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Chunking Techniques to Enhance Learning Outcomes in the Human Body System

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ABSTRACT

Objective: Chunking is a cognitive method that breaks down complex material into smaller, more digestible pieces, improving comprehension and retention of knowledge. This study aims to assess the efficacy of the chunking strategy in improving student learning outcomes for human body system materials. **Method:** The research method was quasi-experimental with a post-test control group design. The research subjects of eighth-grade students consisted of experimental and control classes. The instrument used was a multiple-choice test to understand the concept of human body systems. **Results:** The study showed that the chunking technique effectively improved learning outcomes because it helped the brain process information better. The chunking technique increases students' understanding of the human body system's material, which impacts better learning outcomes. **Novelty:** This study introduces the chunking technique as a strategy in science learning, especially in understanding the material of the human body system. The chunking technique helps teachers present learning that suits the needs of students. The application of chunking techniques in learning, assisted by learning media, can accommodate the differences in student characteristics in class.

INTRODUCTION

The chunking technique divides complex information into smaller pieces that are easier to remember. The chunking technique is also known as segmentation. In particular, the results of the meta-analysis report that segmentation can improve information retention and transfer (Aalioui et al., 2022). The chunking technique is applied to subject matter with pictures and learning videos to make it easier for students to receive and manage information. The chunking technique can improve understanding of information related to symbols or images (Chen et al., 2024). Students who learn with visual media, for example, videos with chunking techniques, show significant improvements in concept understanding and problem-solving skills (Dewanti & Sulistyaningrum, 2023; van Nooijen et al., 2024; Zhang et al., 2020). Adapting learning videos by breaking them into shorter segments can increase focus so that students can understand material with a high difficulty level. Visual support in the form of images and videos is important in science learning, especially in teaching abstract material that students cannot observe directly in the real world.

Some science materials have abstract and complex concepts, requiring an appropriate approach and strategy in their presentation (Dikmen & Korkmaz, 2020). One example of science material that has an abstract concept is the human body system (Astuti et al., 2020). Students cannot directly observe the processes that occur when body systems work (Smith & Jones, 2023). In pictures or videos, Learning media is

Needed (Su & Ju, 2025). The material must be visualized so that the complex process of body system work can be understood by students (Rohandi et al., 2024). Digital or video simulations can help students explore and understand the intricate and complex processes at work of body systems (Huang et al., 2021). Appropriate learning media can increase information retention and students' understanding of science materials (Mercan & Varol Selçuk, 2024). The chunking technique will be better if applied to learning media such as videos because visualization makes it easier for students to manage the information received (Cavanagh & Kiersch, 2023; Krieglstein et al., 2023; Vu et al., 2022). Technology encourages motivation and increases student attention and interaction in learning (Martínez-Huamán et al., 2023). However, prerequisite knowledge is also important to reduce students' cognitive burden so that it impacts better learning outcomes (Endres et al., 2023).

Strategy and technology support plays an important role in improving the quality of learning, which will impact better learning outcomes (Alshammary & Alhalafawy, 2023; Nurdiana et al., 2023). Using video as a learning medium, such as the chunking technique, takes the right strategy. The chunking strategy gives students a more profound understanding (Altiner, 2024). The chunking technique reduces the load on the working memory, thus effectively improving cognitive performance (Küchelmann et al., 2024; Gobet, 2024). Chunking techniques help people organize information more efficiently, making it easier to process and understand complex content (Kosaka, 2024). Chunking improves the efficiency of the solution-finding process by breaking complex problems into simpler pieces (Guo et al., 2024). This study aims to assess the effectiveness of the chunking strategy in improving student learning outcomes on human body system material with the support of media, namely learning videos. The novelty of this study is that segmented videos as a learning tool allow students to focus more on the material presented, and implementing chunking techniques and interactive games can create a meaningful learning experience that impacts improving student learning outcomes.

RESEARCH METHOD

The chunking technique divides knowledge into smaller, more easily consumable parts, which can help students understand complex subjects. Figure 1 shows the chunking technique applied to the learning video.

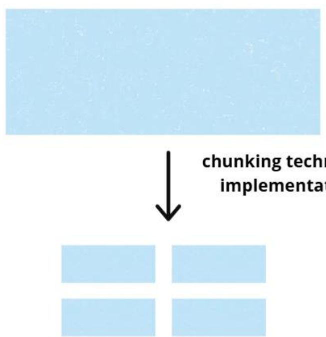

Figure 1. Segmentation in chunking techniques.

In this study, students will be shown videos divided into several different parts, followed by interactive challenges in the form of games and quizzes to help them learn. This quasi-experimental study uses a pretest and post-test control group design. This study uses experimental and control classes of 32 grade 8 students. The experimental class was given treatment: learning by applying the chunking technique using segmented videos. The control class will be given treatment, namely learning by presenting the entire video without segmentation. The research data collection uses pretest and post-test instruments as multiple-choice questions with cognitive levels of understanding to analyze. The cognitive level used is based on Bloom's taxonomy. The test instrument indicates learning success, which can be seen in acquiring student learning outcomes. The scores of the experimental and control groups will be compared to evaluate whether there is a significant difference in learning outcomes due to the chunking technique. Data analysis uses normality, homogeneity, and T-tests.

Figure 2 shows the research procedure, which consists of 7 steps. It starts with preparing teaching materials from the digestive system. After the research subject was determined, a pretest was carried out, and treatment was continued, namely, the implementation of the chunking technique in the learning video. After completing the treatment, students were given a post-test, and the results were analyzed, interpreted, and concluded.

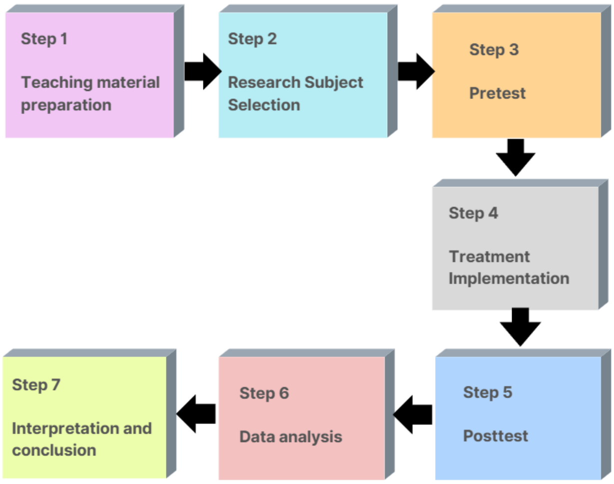

Figure 2. Research procedures.

RESULTS AND DISCUSSION

Results

This study uses an experimental class and a control class. The experimental class applies chunking techniques to the subject matter presented with learning videos. The control class displays learning videos without segmentation of material content. After being given different experimental and control class treatments, the pretest and post-test results were obtained, which were then statistically analyzed descriptively using SPSS 25. The results of the descriptive statistical analysis for each class are shown in Table 1.

Table 1. Descriptive statistics for each group.

Class	N	Mean Pretest	Mean Post-test	Std. Pretest Deviation	Std. Post-test Deviation
Experiment	32	52.968	80.625	6.203	4.877
Control	32	51.562	72.343	6.405	4.396

Table 1 shows that in the experimental group, the standard deviation for the pretest is 6.203, while for the post-test, it is 4.877. It suggests that the experimental group had a more minor variation in learning outcomes after treatment. On the other hand, the control group had a higher standard deviation in the pretest of 6.405 and the post-test of 4.396, reflecting more significant variation in their learning outcomes. The mean difference between the pretest and post-test in both groups showed improved scores after treatment, with a more significant improvement in the experimental group. The data showed that the experimental group experienced a more significant improvement than the control group after treatment.

The data obtained were then correlation analyzed to show the relationship between the implementation of the pretest and post-test in the experimental and control classes. Table 2 shows the results of the correlation analysis of paired samples.

Table 2. Correlation of paired samples.

Paired	N	Correlation	Sig.
Pretest & Posttest (Experiment)	32	0.763	0.000
Pretest & Posttest (Control)	32	0.238	0.190

In the experimental group, the correlation value was 0.763 ($p < 0.001$), which showed a strong and significant relationship between pretest and post-test scores. It shows that students with a good initial understanding tend to improve more after treatment. In contrast, in the control group, a lower correlation value (0.238, $p = 0.190$) indicates that the association between the pretest and the post-test is less intense (not significant), indicating that the improvement in the control group is not entirely dependent on their initial score.

Table 3 shows the results of the t-test analysis, which shows that the mean difference between the pretest and the post-test is -27.656, with a very significant p (Sig. 2-tailed) value ($p < 0.001$). The experimental group's treatment has significantly improved student learning outcomes. In the control group, the average pretest score was 51.562, and the post-test was 72.34. The average difference between the two scores is -20.781, with a p-value (Sig. 2-tailed) also significant ($p < 0.001$). Although the increase in scores in the control group was also significant, the results showed that the experimental group experienced a more significant improvement than the control group. A very low p-value of less than 0.050 indicates a significant difference between the pretest and post-test in the experimental and control classes, with the experimental group showing a more significant improvement than the control class.

Table 3. Paired sample t-test.

Class	Average Difference	Std. Deviation	t	df	Sig. (2-tailed)
Pretest & Posttest (Experiment)	-27.656	4.012	-38.986	31	0.000
Pretest & Posttest (Control)	-20.781	6.852	-17.156	31	0.000

Discussion

This study aims to determine the effectiveness of the chunking technique in improving students' understanding of the concept of the human body system. The findings in this study show that the chunking technique significantly improves learning outcomes, as evidenced by increased understanding that impacts learning outcomes. Applying chunking techniques involves segmenting information or material content into smaller units. Students can better manage the information received; thus, it is easier to understand. Additionally, this study indicates that when students are at ease with the information delivered in pieces, they are more inclined to seek clarification and ask questions. This emphasizes a more participative and engaging learning environment, essential for comprehending and remembering more in-depth information.

The application of methods or treatments applied in experimental classes has a significant impact on student learning outcomes. There are indications that the method applied in the experimental class is more effective in improving understanding of the material of the human digestive system compared to the approach used in the control group. The analysis showed that the experimental group's treatment contributed significantly to improving student learning outcomes. Previous research has proven that active learning methods like collaboration and discussion can encourage better understanding and student engagement (Freeman et al., 2014; Putrantasa et al., 2024).

A high correlation between the pretest and post-test in the experimental group showed that students with a good initial understanding tended to improve more after treatment (Chang & Yang, 2023). It reflects the importance of early assessment in designing appropriate learning interventions (Palomino et al., 2022). Formative assessments help identify student needs and tailor instruction (Eysink & Schildkamp, 2021; Leenknecht et al., 2021; Xuan et al., 2022). In contrast, the low correlation in the control group suggests that initial understanding does not fully influence their learning outcomes (Black & Wiliam, 2021). It can be due to teaching methods that are not interactive or do not suit the needs of students. A more active teaching approach can reduce learning outcomes gaps (Prince & Felder, 2020). In the context of practical applications, these results provide valuable insights for curriculum developers and educators. More interactive and student-oriented learning methods can increase student engagement and understanding, ultimately contributing to better learning outcomes (Hawthorne et al., 2024).

Research also shows that student collaboration in learning activities can significantly improve academic outcomes. Therefore, it is important for educators to design activities that support interaction between students in small groups and class discussions (Astuti et al., 2020). Finally, it is important to evaluate the learning methods applied continuously. By gathering student feedback and analyzing learning outcomes regularly, educators can tailor their approach to meet students' needs and expectations (Guskey, 2021). Thus, the results of this study provide strong evidence to support the use of more active and engaged learning methods. These findings contribute to the educational literature and provide practical guidance for educators in designing effective learning interventions. Overall, the results of the analysis showed that the treatment in the experimental group was very effective in improving learning outcomes, and this provided substantial evidence to support the use of the method in an educational context.

CONCLUSION

Fundamental Finding: The chunking technique applied to human body system material in segmentation videos has been proven to improve student learning outcomes. Applying this technique allows students to understand and remember complex information effectively. By segmenting learning videos into shorter parts, students process information efficiently to make it easier to understand complex concepts and improve their learning outcomes. **Implication**: Applying chunking techniques in teaching can significantly change how students learn. Providing a clear structure facilitates information processing so that teachers can improve the effectiveness of their teaching. By applying the chunking technique, teachers design their learning systematically and well-structured. Well-structured learning can encourage students' motivation to learn because the material presented becomes easier to understand. Overall, the chunking technique contributes to the improvement of student learning outcomes. **Limitation**: Although the chunking technique presents an excellent opportunity to improve student learning outcomes, some limitations are important to note. The effectiveness of the chunking technique depends on the student's ability to recognize segmentation meaningfully. The segmentation of subject matter must be well organized so that it does not cause confusion and increase the cognitive burden of students. **Future Research**: The adaptation of chunking approaches to individual learning styles and varying student skill levels can be the subject of future research. Investigating chunking strategies in various settings, such as those involving varying age groups and educational backgrounds, is also essential. More research can be done to evaluate the chunking technique's efficacy with alternative teaching strategies. As a result, this study can contribute more to our understanding of enhancing learning outcomes across various disciplines.

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