Development of Innovative Learning Resources Based On Projects to Build Psychomotor Students in Anion Analysis Materials

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Abstract. The innovations are integrating mini-project packages and interactive e-modules and their packaging through learning videos. The needs analysis results show that students' learning motivation is low, so innovation must be carried out. The standardization of the products developed is 3.57 or very feasible. The experimental class achieved an average score of 82.29 with a very good category and the control class achieved an average score of 77.77 with a good category as a result of the product implementation in the form of psychomotor skills. The two classes' improvements in learning outcomes are noticeably different. The correlation between psychomotor skills and increased learning outcome is very good. Students who apply project-based innovative learning resources give an excellent response. Innovative products developed can be used by students as learning resources.

Keywords: Improving Learning Outcomes, Projects, Psychomotor, Response.

1 Introduction

The rampant lousy impact due to covid-19 greatly affects the majority of human life, so every country is paying serious attention because the evolution of this pandemic and its impact has drastically changed routines and operational work patterns in various sectors [1] including in the education sector, the pandemic has changed the learning system because it must be done online, which of course will be heavily influenced by the surrounding environment. Therefore, students must be able to adapt to these conditions in expected to raise the standard of instruction. The usage of learning tools must be current with changes to the educational system in order to effectively transfer knowledge. Educators have an active role in this matter, where educators must have updates in carrying out their duties as a channel of knowledge, namely providing teaching at distance conditions and being able to provide solutions to all problems and obstacles that will occur. These barriers include topics that are conducted offline, networks that are difficult to access, and so on [2].

In the 21st century, competitiveness in higher education is increasing, for this reason, it is necessary to develop things that can support learning activities. The development of learning resources must be adapted to technological developments currently being used so that students can enthusiastically participate in lessons [3].

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Chemistry is pure science that cannot be separated from proving a theory that can be carried out in practical activities. Practicum implementation is significantly better in achieving learning goals compared to virtual practicum activities. This is because practicum can provide an opportunity to grow psychomotor skills, for example, learning to install, use, and assemble practicum instruments independently direct, where these activities cannot be separated from the help of the human senses, namely sight, hearing, smell, touch, and also feelings.

One type of learning that is cooperative and student-centered is learning that involves project activities. Learning through project-based activities can inspire students to approach problems in a novel way and enhance communication [4]. Students are required to use the right strategy to achieve project goals. Through project activities, students get the freedom to explore science independently or in groups so that they can combine the results obtained with existing theories. Refers to the results of research by Sumarni [5], Learning with project activities is very influential in growing students' psychomotor skills. This can be assessed optimally through laboratory activities carried out by students.

Video is a good learning media that can be integrated into the subject matter and used in communicating knowledge. This is because the video can show and explain an object like it is accurate without having to find the thing. The use of the video must be in accordance with the topic of discussion conveyed during the lesson [6]. In fact, project-based learning with video tutorials has an excellent impact on developing students' knowledge [7].

Student involvement during learning is needed so that psychomotor students can be aroused [8]. In addition to cognitive, a crucial aspect of being developed is the psychomotor aspect because this aspect is related to the attitudes of students that have an impact on kinesthetic intelligence. Based on the explanation above, the authors want to develop innovative products as learning media in order to grow students' psychomotor skills.

2 Methods

This study's goal was to ascertain how project-based innovative items affected students' psychomotor skills. This research was conducted on 60 students majoring in chemistry education at Medan State University, where 30 students served as experiments and 30 other students as controls. The research begins with a needs analysis, which measures the level of student motivation in learning to use old learning resources, then proceeds with designing the components to be developed, then development is carried out. Innovative product validation is assessed by lecturers according to experts, namely material and media experts, totaling two people each. Students in the experiment group then use the products that are valid. The results of the implementation in this study were psychomotor skills which were measured subjectively using an assessment rubric, improvement in learning outcomes was measured objectively using the N-gain formula, and the correlation between psychomotor skills and N-gain which was analyzed using the Pearson bivariate correlation with the help of SPSS 24.0. Furthermore, the assessment of student responses in the experimental class was measured using a questionnaire.

3 Results and Discussion

The basis for developing learning resources in this study is the analysis of student needs, where the results of the needs analysis are students' learning motivation which is relatively low when carrying out learning on anion analysis material. Three aspects exist in the assessment of student learning motivation, namely the encouragement and need to learn with a large percentage of 57.5%, an interest in learning with a large percentage of 57.5%, and pleasure in finding and solving problems with a large percentage of 72.5 %. Based on these data, the lowest aspect is the drive and need to learn as well as an interest in learning with a moderately motivated category. Therefore, students need updates from learning resources that are by learning in the pandemic era, especially for anion analysis material.

The development of learning resources broadly consists of (1) integration of mini-project packages, (2) integration of instructions for making proposals and project reports, (3) packaging of learning resources, and (4) integration of project videos and videos learning materials. **Table 1.** Contains a list of the finished product components that were created.

Table 1. The learning components are integrated into innovative products developed

No.	Sub-topics	The learning components are integrated into innovative products developed
1.	Introduction	Enrichment of teaching materials, pictures, tables, illustrations about anions in everyday life, some basic questions about anion analysis materials and their assessment guides, learning projects as student activities, guidelines for preparing proposals and project reports, as well as interactive learning videos.
2.	Preliminary reaction	Enrichment of teaching materials, pictures, several questions based on learning resources, and student activities in the laboratory equipped with assessment guides, learning projects as student activities, guidelines for preparing proposals and project reports, as well as interactive learning videos.
3.	Special reaction	Enriching teaching materials, adding tables, and giving examples of the presence of anions in samples in daily life, there are questions related to student activities when doing practicums equipped with an assessment guide. In addition, there are several project activities, project preparation guidelines, and project reports. Summarized in interactive learning videos.

After completing the product development stage, the feasibility of the product is then tested, and this is done by two material expert lecturers. Aspects of the assessment carried out include: content, language, depth of material, design, and graphics. In addition, the feasibility test was also carried out by two media expert lecturers who assessed aspects of learning design and learning communication. The percentage of product feasibility obtained is 89.25% which means the product is very feasible to be implemented. The Comparison of innovative product validation results with project activities is shown in **Figure 1.** below.

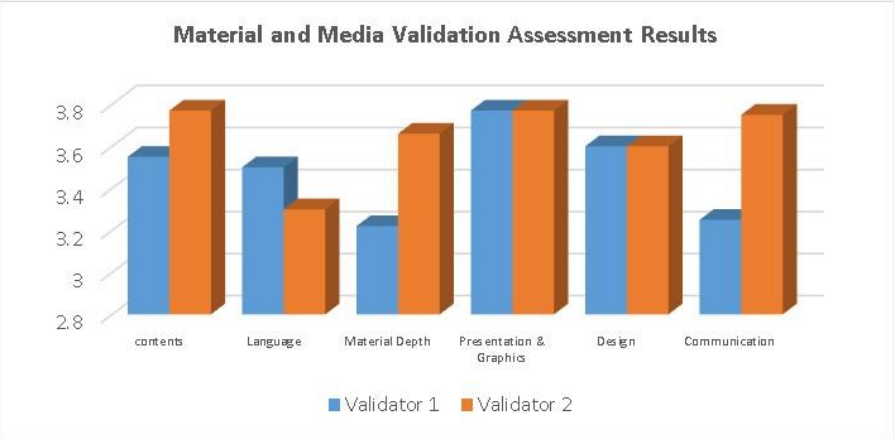

Fig. 1. Comparison of Material and Media Validation Assessment.

Innovative products that have been developed and are feasible, are used by experimental class students during learning. Then to find out the effectiveness of its use, the same learning was carried out in the control class but using student books. The results of product implementation presented in this study are psychomotor skills, increased learning outcomes, correlation of psychomotor skills with increased learning outcomes, and student responses to the use of innovative products involving project activities.

The results of implementation in the form of student psychomotor skills are measured from the results of project planning, project activities, and project reports which are assessed subjectively using an assessment rubric. The rubric for assessing psychomotor skills consists of (1) Perception, the capacity to follow standards, identify practical applications of anion analysis, and recognize theories that are pertinent to the project's or practicum's subject; (2) Manipulating, the ability to plan and choose the right sample in project activities; (3) Precision, the ability to complete tools and materials to support project activities; (4) Articulation, the ability to carry out project/practice activities properly and appropriately; and (5) Naturalization, the ability to manage project/practice results and create knowledge from concluding. **Figure 2.** displays the outcomes of the evaluation of students' psychomotor skills. The figure shows that pupils in the experimental class have better psychomotor skills than those in the control class. The experimental class' mean result was 82.29 with a standard error of 6.54 as compared to the control class' mean value of 77.77 and standard error of 4.64. Among all the aspects measured on psychomotor instruments, the highest aspect that is most mastered by students is the aspect of perception. This part is fairly simple for students to complete because they are expected to be able to comprehend and adhere to the instructions found in cutting-edge learning resources, which is stated in the description. This can be seen when students carry out project activities properly and correctly in accordance with existing guidelines. The findings of this research support Susanti's assertion [9], which states that improving students' psychomotor skills can be done effectively by involving project-based learning.

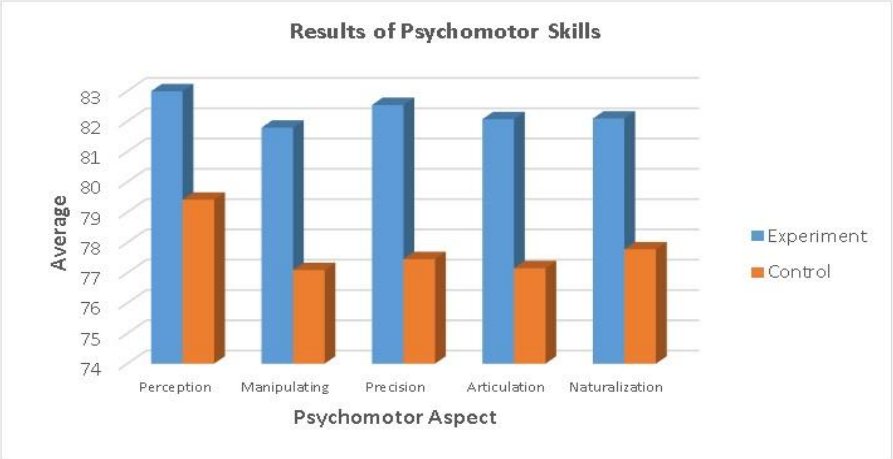

Fig. 2. Comparison of Student Psychomotor Skills Assessment.

In addition to subjective assessments, an objective assessment of student activities is also carried out. In this instance, a test with multiple-choice questions and five answer options is presented to the pupils. **Table 2.** provides a summary of the outcomes of the student's objective evaluation. The table shows that the two classes under test experienced different increases in educational objectives, with the experimental class (0.71 = high) experiencing a greater gain than the control class (0.50 = medium). This is in reference to a study by Husna [10], the findings of which suggest that project-based learning using digital media might boost students' knowledge and creativity, that after experiencing the learning, students give a positive response, Therefore, it is determined that the project-based learning approach using scratch media boost student competence. Additionally, this instructional strategy helps students learn more effectively in the area of entrepreneurship [11].

Table 2. Improvement of Student Learning Outcomes is Measured Objectively

Group	Pretest	Postest	N-Gain
Control	49.56	74.90	0.50
Experiment	49.50	84.83	0.71

With the aid of the software SPSS 24.0, an analysis was conducted to determine the correlation between the data gathered. **Table 3.** contains the findings of the correlation test between improving psychomotor skills and better learning outcomes. The table shows that sig. = 0.000 indicates a significant correlation or association between improved psychomotor skills and improved learning outcomes, while the value of r = 0.949 indicates a very strong correlation between the two variables.

Table 3. Psychomotor Skills Correlation Results with Improved Student Learning Outcomes

Correlations			
		Psikomotorik	N-Gain
Psychomotor	Pearson Correlation	1	.949**
	Sig. (2-tailed)		.000
	N	30	30
N-Gain	Pearson Correlation	.949**	1
	Sig. (2-tailed)	.000	
	N	30	30
**. Correlation is significant at the 0.01 level (2-tailed).			

After using innovative products in learning, so the researchers distributed motivation questionnaires to students. This questionnaire is an instrument that can measure the level of student response to the use of products that have been developed, which consists of three aspects: (1) comprehension (easy to absorb knowledge, able to hone understanding, and increase curiosity), (2) effectiveness (effective in attracting and motivating learners) and (3) interaction (stimulating activeness in learning and creating a sense of satisfaction from learning success). The average value of student responses is classified as very good, with a large percentage of 81.75%. This data is reinforced by the results of research from Fauzia [12]. Energy sources project-based learning is being used in this context, it was found that the student's response was very good. Furthermore, the results of Sugiyanto's research [13] supports the claim that using mobile learning and project-based learning models together significantly improves student learning results as evidenced by the enthusiastic response. **Figure 3.** below displays the outcomes of measuring student responses :

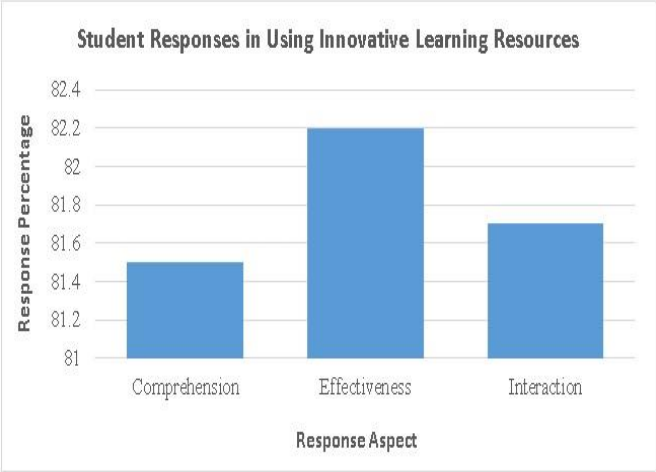

Fig. 3. Student Responses in Using Innovative Learning Resources

According to Figure 3, the aspect of effectiveness is the one that students respond to the most when using innovative learning resources. This means that an innovative product created in one of the analytical chemistry chapters can help and encourage students to learn, draw them to study extensively, and make learning effective and enjoyable.

4 Conclusion

Following the data analysis, it is possible to concluded that project-based new learning resources for developing psychomotor skills using material for anion analysis have been effectively innovated and are extremely likely to be put into use. Innovative learning resources are particularly effective at developing students' psychomotor skills in learning, and as a result, student learning outcomes are better, psychomotor and student learning outcomes are closely related, and students' feedback on the product is rated as very positive.

References

[1] D. Wang *et al.*, "Clinical Characteristics of-138 Hospitalized Patients With 2019 Novel Coronavirus Infected Pneumonia in Wuhan - China," *JAMA*, vol. 323, no. 11, pp. 1061 - 1069, 2020, doi : 10.1001/jama.2020.1585.

[2] T. Pressley and C. Ha, "Teaching during a Pandemic United States Teachers ' Self Ef fi cacy During COVID.19," *Teach. Teach. Educ.*, vol. 106, p. 103465, 2021, doi : 10.1016/j.tate.2021.103465.

[3] H. H. Alharahsheh, A. S. Munna, and S. Hoffmann, "Critical Review - Development-of Learning Resources within Higher Education in Response to the Challenges of COVID-19," *Int. J. Asian Educ.*, vol. 3, no. 2, pp. 148 - 153, 2022, doi : 10.46966/ijae.v3i2.296.

[4] A. Syakur, L. Musyarofah, Sulistiyaningsih, and Wike, "The Effect of Project Based Learning (PjBL) Continuing Learning Innovation on Learning Outcomes of English in Higher Education," *Budapest Int. Res. Critics Linguist. Educ. J.*, vol. 3, no. 1, pp. 625–630, 2020, doi : 10.33258/birle.v3i1.860.

[5] W. Sumarni, S. Wardani, Sudarmin, and D. N. Gupitasari, "Project Based Learning To Improve Psychomotoric Skills - A Classroom Action Research," *J. Pendidik. IPA Indones.*, vol. 5, no. 2, pp. 157 - 163, 2016, doi : 10.15294/jpii.v5i2.4402.

[6] N. W. Febiyanti, P. K. Nitiasih, R. G. L. Budiarta, and N. L. P. E. Adnyayanti, "Significant Effect of Project Based Learning Video on Students Listening Skill in Pandemic Situation," *Int. J. Elem. Educ.*, vol. 5, no. 3, pp. 425 - 433, 2021, doi : 10.23887/ijee.v5i3.34901.

[7] F. Rozi, A. Hamid, and K. Panjaitan, "Development of Tutorial Video Media Based on Project Based Learning in Class XI State Vocational School 1 Pakam Lubuk Development of Tutorial Video Media Based on Project_Based Learning in Class-XI State Vocational School 1 Pakam Lubuk," in *Journal of Physics: Conference Series*, 2020, pp. 1 - 4, doi : 10.1088/1742-6596/1485/1/012056.

[8] T. Supartini, I. Weismann, H. Wijaya, and Helaluddin, "Development of Learning Methods through Songs and Movements to Improve Children's Cognitive and Psychomotor Aspects," *Eur. J. Educ. Res.*, vol. 9, no. 4, pp. 1615 - 1633, 2020, doi : 10.12973/eu-jer.9.4.1615.

[9] Susanti, J. Susilowibowo, and H. T. Hardini, "Effectiveness of Project_based Learning Models to Improve Learning Outcomes and Learning Activities of Students in Innovative Learning," in *International Conference on Economics, Education, Business and Accounting*, 2019, pp. 82 - 95, doi : 10.18502/kss.v3i11.4000.

[10] A. Husna, E. Cahyono, and Fianti, "The Effect of Project Based Learning Model Aided Scratch Media Toward Learning Outcomes and Creativity," *J. Innov. Sci. Educ.*, vol. 8, no. 1, pp. 1 - 7, 2019, doi : 10.15294/JISE.V7I2.25584.

[11] M. Affandi, M. Kamil, A. Suryadi, and T. Mitsuru, "The Effect of Project Based Learning Models on Improving Student Learning Results on Entrepreneurship Education," in *Proceedings of the First Transnational Webinar on Adult and Continuing Education (TRACED 2020)*, 2021, vol. 548, no. Traced 2020, pp. 122 - 128, doi : 10.2991/assehr.k.210508.023.

[12] N. L. U. Fauzia and J. B. Kelana, "Natural Science Problem Solving in Elementary School Students Using PjBL Model," *J. Ilm. Sekol. Dasar*, vol. 4, no. 4, pp. 596 - 603, 2020, doi : 10.23887/jisd.v4i4.28377.

[13] Sugiyanto, A. Setiawan, I. Hamidah, and A. A, "Integration of Mobile Learning and Project Based Learning in Improving Vocational School Competence," *J. Tech. Educ. Train.*, vol. 12, no. 2, pp. 55 - 68, 2020, doi : 10.30880/jtet.2020.12.02.006.