Journal of Educational Technology:
Journal of Learning Research and Development
https://e-journal.undikma.ac.id/index.php/jtp/index

April 2024. Vol. 9 No. 2
E-ISSN: 2656-1417
P-ISSN: 2503-0602
pp. 308-313

The Influence Of Implementing Problem-Based E-Modules On Students' Motivation And Learning Outcomes On Colloid Systems Chemistry Materials In High School

Fedora Deroly Br Nainggolan*, Bajoka Nainggolan
State University of Medan
***Corresponding Author: fedoranainggolan@gmail.com**

Abstract: The research aims to determine the effect of implementing problem-based e-Modules on student motivation and learning outcomes in colloid system material in class XI SMA Negeri 9 Medan. This research method is descriptive quantitative with taking samples from the population by random sampling as many as 60 students as samples (30 students in class XI-2 as experiments and 30 students in class XI-1 as controls). Data was collected through tests and questionnaires, then analyzed using SPSS 24 for Windows with a one-party t-test. The results of the analysis show that students' chemistry learning motivation increased significantly with the implementation of the e-Module, with the average score of the experimental class (71.33%) being higher than the control class (49.00%). This is supported by the results of the one-party t-test which shows a significance value of 0.001 < 0.05. Apart from that, there is a significant influence on students' chemistry learning outcomes, with the experimental class post-test score (79.67) being higher than the control class (74.5) and the one-tailed t-test significance value of 0.031 < 0.05 . Research also shows a positive correlation between motivation and student learning outcomes with a sig value of 0.026 < 0.05, confirming that the application of problem-based e-Modules contributes to improving student chemistry learning outcomes in colloidal systems material.

Article History
Received: 27-03-2024
Reviewed: 28-04-2024
Published: 30-04-2024

Key Words:
Problem-Based e-Module, Motivation, Learning Outcomes, correlation of motivation and learning outcomes.

How to Cite: Nainggolan, F., & Nainggolan, B. (2024). The Influence of Implementing Problem-Based E-Modules on Students' Motivation And Learning Outcomes on Colloid Systems Chemistry Materials in Senior High School. *Jurnal Teknologi Pendidikan : Jurnal Penelitian dan Pengembangan Pembelajaran*, *9*(2), 308-313. doi:https://doi.org/10.33394/jtp.v9i2.11204

https://doi.org/10.33394/jtp.v9i2.11204

Introduction

The progress of a country can increase with education because education can produce superior human resources. With the growth in the quality of education, a country will not be left behind by other countries.In accordance with the provisions contained in Article 1 of Law no. 20/2003, education aims to enable students to actively develop their potential to have religious spiritual strength, self-control, strong personality, intelligence, noble morals, talents and skills needed by themselves, society, nation and state.Therefore, in Indonesia efforts are needed to improve the education sector (Muliaman & Mellyzar, 2020).Currently, the concept of "independent curriculum" is becoming a hot topic in the realm of education in Indonesia, the main aim of which is to intensify the escalation of the quality of education and restore situations affected by critical teaching and learning processes.(Hehakaya & Polattu, 2022).A

April 2024. Vol. 9 No. 2
E-ISSN: 2656-1417
P-ISSN: 2503-0602
pp. 308-313

diverse approach in selecting teaching aids gives educators the freedom to adapt learning to students' needs and interests(Pujiarti, et al., 2023).

One of the learning tools that contributes to the success of the learning process is teaching materials,which is designed to be complex, organized, and based on learning principles implemented by educators and students themselves. Teaching materials have the benefit of expanding understanding of the learning path being followed, serve as a guide in the learning process, including independent learning, and contain practical steps to investigate the material in more depth(Ardiansyah, 2017). e-Modules are one of the teaching materials that can be used in the classroom. e-Module is an electronic form of module that can explain and clearly illustrate the concepts in a learning material. Electronic modules are in principle the same as printed modules in terms of materials and evaluation methods which are designed systematically. However, because it is electronic, the e-Module contains more realistic visualization in the form of images, audio and animation.Thus, its use in learning will be more interesting according to the competencies to be achieved(Shidiq & Najuah, 2020).

Chemistry is one of the sciences taught in secondary schools, containing significant relevance to everyday events, so students are required to be able to relate the material to phenomena that exist in the real world. (Wahyuningtias in Wahyuliani, et al., 2022).Chemical ideas are often applied in a relevant way to life, although many feel less interested in this subject because it is abstract and requires more complex thinking abilities. This can result in students feeling bored easily and less enthusiastic about studying chemistry if the learning process carried out is less interesting.Learning chemistry becomes difficult because there is a gap between the interpretation of concepts and the ability to apply them, which causes difficulties in the learning process(Sirhan in Irsyadi, et al., 2018).

One chemical material that covers various concepts and has direct applications in everyday life is the colloid system.The colloid system is a science in learning that can be explained through three key components in chemistry. As a concrete example at the macroscopic level, we can observe that the dispersed particles in milk remain floating and do not settle. At the submacroscopic level, this is explained through the phenomenon of Brownian motion that colloidal particles continuously exert, preventing them from settling because they are balanced by the force of gravity. At the symbolic level, Brownian motion can be represented through images from observations using an ultrasonic microscope.(Irsyadi, et al., 2018).In learning colloidal systems, there are ideas involving abstract and concrete concepts that are closely related to daily activities, but often cause difficulties in understanding for students. DBy selecting the correct model, method approach and media, students will be able to understand the ideas or concepts contained in the colloid system material. They can also find the right solutions to various challenges presented during the learning process. Under the supervision and guidance of teachers, students are able to develop their own understanding and overcome learning challenges.

Based on researchers' interviews with chemistry teachers at SMA Negeri 9 Medan, data was found regarding chemistry learning outcomeson colloid system material for most studentsstill not reached the Learning Objective Success Criteria (KKTP), namely 75. Meanwhile, the observations made by the researcher when observing were that teachers were still using textbooks from the government as teaching materials in class, andThe teaching method currently used is still traditional, prioritizing the lecture method, which results in a lack of motivation and student inactivity, thereby reducing student learning outcomes in chemistry subjects about colloid systems.

Journal of Educational Technology:
Journal of Learning Research and Development
https://e-journal.undikma.ac.id/index.php/jtp/index

April 2024. Vol. 9 No. 2
E-ISSN: 2656-1417
P-ISSN: 2503-0602
pp. 308-313

To overcome this problem, it is necessary to use e-Modules as problem-based teaching materials which, when used in learning, have an interactive nature because they encourage active student involvement. So that they can improve their learning outcomes. The use of images, videos and animations in e-Modules will help in visualizing learning material, so that readers can easily understand the contents of the module, especially when dealing with complex concepts, when compared to using printed books.Learning resources developed using the Problem-Based Learning (PBL) concept are known as problem-based teaching materials, where daily life problems related to subject matter such as colloid systems are presented so that students can learn and collaborate in solving these challenges.

The results of research conducted (Afriani, et al., 2022) concluded that the application of e-Modules to thermochemical material has the potential to improve student learning outcomes more effectively because it can be used anytime and anywhere.Compared to the control class which relied on printed books, the experimental class which used e-Modules showed higher achievement. Other research conducted(Pratama, et al., 2017) also stated that the application of a chemistry module based on Problem Based Learning on the topic of colloids has proven its effectiveness in several schools with the average learning outcomes of the experimental class being better than the control class. Therefore, it is concluded that PBL-based chemistry modules are more successful in helping students learn than those that do not use them.In line with research (Pane, 2022) shows that students in the experimental class achieved a better level of understanding through the use of problem-based e-Modules on chemical reaction rates. The use of these problem-based electronic modules boosts students' motivation levels in studying chemistry, ultimately resulting in significant improvements in their learning outcomes.So this research aims to determine the motivation and learning outcomes of students and those taught using problem-based e-Modules.

Research Methods

The type of research in this research is descriptive quantitative research with a research design*Pre-test post-test control group design*. The population in the study were all class 1 (30 control class students) and XI-2 (30 experimental class students). Data collection was carried out through a test instrument given in the form of a valid objective test consisting of 20 items selected after testing the validity, reliability, level of difficulty and differentiability of the questions. The test was given at the beginning (pre-test) and at the end of learning (post-test) to determine the increase in student learning outcomes regarding colloid system material and used a non-test instrument in the form of a 25-item statement questionnaire to determine student learning motivation. The data obtained was then analyzed using SPSS 24 for Windows software. Data were analyzed using a normality test (using the Shapiro Wilk test), a homogeneity test (using Levene's test), where data is said to be normally distributed and homogeneous if the significance value is $>\alpha$ (0.05)and a hypothesis test was carried out using the Independent Sample T test (right side test) to determine the effect of implementing problem-based e-modules on students' motivation and learning outcomes, finally a correlation test was carried out (using the bivariate correlation test) to see the correlation between motivation and student learning outcomes. which is learned using problem-based e-modules. Where a hypothesis (Ha) is accepted if the significance value is $<\alpha$ (0.05).

Results and Discussion(12pt, Times New Roman)

Journal of Educational Technology:
Journal of Learning Research and Development
https://e-journal.undikma.ac.id/index.php/jtp/index

April 2024. Vol. 9 No. 2
E-ISSN: 2656-1417
P-ISSN: 2503-0602
pp. 308-313

Based on data processing, it was found that there was an influence of problem-based e-Modules on students' motivation and learning outcomes in colloid system material. This is shown by the data obtained during the research that the average percentage of learning motivation for experimental class students is higher than that of the control class, namely 71.33% (high category) > 49% (medium category)so it can be concluded thatThere is an influence of the application of problem-based e-Modules on student learning motivation in colloid system material.

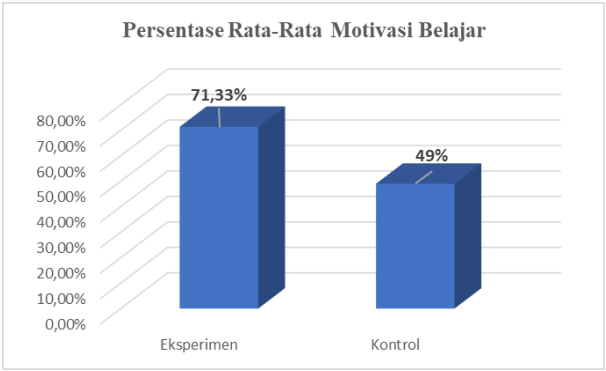

Figure 1. Diagram of Average Percentage of Learning Motivation

Furthermore, based on the learning outcomes data obtained, it is known that the average learning outcomes of the experimental class are higher than those of the control class, namelyThe average pre-test score for the control class was 48.5 and post-test 74.5, while the average pre-test score for the experimental class was 43.5 and post-test 79.67.so it can be concluded thatThere is an influence of the application of problem-based e-Modules on student learning outcomes in colloid system material.

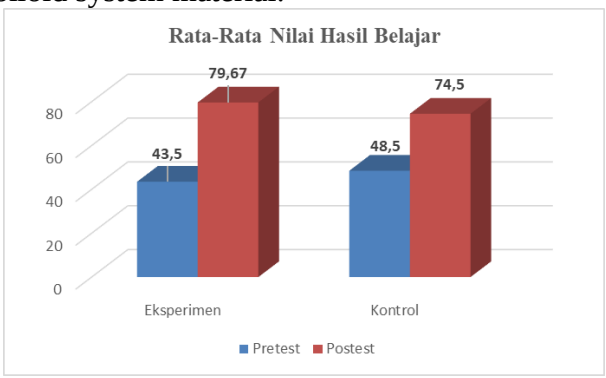

Figure 2. Diagram of Average Learning Outcome Values

1. Learning Motivation Hypothesis

The first hypothesis aims to determine the effect of implementing problem-based e-Modules on student learning motivation. Where students in both classes completed questionnaires after learning, then the data was collected and tested. Hypothesis testing results using the test*Independent Sample T-Test*and obtained sig (2-tailed) namely 0.001. In accordance with the testing criteria, if the data is ≤ 0.05 then Ha is accepted and H0 is rejected, which means that the hypothesis is accepted. Thus, it can be stated that there is an influence of the application of problem-based e-Modules on student learning motivation in colloid system material. According to Rachmawanto, et al (2015), PBL learning can increase students' motivation and interest so that they become active participants in the learning process and improve student learning outcomes. In accordance with this, the e-Module used is equipped with visual aids such as images, videos, animations and quizzes which complement the content

Journal of Educational Technology:
Journal of Learning Research and Development
https://e-journal.undikma.ac.id/index.php/jtp/index

April 2024. Vol. 9 No. 2
E-ISSN: 2656-1417
P-ISSN: 2503-0602
pp. 308-313

of the colloid system and increase its visual appeal, thereby increasing students' incentives to learn (Febriyandi & Andromeda, 2019).

2. Learning Outcome Hypothesis

Based on the results of hypothesis testing using the test*Independent Sample T-Test*in both classes the Sig (2-tailed) is 0.031. Because the sig value ≤□(0.05) according to the testing criteria, it can be stated that the hypothesis is accepted, then Ha is accepted and H0 is rejected. Thus, it can be stated that there is an influence of the application of problem-based e-Modules on student learning outcomes in colloid system material. In accordance with research (Zakiyah & Wulandari, 2023), students who are taught using e-Modules based on Problem Based Learning (PBL) get better learning outcomes than students who are taught using textbooks. This is because the use of PBL-based e-modules for learning produces higher cognitive learning outcomes for students. Where students are given challenges which are then completed to produce solutions. Addition of e-module learning resources that allow students to solve problems freely and objectively, increasing their interest in the subject matter.

3. Correlation Test

In the results of testing the third hypothesis using analysis*bivariate correlation*. Where if the Sig value. > 0.05 then H0 is accepted, while if Sig. < 0.05 then Ha is accepted. From the results of this research in the experimental class, it was found that the Sig. 0.026 < 0.05 and Pearson correlation is 0.405. In accordance with the testing criteria, if the data is ≤ 0.05 then Ha is accepted and H0 is rejected, which means that the hypothesis is accepted. Thus, there is a correlation between learning motivation and student learning outcomes taught with problem-based e-Modules on colloidal systems material with sufficient correlation. In accordance with theDimyati and Mudjiono (2015) stated that students with strong learning motivation will be able to play an active role in their education and carry it out with confidence and responsibility. Students will be able to achieve learning goals and overcome problems that arise, thereby achieving high learning outcomes. Supported by Budiariawan's (2019) research at SMA Negeri 2 Negara on class table at the 1% and 5% significance levels, or 0.391 > 0.297 > 0.229.

Conclusion

The conclusions obtained after completing the research are as follows: 1) There is an influence of the application of problem-based e-Modules on student learning motivation in colloid system material in the experimental class with an average percentage of71.33% withSig value. equal to 0.001 < 0.05. 2) There is an influence of the application of problem-based e-Modules on student learning outcomes in colloid system material in the experimental class with an average learning outcome of79.67 withSig value. equal to 0.031 < 0.05. 3) There is a positive correlation between learning motivation and student learning outcomes who are taught using problem-based e-Modules on colloid system material with a Sig value. 0.026 < 0.05 with a person correlation of 0.405 (sufficient category).

Recommendations

After collecting, processing and interpreting data, the researcher made the following recommendations:

1. For teachers and prospective teachers who will teach material about colloid systems, it is recommended to utilize problem-based e-Modules. Student learning outcomes will increase as a result of active learning when learning using e-Modules. However, it is important for teachers or prospective teachers to have the ability to manage the class well so that learning can be implemented optimally.

April 2024. Vol. 9 No. 2
E-ISSN: 2656-1417
P-ISSN: 2503-0602
pp. 308-313

2. To future researchers to be more effective in managing research time and continuing this research to improve the substance with thorough preparation, both personally and in providing the equipment needed for the learning process.

References

Afriani, N., Haris, M., Savalas, LRT, & Sofia, BFD (2022). The Influence of the Electronic Chemistry Module on the Learning Outcomes of Class XI MIPA Students at SMAN 1 Jonggat on Thermochemical Material. Scientific Journal of the Education Profession, 7(1), 84-88.

Ardiansyah, R., Corebima, AD, & Rohman, F. (2017). Development of Genetic Mutation Teaching Materials in Genetics Courses. Journal of Education: Theory, Research and Development, 2(7), 927–933.

Hehakaya, E., & Pollatu, D. (2022). Teacher Problems in Implementing the Independent Curriculum. DIDAXEI, 3(2), 394-408.

Irsyadi, R. (2018). Efforts to Improve Student Memory Ability and Learning Achievement on Colloid Material Using the Cooperative Integrated Reading and Composition (CIRC) Learning Model Equipped with Webquest Media for Class XI Science 2 Semester II Students at SMA N 2 Boyolali Academic Year 2016/2017. Journal of Chemical Education, 7(2), 259-266.

Muliaman, A., & Mellyzar, M. (2020). Improving Learning Outcomes Using the Project Based Learning Model on Reaction Rate Material. Chemistry in Education, 9(2), 91-95.

Pane, RF, & Sugiharti, G. (2022). Use of Problem-Based Teaching Materials to Improve Learning Outcomes and Student Motivation on Reaction Rate Material. Journal of Educational Technology: Journal of Learning Research and Development, 7(2), 260-268.

Pratama, GW, Ashadi, A., & Indriyanti, NY (2017). Effectiveness of Using Problem-Based Learning (PBL) Chemistry Learning Modules to Improve Students' Critical Thinking Ability on Class XI High School Colloid Material. In Proceedings of SNPS (National Science Education Seminar), 150-156.

Pujiarti, E., Amiruddin, A., Sari, R., Purba, FD, Ahmadi, KD, & Mulya, S. (2023). Implementation of the Independent Curriculum in Improving Teacher Professionalism Competence at SMKS 2 Tamansiswa Pematangsiantar. Journal of Research, Education and Teaching: JPPP, 4(1), 11-18.

Sidiq, R., & Najuah. (2020). Development of Android-Based Interactive E-Modules in Teaching and Learning Strategy Courses. Journal of History Education, 9(1), 1–14.

Sirhan, G. (2007). Learning difficulties in chemistry: An overview. Journal of Turkish Science Education, 4(2), 1-20.

Wahyuliani, D., Danial, M., & Sanusi, W. (2022). Development of e-Modules on colloidal materials to improve students' creative thinking abilities. Journal of Chemical Education, 5(2), 207-215.