well as grow and develop the attitudes and values required. In this way, these skills become the driving force behind the discovery and development of facts and concepts, as well as the growth and development of attitudes and values (Sinuraya et al, 2019; Srijayanti et al, 2020).

Furthermore, the factor causing the increase in science process skills among students in the experimental group was because the physics teaching materials which were integrated with Jayapura local wisdom used in physics learning had the advantage of being integrated with the local wisdom of the community, so that students were very interested and can easily understand them because of the examples. The examples and material presented are appropriate to the context of their daily lives. Integrating local cultural wisdom in Physics learning activities makes learning appropriate to daily life and the real world, making learning meaningful because it fits the socio-cultural context of the Jayapura community.

Students' conceptual mastery showed much better results in the experimental group who learned by integrating the local potential of the Jayapura community, as shown in Table 3 above. Students who learned by integrating local potential experienced a 0,62 increase in N-gain in concept mastery (medium category), much higher than students in the control class with an N-gain score of 0.34 (medium category).

The application of physics learning which is integrated with local potential and local wisdom of Jayapura in Heat Transfer material has proven to create effective interactions between students and students and students and teachers. This interaction arises because students and teachers can be directly involved in learning through group discussion activities and conducting learning (observations) in the classroom and in the surrounding environment, so that students are able to construct their own knowledge. This statement is in accordance with the opinion of Suastra et al (2017) and Fatimah et al (2023) who state that through contextual learning it is hoped that the knowledge that students gain through the teaching and learning process in the classroom is knowledge that is built and owned by themselves. Another factor that facilitates students' learning process is that the use of contextual teaching materials or modules, teaching materials or modules that present real examples in everyday life related to the lesson topic help students understand and master newly learned concepts (Risamasu & Pieter, 2024).

Furthermore, in the Manova test results in Table 4, the Sig value is obtained: 0.00, which shows that integrating Jayapura local wisdom into Physics learning significantly influences students' process skills and mastery of concepts. It was found that there were differences in students' science process skills and mastery of

concepts with better results in the experimental group who studied by integrating local Jayapura wisdom in learning physics. The experimental group got much better results than the control group who studied using conventional methods.

These results are in accordance with research by Sudarmin et al (2018); Najib et al (2019); and Fatimah et al (2023), who found that students who studied using learning modules that used an ethnoscience approach got better cognitive learning outcomes and developed a more dominant entrepreneurial attitude compared to students who studied using a conventional learning approach in the form of the lecture method.

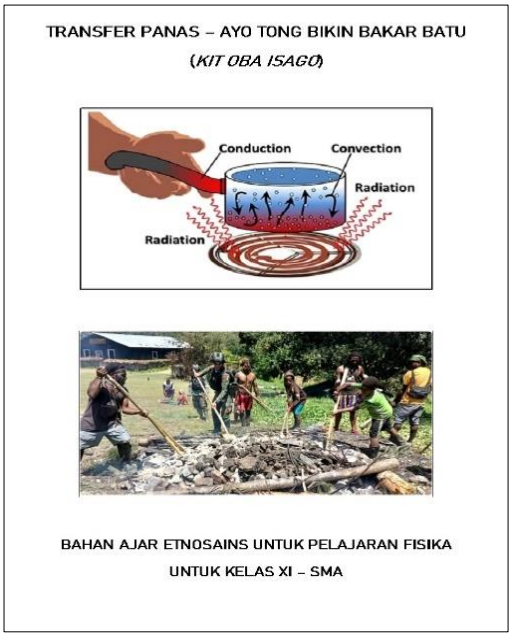

Figure 4. Physics teaching materials used in this research

The physics learning approach that integrates local Jayapura wisdom into physics learning significantly influence students' process skills and mastery of concepts; this is because students are familiar with activities that occur in their everyday life. Something that has become a habit will make an impression on students' memories and when integrated into learning will provide an extraordinary stimulus in building students' science concepts. For example, using the *Barapen* activity (cooking foods with heated stones), students understand that cooked meat and vegetables are cooked due to the flow of heat by conduction; this is because they are used to seeing cooking activities using hot stones. Therefore, teaching material on Heat Transfer by conduction becomes easier for students to understand.

Physics teaching materials with the integration of Jayapura local wisdom used in this research are shown in Figure 4.

CONCLUSION

Based on the results of data processing and discussion of research results, it was concluded that integrating Jayapura local wisdom in physics lessons gave positive results, 1) in the aspect of science process skills, an average N-gain score of 0.56 was obtained for the experimental group and 0.24 for the control group; 2) in the aspect of conceptual mastery, an average N-Gain score of 0.62 was obtained the experimental group and 0.34 for the control group; 3) Manova test results show that there are significant differences in science process skills and conceptual mastery between the experimental group and the control group with a Sig. of 0.00 (less than 0.05), which proves that the integration of local Jayapura wisdom into Physics learning significantly influences students' process skills and mastery of concepts.

From the positive results that have been obtained, educators should start to get used to integrating local potential and local wisdom that exists in the Jayapura community to get better physics learning results. Furthermore, educators can develop E-LKPD based on the local wisdom of the Jayapura community to accommodate the use of technology in learning, so that they use technology as a modern learning

medium but do not forget their identity in the form of local culture.

REFERENCES

Fatimah, A. Z., Maryono. & Firdaus. (2023). Development of a Natural Science Module Based on Local Tourism, Wonosobo Color Lake, to Improve Mastery of Concepts for Junior Hih School Students in Light and Optical Instruments. *Jurnal Pendidikan Fisika dan Teknologi*. 9(1). 185-190. https://dx.doi.org/10.29303/jpft.v9i1.5090.

Hake, R. R. (1999). *Analyzing Change/Gain Scores.* Diakses dari *http://www.physics.indiana.edu/~sdi/AnalyzingChange-Gain.pdf* pada tanggal 20 Maret 2017.

Kemendikbud. (2013). Materi Pelatihan Guru Implementasi Kurikulum 2013 SMP/MTs IPA. Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu Pendidikan, Jakarta.

Lia, L. & Sugiarti. (2022). Development of Physics Learning Multimedia with Tutorial Model Based on Local Wisdom 'Tebing Gerinting' for Middle School. *Jurnal Pendidikan Fisika dan Teknologi*. 8(2). 282-292. http://dx.doi.org/10.29303/jpft.v8i2.4404.

Media Indonesia (Desember, 2023). Skor PISA Indonesia tidak Mencapai Target RPJMN 2024. https://www.medcom.id/pendidikan/news-pendidikan/GNlPJEgN-skor-pisa-indonesia-tak-capai-target-rpjmn-2024

Najib, D. K., Ulfa, S., & Sulthoni. (2019). Pengembangan Media Pembelajaran Interaktif Kearifan Lokal Banyuwangi untuk Siswa Kelas V. *Jurnal Kajian Teknologi Pendidikan*, 2(1), 75–81. https://doi.org/http://dx.doi.org/10.17977/um038v2i12019p075.

Pieter, J., Risamasu, P. V. M., & Budiarti, I. S. (2023). Pengembangan Bahan Ajar Berbasis Kearifan Lokal Jayapura untuk Meningkatkan Keterampilan Proses Sains dan Penguasaan Konsep. *Jurnal Pendidikan Fisika*, 12(2), 171-177. https://doi.org/10.24114/jpf.v12i2.49444

Risamasu, P.V. M., Pieter, J., & Gunada, I. W. (2023). Rekonstruksi Pengetahuan Sains Ilmiah Berbasis Kearifan Lokal Masyarakat di Pinggiran Danau Sentani Jayapura. *Jurnal Ilmiah Profesi Pendidikan***,** 8 (4): 2687 – 2695. https://doi.org/10.29303/jipp.v8i4.1866

Risamasu, P.V.M. & Pieter, J. (2024). Pengembangan E-LKPD Berbasis Problem Based Learning untuk Meningkatkan Kemampuan Pemecahan Masalah Peserta Didik. *Jurnal Pendidikan Fisika Undiksha.* 14(1), 443-453. https://doi.org/10.23887/jjpf.v14i1.75941

Sinuraya, J. ., Panggabean, D.D. & Wahyuni, I. (2019). Analysis of Relationship Science Process Skills and Creativity with the Cognitive Learning Outcomes Used of The Icare Practice Based on Worksheet on Learning High School Physics Courses. *Jurnal Pendidikan Fisika*, 8(2). 85–90. DOI: 10.22611/jpf.v8i2.14844.

Suastra, I.W., Jatmiko, B, Ristiati, N.P., & Yasmini, L.P.B. (2017). Developing characters based on local wisdom of bali in teaching physics in senior high school. *Jurnal Pendidikan IPA Indonesia.* 6(2) (306-312). https://doi.org/10.15294/jpii.v6i2.10681

Sudarmin, Febu, R., Nuswowati, M., & Sumarni, W. (2017). Development of ethnoscience approach in the module theme substance additives to improve the cognitive learning outcome and student's entrepreneurship. IOP Conf.

Series: *Journal of Physics*: Conf. Series 824. https://doi.org/10.1088/1742-6596/824/1/012024 .

Sugiyono (2014). *Metodologi Penelitian Pendidikan*. Pendekatan Kuantitasif, kualitatif dan R & D. Bandung: Alfabeta.

Sumayana, Y. (2017). Pembelajaran Sastra di Sekolah Dasar Berbasis Kearifan Lokal (Cerita Rakyat). *Mimbar Sekolah Dasar*. 4(1), 21-28. Doi: 10.23819/mimbar-sd.v4i1.5050.

Sumiati, T., Majid, N. W.A., Motilal, C., & Jayanti, G.D. (2020). Penanaman Nilai Kearifan Lokal dalam Pembelajaran Calon Guru di LPTK Purwakarta. *Premiere Educandum – Jurnal Pendidikan Dasar dan Pembelajaran*. 10(1). 9-21. Doi.org/10.25273/pe.v10i1.5333.

Srijayanti, P. & Derlina (2020). Ethnophysical Integration in Cooperative Learning Based on Javanese Culture to Improve Generic Science Skills and Student Self-Efficacy. *Jurnal Pendidikan Fisika*, 9(1). 30 – 34. https://doi.org/10.22611/jpf.v9i1.14058 .

Wahyuni, A., & Lia, L. (2020). Pengembangan Komik Fisika Berbasis Kearifan Lokal Palembang di Sekolah Menengah Atas. *Jurnal Penelitian Pembelajaran Fisika*, 11(1), 37–46. https://doi.org/10.26877/jp2f.v11i1.4187.

Wildan, W., Hakim, A., & Supriadi, S. (2019). Pengembangan Perangkat Pembelajaran IPA Berbasis Lingkungan Untuk Siswa SMP/MTs. Jurnal Ilmiah Profesi Pendidikan, 3(2). https://doi.org/10.29303/jipp.v3i2.22