International Journal of Education, Vocational and Social Science
https://e-journal.citakonsulindo.or.id/index.php/IJEVSS
E-ISSN : 2963 4954
IJEVSS

Differentiated PowerPoint to Improve Science Learning Outcomes on Lithosphere and Hydrosphere Material

Fransiska Elvira David Making[1]
[1]Program Studi Pendidikan Luar Biasa, Fakultas Ilmu Pendidikan, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia
Ishartiwi[2]
[2]Program Studi Pendidikan Luar Biasa, Fakultas Ilmu Pendidikan, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

Corresponding Author: fransiska70fip.2025@student.uny.ac.id

Abstract

This classroom action research examines the implementation and effectiveness of PowerPoint integrated with differentiated learning to improve learning outcomes in Natural and Social Sciences (IPAS) on the topic of the lithosphere and hydrosphere. The research participants were two fifth-grade students experiencing learning difficulties at SDN 002 North Malinau. A hybrid design combining a single case study and action research was implemented in two cycles, with two 70-minute meetings in each cycle. Data were collected through pretests and posttests, classroom observations, semi-structured interviews, documentation, and the researcher's reflection journal. Quantitative data were analyzed descriptively, while qualitative data were examined through thematic analysis, chronological comparison, and pattern matching. Students scored 30 and 10 on the pretest, 90 and 60 after Cycle I, and 100 and 100 after Cycle II. Thus, classical completeness increased from 0% to 50% and finally to 100%. The average learning engagement also increased from 67.85% in Cycle I to 89.30% in Cycle II. These improvements were supported by gradual visual support, simplified instructions, differentiated tasks, discussion-stimulating strategies, rewards, intensive guidance, and the addition of videos and simulations. Findings indicate that PowerPoint-based differentiated learning can improve conceptual understanding, participation, and science learning outcomes for students who require a slower pace of learning and repeated support.

Keywords:Differentiated learning, PowerPoint, Science, Learning difficulties, Elementary school

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INTRODUCTION

Natural and Social Sciences, known in Indonesia as IPAS, aims to help elementary school students understand natural and social phenomena in an integrated manner. In fifth grade, the topic of Earth's structure, specifically the lithosphere and hydrosphere, requires students to recognize layers and processes that cannot always be directly observed. The abstract nature of this material makes visualization, guided explanations, and associations with environmental phenomena close to students' lives crucial. The national curriculum also expects learning activities to develop investigative, reasoning, and problem-solving skills, rather than simply memorizing terms.(Ministry of Education, Culture, Research, and Technology, 2022)

These demands can be particularly challenging for students with learning disabilities. These students may process information more slowly, have difficulty following complex instructions, and require more time, repetition, and concrete visual support. When learning is delivered at a single pace through lectures and textbooks alone, students who need additional support may lose attention, become passive, and fail to connect scientific concepts with meaningful examples. Therefore, inclusive learning requires systematically adapting instruction while still providing access to the same essential learning objectives.(Hallahan et al., 2015)

Differentiated learning provides a pedagogical framework for addressing these differences. This approach adapts content, learning processes, products, and learning environments based on students' readiness, interests, and learning profiles.(Creswell, 2013)In the context of this research, differentiation can be implemented by simplifying explanations without reducing core concepts, varying the way information is presented, providing additional time and guidance, and allowing students to demonstrate understanding through tasks appropriate to their ability level. Differentiation is most effective when assessment and learning are continuously connected so that teachers can adjust support based on student responses.(Tomlinson, 2017)

PowerPoint can serve as a practical medium for implementing this differentiation. Text, diagrams, photos, animations, videos, navigation buttons, and short quizzes can be arranged into a structured learning sequence. Multimedia representations can narrow the gap between abstract concepts and concrete experiences if relevant words and visuals are presented coherently and unnecessary information is minimized.(Majid, 2017)This medium also allows teachers to pause, repeat, or review certain material, which is important for students who require a slower learning pace and repeated exposure.

Initial observations in a fifth-grade class at SDN 002 North Malinau identified two students who consistently scored below the Minimum Completion Criteria (KKM) of 70 in science. They

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required repeated explanations, had difficulty following the sequence of abstract material, and demonstrated limited participation when learning relied solely on lectures, textbooks, and the blackboard. The absence of a dedicated assistant teacher made it difficult to provide ongoing individual support during regular learning.(Rusman, 2017)Therefore, this study integrated differentiated learning and PowerPoint into a two-cycle intervention. This study aimed to describe the implementation of the intervention and determine its impact on learning outcomes and student engagement in the lithosphere and hydrosphere material.

METHOD

This study uses a hybrid design that combines a holistic single case perspective with classroom action research.(Sugiyono, 2020)The single case perspective allows for an in-depth study of two target students in their natural classroom context, while the action research cycle allows for interventions to be refined through iterative stages of planning, acting, observing, and reflecting.(Stringer, 2014)The study was conducted in a fifth-grade class at SDN 002 North Malinau, Malinau Regency. Two students were purposively selected based on consistently low science achievement, teacher recommendation, need for recurrent learning support, regular attendance, and parental permission. The pseudonyms YN and MP are used throughout this article.(Arikunto, 2019)

The intervention consisted of two cycles, each consisting of two 70-minute sessions. In Cycle I, teachers used PowerPoint presentations containing contrasting images, animations of Earth's layers, brief explanatory sections, navigation buttons, guided questions, and quizzes. Differentiation was implemented through simplified visual content, individualized instruction and additional processing time, and assignments tailored to students' current abilities. Students also worked on worksheets and participated in small group activities. Reflections on Cycle I informed improvements in Cycle II.

Data were collected through a ten-item learning outcome test, an engagement observation sheet with fourteen indicators, semi-structured interviews, student work, classroom documentation, and the researcher's reflection journal. The same content indicators were assessed before and after each cycle of the intervention. Raw learning outcome scores were converted to a scale of 0-100. The intervention was declared successful if both students achieved the Minimum Competency (KKM) of 70 and the average observed engagement reached at least 80%.

Learning outcome and engagement data were analyzed using descriptive comparisons

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between pre-cycle, Cycle I, and Cycle II. Qualitative evidence was organized chronologically and analyzed thematically to identify changes in attention, participation, task completion, and response to media. Pattern matching was used to compare observed changes with the expected impacts of differentiated learning and multimedia. Credibility was strengthened through triangulation of tests, observations, interviews, documentation, and reflective notes, as well as by maintaining a traceable record of evidence.(Yin, 2014)

RESULTS AND DISCUSSION

Differentiated PowerPoint Implementation

Cycle I demonstrated that PowerPoint captured the attention of both students and helped them respond to the images and animations. YN was generally able to follow the learning sequence and complete the assigned tasks, while MP required more frequent individual prompts and guidance. Both students remained passive when asked to ask questions or initiate discussions. Reflection also identified insufficient elaboration time, verbal instructions that were not always understood, and uneven participation during group work. Average engagement remained below the 80% success criterion.(Tomlinson & Moon, 2013)

Cycle II included seven key improvements: brief icebreaker activities, more heterogeneous group composition, step-by-step visual instructions on each slide, additional videos and simple simulations, an extended elaboration stage, discussion starters (talk moves) with small rewards for active participation, and more intensive mentoring for MPs. MPs also received worksheets with reduced language complexity without eliminating the same core concepts. These improvements made the learning sequence clearer and provided more opportunities for processing, discussing, and demonstrating understanding.(Westwood, 2018)

Learning outcomes

Table 1. Learning Outcomes in Each Action Cycle

Indicator	Pre-cycle	Cycle I	Cycle II
YN Score (0-100)	30	90	100
MP Score (0-100)	10	60	100
Average value	20	75	100
Students who achieve KKM 70	0 of 2	1 of 2	2 of 2
Classical completion	0%	50%	100%

Table 1 shows consistent improvement in learning outcomes. Before the intervention, YN

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answered three of the ten items correctly and MP answered one item correctly, equivalent to scores of 30 and 10, respectively. Neither student achieved the KKM. After Cycle I, YN scored 90 and was declared complete, while MP scored 60 and still needed support. After improvement in Cycle II, both students scored 100. The average score increased from 20 in the pre-cycle to 75 in Cycle I and 100 in Cycle II, while classical completeness increased from 0% to 50% and then 100%.

Student Engagement

Table 2. Student Involvement in Cycle I and Cycle II

Participants	Cycle I	Cycle II	Improvement
YN	71.40%	92.90%	21.50 points
MP	64.30%	85.70%	21.40 points
Average	67.85%	89.30%	21.45 points

Improved learning outcomes were accompanied by increased participation. YN's engagement increased from 71.4% to 92.9%, while MP's engagement increased from 64.3% to 85.7%. The average increase was 21.45 percentage points and exceeded the established success criteria in Cycle II. Observation notes indicated more sustained attention, better task completion, more positive peer interactions, and a greater willingness to answer questions. MP still required occasional guidance and lacked confidence in initiating questions, but the overall improvement was substantial.

DISCUSSION

The results showed that the effectiveness of the intervention did not depend solely on PowerPoint as a display tool. Improvements occurred because the medium was placed within a differentiated learning sequence.(Daryanto, 2016)Visual explanations and animations support access to abstract concepts, while simplified instructions, customized worksheets, additional time, and teacher guidance reduce barriers to participation. This combination reflects the principle that content and processes need to be tailored to students' readiness without separating them from the essential curriculum.(Hamalik, 2017)

The multimedia design also appears to support comprehension by coordinating relevant words and visuals. Students can observe representations of the Earth's layers and water-related processes, pause at difficult sections, and receive immediate reinforcement through questions and quizzes. These features align with multimedia learning principles, particularly the use of

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focused visual-verbal representations and manageable segments to support cognitive processing.(Joyce et al., 2015)For students who need repetition, the ability to review the same visual sequence is very beneficial.

The difference between Cycle I and Cycle II shows the important value of reflective action research.(Slavin, 2018)The first cycle showed that engaging media alone does not automatically lead to active discussion or independent task completion (Daryanto, 2016). Participation increased when teachers added explicit discussion prompts, rewards, visual instructions, longer processing time, and targeted assistance. In other words, the pedagogical decisions that accompany media use are as important as the media itself. This iterative adjustment is the essence of action research: evidence from classroom practice is used to refine subsequent actions.(Hattie, 2015)

The findings of this study have practical implications for inclusive elementary school classrooms. Teachers can develop low-cost presentations using commonly available software and use them to provide diverse representations, differentiated practice, and repeated access to materials. However, this intervention requires adequate projection equipment, a stable power supply, careful time management, and teacher skills in observing individual responses.(Mayer, 2020). Therefore, technology needs to be treated as part of a responsive learning system, not as a substitute for direct teacher guidance.(Zubaidah, 2019)

Several limitations should be considered. This study involved only two students at one school and was conducted over two short cycles; therefore, the findings are contextual and do not yet demonstrate long-term retention or broad generalizability. Observational and interview data may also contain researcher subjectivity, despite triangulation. Future research should involve more diverse participants, use comparison groups where appropriate, and examine whether learning gains are sustained after the intervention ends.

CONCLUSION

This study shows that the application of PowerPoint based on differentiated learning is effective in improving the learning outcomes and engagement of fifth grade students who have learning difficulties in the lithosphere and hydrosphere material. The results of the action show an increase in learning completeness from 0% in the pre-cycle to 50% in Cycle I and reaching 100% in Cycle II. The average student engagement also increased from 67.85% to 89.30%, which indicates that the use of visual media combined with adjustments to content, process, learning tempo, gradual instructions, and individual guidance can help students understand abstract

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concepts and participate more actively in learning. These findings confirm that learning success is not only determined by the use of media, but also by the application of differentiation strategies that are appropriate to the needs and learning characteristics of each student.

However, the results of this study still have limitations because they only involved two students in one school and with a relatively short duration of intervention, so the generalizability of the findings and the sustainability of the intervention impact cannot be ensured. Furthermore, observation and interview data are potentially influenced by researcher subjectivity despite triangulation. Therefore, further research is recommended involving a larger number of participants, more diverse student characteristics, a longer intervention period, and the use of a comparison group to obtain stronger empirical evidence. Practically, the results of this study provide implications that elementary school teachers, especially in inclusive classes, can utilize PowerPoint-based differentiated learning as an alternative learning strategy that is easy to implement to improve conceptual understanding, active participation, and student learning outcomes through the presentation of materials that are more adaptive, interactive, and tailored to individual learning needs.

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