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Multiple Intelligences in Elementary Science Education: Impact of Guided Discovery Approach on Learning Interest

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ABSTRAK

Pendidikan sains pada tingkat sekolah dasar sering mengabaikan dimensi proses, lebih menekankan pada produk akhir dari pengetahuan. Penelitian ini bertujuan untuk menganalisis pengaruh model Guided Discovery Learning *terhadap minat mahasiswa dalam mengembangkan pembelajaran IPA dasar berbasis kecerdasan majemuk. Dengan menggunakan desain pra-eksperimental, 27 mahasiswa semester enam dari program Pendidikan Guru Sekolah Dasar berpartisipasi dengan pengambilan sampel menggunakan purposive sampling. Pengumpulan data meliputi observasi, kuesioner, tes, dan dokumentasi, dengan data dianalisis menggunakan statistik deskriptif dan uji t. Hasil penelitian menunjukkan adanya perbedaan yang signifikan sebelum dan sesudah penerapan model* Guided Discovery *di kelas. Sehingga dapat disimpulkan bahwa, model* Guided Discovery Learning *memiliki dampak yang signifikan terhadap minat belajar siswa dalam pengembangan pembelajaran sains dasar berbasis kecerdasan majemuk. Penelitian ini memberikan bukti bahwa pembelajaran penemuan terbimbing dan umpan balik yang membangun merupakan strategi yang efektif untuk meningkatkan kualitas pembelajaran dan minat belajar siswa. Model ini tidak hanya meningkatkan minat belajar siswa tetapi juga mempromosikan keterampilan berpikir kritis dan pemecahan masalah.*

ABSTRACT

Science education at the elementary school level often ignores the process dimension, emphasizing more on the final product of knowledge. This study aims to analyze the effect of Guided Discovery Learning model on students' interest in developing multiple intelligence-based basic science learning. Using a pre-experimental design, 27 sixth semester students from the Elementary School Teacher Education program participated with purposive sampling. Data collection included observation, questionnaires, tests, and documentation, with data analyzed using descriptive statistics and t-test. The results showed a significant difference before and after the application of Guided Discovery model in the classroom. So it can be concluded that, the Guided Discovery Learning model has a significant impact on student learning interest in the development of multiple intelligence-based basic science learning. This research provides evidence that guided discovery learning and constructive feedback is an effective strategy to improve learning quality and students' interest in learning. This model not only increases students' interest in learning but also promotes critical thinking and problem-solving skills.

1. INTRODUCTION

Science Education is one of the crucial subjects taught at various educational levels. However, science education at the elementary school level often needs to pay more attention to the process dimension. Current teaching methods prioritize the end product, such as knowledge found in books, without paying adequate attention to the process required to understand and master that knowledge. The process dimension is essential in helping students not only acquire knowledge but also develop the ability to explore and discover it independently (Alalwan et al., 2020; Mora et al., 2020) . Students' interest in learning Natural Sciences (Science) in the Primary School Teacher Education study program still needs to improve (Cofré et al., 2019; Harefa et al., 2023; Yanti, 2019). This is due to ineffective teaching methods that often disregard both product and process dimensions in science education (Jolly & Chang, 2019; Lin et al., 2021). The lack of student engagement in the teaching and learning process results in low motivation to explore

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information, make decisions, and solve problems independently (Amerstorfer & Kistner, 2021; Bond, 2020; Rone et al., 2023). A monotonous and non-interactive learning process is also a major factor contributing to the low interest and participation of students in science education. Therefore, a more innovative and interactive approach is needed to increase student engagement and interest in learning, as well as to train them in critical thinking and problem-solving skills (Duncan, 2020; Okolie et al., 2022; Zhampeiis et al., 2022).

Students with a high interest in learning tend to be more enthusiastic and active in the learning process, achieving optimal learning outcomes. Learning is a process of changing student behavior influenced by internal and external factors. During the learning process, the interaction between teachers and students plays a crucial role, and factors such as motivation, concentration, reaction, organization, understanding, and review affect students' psychology. Effective interaction between teachers and students can create a more dynamic learning atmosphere, supporting meaningful learning (Cheung et al., 2021; Rusticus et al., 2023; Yang et al., 2021). To increase students' interest in learning and train their creative thinking skills, specific teaching methods are required. One effective method is the discovery learning model. This model allows students to be active during the learning process, fosters a search attitude, and enhances problem-solving skills. Other researches explains that through this model, students can engage directly in the discovery process, making the knowledge gained more enduring, self-motivating, and easier to express. Thus, the application of the discovery learning method can be an effective solution to address the low interest in learning among students in science education and improve the overall quality of education (Akhir et al., 2023; Astuti et al., 2023; Muliati & Syam, 2020).

Previous research shows that the guided discovery learning model can have a positive impact on students' skills and learning outcomes. In another researcher's study showed that, the use of virtual laboratories in secondary school physics education helped improve students' science process skills. This shows that guided discovery learning model can improve specific skills in science subjects. Another study also showed that guided discovery learning can improve students' mathematical problem solving ability and self-efficacy in the context of local culture (Batak Toba). This suggests that this approach is effective not only in science subjects but also in mathematics, with the added cultural dimension enriching the learning process. The next study also examined the use of active learning methods to develop multiple intelligences in moral education. Although the subject contexts are different, this and related research both use approaches that focus on developing multiple intelligences. Both studies show that learning strategies that integrate multiple intelligence theory can improve various aspects of student learning (Gunawan et al., 2019; Simamora et al., 2019; Thambu et al., 2021).

This study is different from other studies because this study focuses on developing students' learning interest in science education learning for elementary schools based on Multiple Intelligence. Gunawan's research focused on improving students' science process skills using virtual laboratories in high school physics subjects. This difference is important because interest in learning is an important aspect in higher education that can affect student engagement and academic success. Another study integrated the local cultural context into mathematics education. Although this study did not include cultural dimensions, it focused on developing students' learning interest in science education development subjects for elementary schools. This shows that although the same learning model is used, application in different contexts and subjects can result in different focus and outcomes. Lastly, other researchers used an active learning approach to develop multiple intelligences in moral education, while this study used Guided Discovery Learning to develop learning interest in the context of elementary science education. This shows that while the approach used to develop multiple intelligences may be the same, the application and focus on different subjects yields different results (Gunawan et al., 2019; Simamora et al., 2019; Thambu et al., 2021).

Thus, the purpose of this study is to explore the influence of the Guided Discovery Learning model on students' interest in learning in the course of science education development for elementary schools based on Multiple Intelligence. This study offers a new contribution by exploring the influence of the Guided Discovery Learning model on students' interest in learning in the course of science education development for elementary schools based on Multiple Intelligence. Previous research has shown the effectiveness of discovery-based learning models and the development of multiple intelligences in different contexts and subjects. However, this study is unique in its focus on higher education and its integration with multiple intelligence theory in elementary science education. This provides new insights into how this method can increase student interest and engagement, which are essential aspects of higher education and the future professional development of students.

2. METHOD

This study employs a quantitative research design with a pre-experimental type or One-Group Pretest-Posttest design to determine the results before and after treatment in a single group. The research was carried out at the Muhammadiyah University of Magelang, with the subjects being 27 sixth-semester students of the Elementary School Teacher Education (PGSD) program majoring in Science Education. The sampling technique used was purposive sampling, which selects samples based on the relevance of the subjects to the research topic and the ease of data collection, such as geographical proximity and the availability of students to participate in the research. Data collection techniques included observation, questionnaires, tests, and documentation. The research instruments were a learning interest questionnaire and pre-test and post-test questions. The data analysis technique used was descriptive statistical analysis with a Likert scale to measure the respondents' attitudes, opinions, and perceptions, and percentage analysis to determine the intensity of students' attitudes toward the Guided Discovery Learning model. The prerequisite test analysis to determine the sample includes normality and homogeneity tests using SPSS 25. This is done to determine whether the samples are normally distributed and homogeneous. If both samples are regular and homogeneous, the Independent-Sample T Test is used. This test aims to determine whether applying the guided discovery approach has an effect. The hypothesis acceptance categories are as follows: if the significance is ≥ 0.05, then H0 is accepted, and if the significance is < 0.05, then H1 is accepted (Alita et al., 2021; Anan Sutisna, 2021).

3. RESULT AND DISCUSSION

Result

In this session, students were divided into several small groups to ensure each member could actively participate in creating a lesson plan. The Guided Discovery Learning approach based on Multiple Intelligences was chosen to enhance student engagement and understanding of elementary science material. The first session began with a quiz administered through Google Forms 15 minutes before the class started. The quiz results showed an increase in student engagement compared to using the Quizizz application. Through a lecture video sent via WhatsApp, students were introduced to the concept of Multiple Intelligences and its application in science education. In the second session, students were assigned a project to create a simple lesson plan based on Multiple Intelligences. Each group consisted of several students to ensure active participation from every member. Seven out of ten groups presented their work; however, there were areas for improvement, particularly in the omission of educational media in the lesson plans. The instructor provided feedback and constructive criticism, asking students to revise their lesson plans and resubmit the assignments. The groups that still needed to present were expected to improve their tasks.

The third session began with presentations of the revised lesson plans by the three groups that had yet to present previously. The results were much better compared to the previous presentations, indicating that providing feedback to students has a very positive impact. The instructor gave additional feedback and emphasized the importance of responding to students' work. The Guided Discovery Learning process involves steps such as problem identification, data collection, data analysis, hypothesis formation, experimentation and verification, presentation and discussion, and reflection. Students were encouraged to identify problems or questions to be explored during the science learning process based on Multiple Intelligences. They worked in groups to collect data from various sources, analyze the data using their various intelligences, and form hypotheses based on their analyses. Students then conducted experiments or practical activities to test their hypotheses, observed the results, and recorded their findings. Each group presented their experimental results and engaged in discussions to clarify concepts that needed to be better understood. Students were also encouraged to reflect on the learning process they had undergone, identifying which intelligences were most dominantly used and how they could improve other intelligences. This approach aims to increase student engagement and understanding of science material, as well as to develop the various types of intelligence possessed by each student.

The Guided Discovery Learning model based on multiple intelligences has been implemented in the Elementary Science Development course to improve the quality of the learning process. This research evaluates students' perceptions of the effectiveness of this model through several indicators, including learning preparation, involvement and interest, independence and responsibility, and the teaching methods used. The student perceptions of the learning process are presented in Table 1.

Table 1. Student Perceptions of The Learning Process

Indicator	Related Statements	Average (%)	Criteria
Learning Preparation	I study the Elementary Science Development material that will be taught the next day every night; I bring various sources for the Elementary Science Development course; I take notes on the material provided by the lecturer; I am interested when the lecturer explains the Elementary Science Development material	79.6%	Agree
Involvement and Interest	I do not enjoy attending the Elementary Science Development course; I am reluctant to attend the Elementary Science Development course due to uninteresting teaching methods; I am a passive student in class; I prefer being given assignments rather than attending the class material; I enjoy the project-based assignments in the Elementary Science Development course; I am very enthusiastic when given a large group project for the Elementary Science Development course; I often discuss the Elementary Science Development material outside the classroom; I borrow notes from friends when I have to miss the Elementary Science Development class; I am an active questioner in class	64.8%	Agree
Independence and Responsibility	I do not like to ask questions if I do not understand the explained material; I try to do individual assignments according to my ability; I often discuss the Elementary Science Development material outside the classroom	76.7%	Agree
Teaching Methods	Using the guided discovery learning method motivates me to learn; I find this guided discovery learning method useful in the Elementary Science Development course based on multiple intelligences; I feel more independent when the lecturer uses the discovery learning method in the Elementary Science Development course; I do not feel any difference between the discovery learning method and conventional methods; I do not feel an active atmosphere in the classroom when using the discovery learning method; I find the Elementary Science Development course based on multiple intelligences harder to understand when using the discovery learning method; I prefer conventional methods for the Elementary Science Development course; The assignments given make me bored because I have to understand the material by myself; During the discovery learning method in the Elementary Science Development course, I feel more agile in problem-solving; I feel my performance has improved in this course since using the discovery learning method.	72.2%	Agree

Table 1 shows student perceptions of the learning process in the Elementary Science Development course based on four indicators: Learning Preparation, Involvement and Interest, Independence and Responsibility, and Teaching Methods. The Learning Preparation indicator includes four statements with a total score of 426 and an average of 79.6%, indicating the "Agree" category for the student's preparation. The Involvement and Interest indicator encompasses nine statements with a total score of 726 and an average of 64.8%, also indicating the "Agree" category but with a lower score compared to Learning Preparation. The Independence and Responsibility indicator consists of three statements with a total score of 309 and an average of 76.7%, which also falls in the "Agree" category. Lastly, the Teaching Methods indicator involves ten statements with a total score of 1045 and an average of 72.2%, reflecting that students "Agree" with the teaching methods used. Overall, this table illustrates that students have a positive perception of various aspects of the learning process in the Elementary Science Development course.

The pretest and posttest scores of students after the implementation of the Guided Discovery Learning model in the Basic Science Development Course Based on Multiple Intelligence are presented in Table 2.

Table 2. Descriptive Statistics

	Pretest	Posttest
Mean	67.30	86.15
Std. Deviation	5.947	4.158
Minimum	58	77
Maximum	80	92
N	27	27
Total	1817	2326
Average	67	86

Based on Table 2, the results of the descriptive statistical analysis show a significant increase between the pretest and posttest scores of students after the implementation of the Guided Discovery Learning model in the Basic Science Development Course Based on Multiple Intelligence. The average pretest score was 67.30 with a standard deviation of 5.947, while the average posttest score increased to 86.15 with a standard deviation of 4.158. The pretest score range was from 58 to 80, while the posttest score ranged from 77 to 92. With a sample size of 27 students, the total pretest and posttest scores were 1817 and 2326, respectively. The average pretest and posttest scores were 67 and 86, respectively, indicating a significant improvement in students' learning outcomes after the implementation of this learning method. The summary of prerequisite test and hypothesis test results are presented in Table 3.

Table 3. Summary of Prerequisite Test and Hypothesis Test Results

No	Component	Sig.	Description
1.	Normality Test (One-Sample Kolmogorov-Smirnov Test)	0.053	Normally Distributed
2.	Homogeneity Test (Levene's Test)	0.940	Homogeneous
3.	t-Test (Independent-Sample T Test)	0.000	Significant Difference

Based on Table 3, the analysis results show that the data is normally distributed, with a significance value of 0.053 in the One-Sample Kolmogorov-Smirnov Test. This means that the significance value is greater than 0.05, concluding that the data is normally distributed. Additionally, the Homogeneity Test using Levene's Test shows a significance value of 0.940, which is also greater than 0.05. Thus, it can be concluded that the tested data is homogeneous. Furthermore, the t-Test (Independent-Sample T-Test) results show a significance value of 0.000, which is less than 0.05. This indicates that there is a significant difference in the pretest and posttest scores. Overall, these results support the acceptance of the hypothesis that the Guided Discovery Learning Model has an effect on learning interest in Basic Science Development courses based on Multiple Intelligence.

Discussion

The guided discovery learning model has a significant impact on students' interest in learning in the course of developing science teaching for elementary schools based on Multiple Intelligences. This learning process involves dividing students into small groups to create lesson plans based on Multiple Intelligences, which are then presented and receive constructive feedback from the instructor. These findings reinforce previous study by Dewey (1916), who emphasized the importance of discovery-based learning in enhancing student engagement and understanding, as well as Bruner's (1961) view that learning through discovery helps students develop critical and analytical thinking skills. In the context of this study, the application of Multiple Intelligences-based learning, as proposed by Gardner (1983), has proven effective (Chu et al., 2019; Ouzzine et al., 2022; Saputri et al., 2022). Students present their plans and receive constructive feedback from the instructor, which, according to other researches, can improve student achievement. The improvement in the quality of students' work was evident in the second and third presentations after receiving feedback, demonstrating the effectiveness of this method in enhancing student performance. The average score of each indicator in this study falls within the "Agree" category, with the highest score in Learning Preparation (79.6%). This indicates that students who prepare well before learning tend to have a better understanding and higher outcomes. The increase in scores on the pretest and posttest confirms the effectiveness of this model in improving learning outcomes. The t-test results

(Independent-Sample T-Test) show a significance value of 0.000, which is less than 0.05, indicating a significant difference in the pretest and posttest scores. Overall, these results support the hypothesis that the Guided Discovery Learning Model has a positive impact on students' interest in learning Basic Science Development based on Multiple Intelligence. These findings are consistent with previous research, which showed that effective learning preparation strategies can significantly improve students' academic achievement. This study reinforces the findings that guided discovery learning and constructive feedback can enhance the quality of learning and students' interest in learning. Holistic and integrated learning methods have proven effective in achieving optimal educational outcomes by increasing student engagement, independence, and responsibility in the learning process (Almoslamani, 2022; Simamora et al., 2019).

Further support comes from research by other researchers, which investigated the guided inquiry model through virtual laboratories, showing that the guided discovery approach significantly improves students' scientific process skills. This study also shows an improvement in students' learning outcomes in Multiple Intelligences-based Science learning. Research by other researchers supports these findings by showing that guided discovery learning in the context of local culture can enhance students' mathematical problem-solving abilities and self-efficacy. Additionally, research by other researchers reinforces the view that integrating active learning methods can develop students' various multiple intelligences (Gunawan et al., 2019; Maharani et al., 2020; Romanow et al., 2020; Simamora et al., 2019; Thambu et al., 2021). Overall, this study strengthens previous findings that guided discovery learning and constructive feedback can enhance the quality of learning and students' interest in learning. The holistic and integrated learning approach has proven effective in achieving optimal educational outcomes by increasing student engagement, independence, and responsibility in the learning process. Several limitations need to be addressed for future improvement. This study only involved one university with a limited sample size, so the results may need to be generalized to a larger population. Future research could involve multiple universities with larger sample sizes to strengthen the generalization of the findings. Finally, the use of questionnaires and observations can be expanded by including additional qualitative methods, such as in-depth interviews and focus group discussions, to gain a deeper understanding of the factors influencing students' learning interests. This study implies that the application of guided discovery learning methods and constructive feedback can significantly improve the quality of learning and students' interest in learning. The holistic and integrated learning approach is not only effective in achieving optimal educational outcomes but also in increasing student engagement, independence, and responsibility in the learning process. Thus, the application of these learning strategies can serve as a reference for educational institutions to design more effective curricula and teaching methods, create more conducive learning environments, and promote better academic development for students.

4. CONCLUSION

This research concludes that the Guided Discovery Learning model has a significant impact on students' learning interest in the development of basic science learning based on multiple intelligences. The learning process, which involves dividing students into small groups to design and present lesson plans, accompanied by constructive feedback from instructors, has proven effective in enhancing students' engagement, understanding, and learning outcomes. Additionally, this method encourages students' independence and responsibility, ultimately contributing to improved academic achievement. This study provides evidence that guided discovery learning and constructive feedback are effective strategies for improving the quality of learning and students' interest in learning. Several limitations need to be addressed for future improvement. This study only involved one university with a limited sample size, so the results may need to be generalized to a larger population. Future research could involve multiple universities with larger sample sizes to strengthen the generalization of the findings. Finally, the use of questionnaires and observations can be expanded by including additional qualitative methods, such as in-depth interviews and focus group discussions, to gain a deeper understanding of the factors influencing students' learning interests.

5. REFERENCES

Akhir, M., Siburian, J., & Effendi, M. H. (2023). A Study Comparison the Application of Discovery Learning and Problem Based Learning Models on the Critical Thinking Ability. *Integrated Science Education Journal*, *4*(2), 84–89. https://doi.org/10.37251/isej.v4i2.390.

Alalwan, N., Cheng, L., Al-Samarraie, H., Yousef, R., Ibrahim Alzahrani, A., & Sarsam, S. M. (2020). Challenges and Prospects of Virtual Reality and Augmented Reality Utilization among Primary School

Teachers: A Developing Country Perspective. *Studies in Educational Evaluation*, *66*(1), 1–12. https://doi.org/10.1016/j.stueduc.2020.100876.

Alita, D., Putra, A. D., & Darwis, D. (2021). Analysis of classic assumption test and multiple linear regression coefficient test for employee structural office recommendation. *IJCCS (Indonesian Journal of Computing and Cybernetics Systems)*, *15*(3), 295. https://doi.org/10.22146/ijccs.65586.

Almoslamani, Y. (2022). The impact of learning strategies on the academic achievement of university students in Saudi Arabia. *Learning and Teaching in Higher Education: Gulf Perspectives*, *18*(1), 4–18. https://doi.org/10.1108/LTHE-08-2020-0025.

Amerstorfer, C. M., & Kistner, C. F. von M. (2021). Student Perceptions of Academic Engagement and Student-Teacher Relationships in Problem-Based Learning. *Frontiers in Psychology*, *12*(1), 1–18. https://doi.org/10.3389/fpsyg.2021.713057.

Anan Sutisna, M. P. (2021). *Metode Penelitian Kualitatif Bidang Pendidikan* (1st ed.). UNJ PRESS. https://books.google.co.id/books?id=Z_UfEAAAQBAJ.

Astuti, N., Hidayat, N., & Nuraini, S. (2023). The Use of Discovery Learning in Building Students ' Motivation in Writing Descriptive Text. *3rd English Teaching, Literature, and Linguistics (ETERNAL) Conference*, 489–498.

Bond, M. (2020). Facilitating student engagement through the flipped learning approach in K-12: A systematic review. *Computers and Education*, *151*(1), 1. https://doi.org/10.1016/j.compedu.2020.

Cheung, S. K. S., Kwok, L. F., Phusavat, K., & Yang, H. H. (2021). Shaping the future learning environments with smart elements: challenges and opportunities. *International Journal of Educational Technology in Higher Education*, *18*(1), 1–9. https://doi.org/10.1186/s41239-021-00254-1.

Chu, S. K. W., Reynolds, R. B., Tavares, N. J., Notari, M., & Lee, C. W. Y. (2019). *21st Century Skills Development Through Inquiry-Based Learning*. Springer Nature Singapore. https://doi.org/10.1145/3337682.

Cofré, H., Núñez, P., Santibáñez, D., Pavez, J. M., Valencia, M., & Vergara, C. (2019). A Critical Review of Students' and Teachers' Understandings of Nature of Science. *Science and Education*, *28*(3–5), 205–248. https://doi.org/10.1007/s11191-019-00051-3.

Duncan, K. J. (2020). Examining the Effects of Immersive Game-Based Learning on Student Engagement and the Development of Collaboration, Communication, Creativity and Critical Thinking. *TechTrends*, *64*(3), 514–524. https://doi.org/10.1007/s11528-020-00500-9.

Gunawan, Harjono, A., Hermansyah, & Herayanti, L. (2019). Guided inquiry model through virtual laboratory to enhance students' science process skills on heat concept. *Cakrawala Pendidikan*, *38*(2), 259–268. https://doi.org/10.21831/cp.v38i2.23345.

Harefa, D., Sarumaha, M., Telaumbanua, K., Telaumbanua, T., Laia, B., & Hulu, F. (2023). Relationship Student Learning Interest To The Learning Outcomes Of Natural Sciences. *International Journal of Educational Research & Social Sciences*, *4*(2), 240–246. https://doi.org/10.51601/ijersc.v4i2.614.

Jolly, E., & Chang, L. J. (2019). The Flatland Fallacy: Moving Beyond Low–Dimensional Thinking. *Topics in Cognitive Science*, *11*(2), 433–454. https://doi.org/10.1111/tops.12404.

Lin, K. Y., Wu, Y. T., Hsu, Y. T., & Williams, P. J. (2021). Effects of infusing the engineering design process into STEM project-based learning to develop preservice technology teachers' engineering design thinking Kuen-Yi. *International Journal of STEM Education*, *8*(1), 1–15.

Maharani, R., Marsigit, M., & Wijaya, A. (2020). Collaborative learning with scientific approach and multiple intelligence: Its impact toward math learning achievement. *The Journal of Educational Research*, *113*(4), 303–316. https://doi.org/10.1080/00220671.2020.1806196.

Mora, H., Signes-Pont, M. T., Fuster-Guilló, A., & Pertegal-Felices, M. L. (2020). A collaborative working model for enhancing the learning process of science & engineering students. *Computers in Human* Behavior, 103(1), 140–150. https://doi.org/10.1016/j.chb.2019.09.008.

Muliati, M., & Syam, U. (2020). Promoting Discovery Learning Method for Efl Students in Reading Comprehension. *Exposure : Jurnal Pendidikan Bahasa Inggris*, *9*(2), 370–382. https://doi.org/10.26618/exposure.v9i2.4083.

Okolie, U. C., Igwe, P. A., Mong, I. K., Nwosu, H. E., Kanu, C., & Ojemuyide, C. C. (2022). Enhancing students' critical thinking skills through engagement with innovative pedagogical practices in Global South. *Higher Education Research and Development*, *41*(4), 1184–1198. https://doi.org/10.1080/07294360.2021.

Ouzzine, A., Erguig, R., & Boudlal, A. (2022). Discovery-Based Teaching Methodology: A Framework for Quality Teaching and Learning. *Journal of Applied Language and Culture Studies*, *5*(5), 9–27.

Romanow, D., Napier, N. P., & Cline, M. K. (2020). Using active learning, group formation, and discussion to increase student learning: A business intelligence skills analysis. *Journal of Information Systems Education*, *31*(3), 218–231. https://aisel.aisnet.org/jise/vol31/iss3/6.

Rone, N., Guao, N. A., Jariol, M., & Acedillo, N., Balinton, K., & Francisco, J. (2023). Students' Lack of Interest,

Motivation in Learning, and Classroom Participation: How to Motivate Them? *Psychology and Education: A Multidisciplinary Journal*, *7*(8), 636–645. https://doi.org/10.5281/zenodo.7749977.

Rusticus, S. A., Pashootan, T., & Mah, A. (2023). What are the key elements of a positive learning environment? Perspectives from students and faculty. *Learning Environments Research*, *26*(1), 161–175. https://doi.org/10.1007/s10984-022-09410-4.

Saputri, W., Priyambodo, P., Winarto, W., & Jayawardana, H. B. A. (2022). Penguatan Fungsi dan Peran Sekolah: Solusi Pembelajaran Sains bagi Generasi Y dan Z di Era 4.0. *BIOEDUSAINS:Jurnal Pendidikan Biologi Dan Sains*, *5*(1), 54–68. https://doi.org/10.31539/bioedusains.v5i1.3388.

Simamora, R. E., Saragih, S., & Hasratuddin, H. (2019). Improving Students' Mathematical Problem Solving Ability and Self-Efficacy through Guided Discovery Learning in Local Culture Context. *International Electronic Journal of Mathematics Education*, *14*(1), 61–72.

Thambu, N., Prayitno, H. J., & Zakaria, G. A. N. (2021). Incorporating Active Learning into Moral Education to Develop Multiple Intelligences: A Qualitative Approach. *Indonesian Journal on Learning and Advanced Education*, *3*(1), 17–29. https://doi.org/10.23917/ijolae.v3i1.10064.

Yang, J., Peng, M. Y. P., Wong, S. H., & Chong, W. L. (2021). How E-Learning Environmental Stimuli Influence Determinates of Learning Engagement in the Context of COVID-19? SOR Model Perspective. *Frontiers in Psychology*, *12*(1), 1–12. https://doi.org/10.3389/fpsyg.2021.584976

Yanti, Y. E. (2019). Studi Awal Motivasi Belajar Mahasiswa Pendidikan Guru Sekolah Dasar (Pgsd) Pada Mata Kuliah Konsep Dasar Ipa. *Caruban: Jurnal Ilmiah Ilmu Pendidikan Dasar*, *2*(2), 63–70. https://doi.org/10.33603/cjiipd.v2i2.2200.

Zhampeiis, K., Assanova, G., Toishybaeva, G., Saparbaeva, A., Orazbaeva, A., & Manapova, G. (2022). Academic Lectures: Communicative Approaches To Interactive Lectures In Today's Classroom. *Journal of Positive School Psychology*, *2022*(6), 7545–7555.