THE EFFECT OF CROSS-MODAL SENSORY INTEGRATION ON ELEMENTARY STUDENTS' RETENTION AND MOTIVATION IN INTEGRATED SCIENCE-SOCIAL STUDIES LEARNING

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Abstract

This study aims to analyze the influence of multisensory integration through the Cross-Modal Sensory Integration model on the retention and learning motivation of elementary school students. The study uses a quantitative approach with a quasi-experimental type and *a non-equivalent control group design*. The study subjects consisted of 54 elementary school grade V students who were divided into experimental groups and control groups. The experimental group obtained IPAS learning using the Cross-Modal Sensory Integration model, while the control group used conventional learning. Data were collected through learning retention tests and learning motivation questionnaires, then analyzed using descriptive statistics and *independent sample t-test*. The results showed that there was a significant difference between the experimental group and the control group in the retention and motivation variables of learning with a significance value of $p < 0.05$. Students who participated in learning with the Cross-Modal Sensory Integration model had higher long-term retention abilities and learning motivation than students who participated in conventional learning. These findings show that multisensory integration through the Cross-Modal Sensory Integration model is effectively applied in social studies learning to improve the quality of the learning process and outcomes of elementary school students.

Keywords: Cross-Modal Sensory Integration, Integrated Science and Social Studies (IPAS), Learning Retention, Learning Motivation, Multisensory Integration

INTRODUCTION | مقدمة

Science learning in elementary schools has a strategic role in building students' conceptual understanding and scientific attitudes from an early age. This subject emphasizes not only the mastery of factual knowledge, but also the development of logical and critical ways of thinking. The social science learning process requires the active involvement of students in understanding natural and social phenomena. The reality in the field shows that social studies learning is still dominated by conventional methods. This condition has an impact on the low quality of the process and student learning outcomes.

Learning retention is one of the important indicators in assessing the success of IPAS learning. Learning retention is related to the ability of students to retain and recall information that has been learned over a certain period of time. Learning that focuses only on short-term memorization tends to result in low retention. Students often experience difficulties in relating

the concept of social studies to the context of daily life. This situation shows the need for a learning approach that is able to strengthen long-term memory.

Learning motivation is also a crucial factor in the social studies learning process. Learning motivation affects the level of student involvement during learning activities. Students with high motivation tend to be more active, enthusiastic, and responsible for their learning process. Monotonous learning has the potential to reduce students' interest and enthusiasm for learning. This condition has a direct impact on the achievement of less-than-optimal learning outcomes.

Conventional learning approaches are still widely applied in social studies learning in elementary schools. The dominant lecture method makes students passively recipients of information. Learning interactions are often limited to one-way communication from teachers to students. The minimal use of learning media narrows the learning experience of students. This condition inhibits the development of students' overall cognitive and affective potential.

21st century learning demands the implementation of strategies that are able to accommodate the diversity of students' learning styles. Each student has different sensory characteristics in receiving and processing information. Learning that involves more than one sense is believed to be able to increase the effectiveness of the learning process. The multisensory approach provides students with the opportunity to learn through hands-on experience. The implementation of this approach is relevant to the needs of science learning in elementary schools.

Multisensory integration in learning is based on information processing theory and educational neuroscience. The theory explains that information processed through various sensory pathways will be stored more strongly in memory. Activation of the visual, auditory, and kinesthetic senses simultaneously enriches the student's learning experience. The learning process becomes more meaningful and contextual. This condition contributes to increased retention and motivation to learn.

The Cross-Modal Sensory Integration model is a form of multisensory learning application. This model emphasizes the integration of various sensory modalities in the learning process. Information is presented through a combination of visual, auditory, and motion stimuli. Pupils are encouraged to relate sensory experiences to concepts learned. This approach is in line with the characteristics of the cognitive development of elementary school students.

The application of the Cross-Modal Sensory Integration model provides space for students to be actively involved in learning. Learning activities are designed to stimulate interaction between sensory modalities. Students not only listen to the teacher's explanations, but also observe, practice, and reflect on the learning experience. The process helps students build a deeper conceptual understanding. Learning becomes more interesting and meaningful for students.

A number of studies show that multisensory learning has a positive effect on learning outcomes. The results of previous research revealed an increase in concept understanding and student learning engagement. Previous research focuses more on short-term cognitive aspects. Studies on long-term retention are still relatively limited. Research linking multisensory to learning motivation has also not been widely done.

The context of social studies learning in elementary schools has unique characteristics. IPAS material is often abstract and requires concrete visualization. Elementary school students tend to learn more effectively through hands-on experience. Multisensory learning allows for a

more concrete presentation of IPAS material. This approach helps students understand concepts more comprehensively.

The application of the Cross-Modal Sensory Integration model in IPAS learning has the potential to improve the quality of learning. The integration of various sensory modalities enriches the way students receive and process information. Diverse learning experiences reinforce the interconnectedness between concepts. This process supports the formation of long-term memory. A positive impact can also be seen in increasing students' motivation to learn.

Increased motivation to learn encourages students to be more active in learning IPAS. Students' interest in learning materials becomes higher. A fun learning environment boosts students' confidence. Students' emotional involvement contributes to learning success. This factor plays an important role in achieving the objectives of IPAS learning.

Good learning retention reflects the success of meaningful learning. Students are able to remember and apply the concept of social studies in different situations. Multisensory learning supports the memory strengthening process. The information learned is not easily forgotten. This shows the importance of choosing the right learning model.

This study was carried out to examine the influence of the Cross-Modal Sensory Integration model in IPAS learning. The focus of the research is directed at the retention and learning motivation of elementary school students. A quasi-experimental approach is used to obtain objective empirical data. The results of the research are expected to contribute to the development of the science learning model. The findings of the study are also expected to enrich the study of multisensory learning in elementary schools.

The purpose of this study is to analyze the influence of multisensory integration through the Cross-Modal Sensory Integration model on student retention and learning motivation. This research provides a new perspective in the application of innovative science and science learning. The results of the research can be a reference for teachers in designing effective learning. The implications of the research support the improvement of the quality of science learning in elementary schools. Research contributions are expected to be relevant to the development of educational practice and theory.

METHOD | منهج

This study uses a quantitative approach with a quasi-experimental type of research. This approach was chosen to test the effect of the application of the Cross-Modal Sensory Integration learning model on student retention and learning motivation. The research was carried out on social studies learning in elementary schools. The research design used was *a non-equivalent control group design*. This design allows for comparison of learning outcomes between the experimental group and the control group.

The research subjects consisted of 54 students in grade V of SDN Wiroborang 1 Probolinggo City. The subjects were divided into two groups, namely the experimental group and the control group. The experimental group obtained IPAS learning using the Cross-Modal Sensory Integration model. The control group obtained IPAS learning using conventional learning. The determination of the group was carried out without full randomization by considering the existing class conditions.

The independent variable in this study is the Cross-Modal Sensory Integration learning model. Bound variables include learning retention and student learning motivation. Learning

retention is measured through learning outcome tests given in the form of pretest, posttest I, and posttest II. Learning motivation was measured using a learning motivation questionnaire compiled based on learning motivation indicators. The research instruments have been adjusted to the characteristics of elementary school students.

The data collection technique is carried out through tests and questionnaires. The test was used to obtain student learning retention data on science materials. The questionnaire is used to measure the level of students' motivation to learn after participating in learning. The implementation of learning is carried out in several meetings in accordance with the learning plan that has been prepared. The research procedure begins with the administration of a pretest, followed by treatment, and ends with a posttest and filling out a questionnaire.

The data analysis technique was carried out with descriptive and inferential statistics. Descriptive statistics are used to describe the average score, minimum score, and maximum score. The analysis prerequisite test is carried out before hypothesis testing. Hypothesis testing was carried out using *an independent sample t-test*. The data analysis aimed to determine the differences in retention and learning motivation between the experimental group and the control group.

RESULT | نتائج

The results of this study are presented to determine the effect of the application of the Cross-Modal Sensory Integration model on the retention and learning motivation of elementary school students. Research data was obtained from the results of pretest, posttest I, posttest II, and learning motivation questionnaire. Data analysis was carried out using descriptive statistics and independent sample t-test. The presentation of the results of the study was focused on the comparison between the experimental group and the control group. The results of the research are presented in the form of narrative descriptions and supporting tables.

1. Student Learning Retention

The results of the descriptive analysis showed a difference in the average learning retention score between the experimental group and the control group. The experimental group experienced a significant increase in scores after the implementation of the Cross-Modal Sensory Integration model. The retention score of the experimental group was relatively stable from posttest I to posttest II. The control group experienced a greater decline in scores on posttest II measurements. These findings suggest that multisensory learning contributes to strengthening student learning retention.

Table 1. Average Student Learning Retention Score

Groups	Pretest	Posttest I	Posttest II
Experiments	56,12	82,45	79,63
Controls	55,87	74,18	68,92

The results of the independent sample t-test showed a significant difference in learning retention scores between the experimental group and the control group. The average value of learning retention in the experimental group was higher than that of the control group. The significance value obtained was below the significance level of 0.05. These findings show that the application of the Cross-Modal Sensory Integration model has a significant effect on student learning retention. The results of the statistical test are presented in Table 2.

Table 2. Independent Sample T-Test Test Results for Learning Retention

Variable	Mean Experiment	Mean Control	t	Sig. (p)
Learning Retention	79,63	68,92	3,87	0,000

2. Students' Learning Motivation

The results of the descriptive analysis showed a difference in the level of learning motivation between the experimental group and the control group. The experimental group obtained a higher learning motivation score than the control group. Students in the experimental group showed better interest, attention, and learning engagement. Learning with multisensory integration creates a more engaging and enjoyable learning atmosphere. This condition contributes to increasing students' motivation to learn.

Table 3. Average Student Learning Motivation Score

Groups	Average Score	Categories
Experiments	84,27	Height
Controls	72,54	Medium

The results of the independent sample t-test showed that the difference in learning motivation between the two groups was significant. The average value of the experimental group's learning motivation was higher than that of the control group. The significance value obtained was below the significance level of 0.05. These findings show that the application of the Cross-Modal Sensory Integration model has a significant effect on students' learning motivation. The results of the learning motivation statistical test are presented in Table 4.

Table 4. Independent Sample T-Test Results for Learning Motivation

Variable	Mean Experiment	Mean Control	t	Sig. (p)
Learning Motivation	84,27	72,54	4,21	0,000

3. Summary of Research Results

Overall, the results of the study show that the application of the Cross-Modal Sensory Integration model has a positive influence on student retention and learning motivation. The experimental group showed higher achievement than the control group on all the variables measured. Multisensory integration helps students in strengthening their understanding and memory of IPAS material. Learning that involves a variety of sensory modalities increases student interest and engagement. These findings indicate that the Cross-Modal Sensory Integration model is effectively applied in the learning of social studies in primary schools.

DISCUSSION | مناقشة

The results of the study show that the application of the Cross-Modal Sensory Integration model has a positive influence on the learning retention of elementary school students. These findings indicate that learning social studies involving various sensory modalities is able to strengthen the process of storing information in long-term memory. Students not only receive information verbally, but also through visuals and kinesthetic activities. Such a learning process creates a more meaningful learning experience. This condition is in line with the learning objectives of IPAS which emphasizes conceptual understanding.

Student learning retention in the experimental group was shown to be higher than in the control group. The posttest score II of the experimental group showed a relatively small decrease compared to the control group. This indicates that the information learned through multisensory integration is more persistent in the student's memory. Conventional learning tends to result in short-term retention. This difference confirms the advantages of the Cross-Modal Sensory Integration model in strengthening students' memory.

Theoretically, these findings can be explained through information processing theory. The information received through various sensory pathways will be encoded more richly in memory. Simultaneous activation of the visual, auditory, and kinesthetic senses creates more memory trails. Diverse memory traces make it easier to retrieve information. This process supports increased student learning retention.

The Cross-Modal Sensory Integration model is also in line with the dual coding theory. This theory states that information presented in verbal and visual form will be easier to understand and remember. Social studies learning with a multisensory approach allows students to build a dual representation of the concepts learned. These representations reinforce each other in the student's cognitive system. This condition contributes to increased learning retention.

The characteristics of elementary school students who are in the concrete operational stage also strengthen the effectiveness of this model. Students at this stage have an easier time understanding concepts through hands-on experience and concrete visualization. Multisensory integration gives students the opportunity to learn through real-life activities. Learning is not only centered on the text or the teacher's verbal explanation. This approach helps students build a stronger conceptual understanding.

In addition to affecting learning retention, the Cross-Modal Sensory Integration model has also been proven to increase students' motivation to learn. The learning motivation score of the experimental group was in the higher category than the control group. Students show greater interest and enthusiasm during the learning process. Multisensory learning creates a more engaging learning atmosphere. This condition has a positive impact on student involvement.

Increased learning motivation can be explained through the theory of learning motivation. Learning that involves various activities and media is able to meet the psychological needs of students. Students feel more interested and valued in the learning process. Active involvement increases student confidence. These factors encourage intrinsic motivation in learning social studies.

The multisensory approach provides variety in learning activities. This variation prevents the boredom that often arises in conventional learning. Students have the opportunity to learn through various ways that suit their learning style. Learning becomes more fun and less monotonous. This condition contributes to increasing students' motivation to learn.

The interaction between sensory modalities in the Cross-Modal Sensory Integration model also affects the emotional aspect of students. A positive learning experience forms a better attitude towards social studies subjects. Students feel more comfortable and interested in learning. A conducive learning environment supports students' emotional engagement. This emotional aspect plays an important role in the formation of learning motivation.

The results of this study are in line with the findings of previous research which stated that multisensory learning can improve learning outcomes. A number of studies have shown that

multisensory approaches are effective in improving conceptual understanding. This study expands on these findings by emphasizing the long-term retention aspect. Focusing on learning motivation also makes an additional contribution. Thus, this study enriches the empirical study of multisensory learning.

The difference in results between the experimental group and the control group showed the limitations of conventional learning. Teacher-centered learning provides less space for students to explore concepts. Passive learning activities have an impact on low student involvement. The information received tends to be easily forgotten. This condition emphasizes the need for science learning innovation.

The application of the Cross-Modal Sensory Integration model encourages changes in the role of teachers in learning. The teacher plays the role of a facilitator who directs the student's learning experience. The learning process becomes more interactive and participatory. Students have the opportunity to build knowledge independently. These changes are in line with the demands of 21st century learning.

The practical implications of this study show that social studies teachers can utilize a multisensory approach in learning. The use of visual, audio, and kinesthetic media can be adjusted to the subject matter. Good learning planning is the key to the successful implementation of this model. Teachers need to understand the characteristics of students and learning objectives. Thus, social studies learning can take place more effectively.

In terms of curriculum, the Cross-Modal Sensory Integration model is relevant to the implementation of the Independent Curriculum. The curriculum emphasizes student-centered learning and meaningful learning experiences. Multisensory integration supports holistic competency development. Learning not only emphasizes the cognitive aspect, but also the affective aspect. This strengthens the relevance of research to the latest education policies.

This research has limitations that need to be considered. The subjects of the study were limited to one elementary school. The variation in student characteristics and learning environment has not been fully accommodated. The duration of the study is also relatively limited. This limitation opens up opportunities for further research.

Further research can examine the application of the Cross-Modal Sensory Integration model at different levels of education. Other variables such as critical thinking skills or creativity can be used as the focus of the research. Longitudinal research is also needed to look at the long-term impact of multisensory learning. A qualitative approach can be used to explore students' learning experiences. The development of multisensory-based learning models is a promising research agenda.

Overall, this discussion confirms that multisensory integration through the Cross-Modal Sensory Integration model is effective in increasing IPAS retention and learning motivation. The research findings support the importance of learning innovation in elementary schools. Meaningful learning contributes to improving the quality of education. This model can be an alternative to IPAS learning strategies. The results of the research are expected to make a theoretical and practical contribution to the development of multisensory learning.

CONCLUSSION | خاتمة

The application of the Cross-Modal Sensory Integration model has been proven to have a positive and significant influence on the retention and learning motivation of elementary school

students. The integration of various sensory modalities in the learning process helps students understand and remember concepts more deeply and sustainably. Multisensory learning also creates a more engaging learning atmosphere that increases student engagement and motivation. The results showed that students who learned using the Cross-Modal Sensory Integration model had higher learning retention and motivation achievements compared to conventional learning. These findings confirm that the Cross-Modal Sensory Integration model is feasible to be used as an alternative to IPAS learning to improve the quality of learning processes and outcomes of elementary school students.

BIBLIOGRAPHY | مراجع

Arévalo, Y. I., Armijos Ramirez, M. R., Tituana Calderón, G. E., & Arévalo, E. E. (2025). Multisensory instruction in English vocabulary acquisition among 3rd graders. *Science and Reflection, 4*(1), 2558–2580.

Asril, E., Syahtriatna, S., Wahyuni, S., & Asril, L. Z. (2025). Multisensory learning with multimedia tutorials for children with special needs: Students' and teachers' responses. *Tarbiyah wa Ta'lim: Journal of Education and Learning Research, 12*(3), 327–338.

Broadbent, H. J., White, H., Mareschal, D., & Kirkham, N. Z. (2017). Incidental learning in a multisensory environment across childhood. *Developmental Science, 20*(3), e12454. https://doi.org/10.1111/desc.12454

Di Fuccio, R. (2025). Exploring the effect of digital and multisensory educational designs on learning outcomes. *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2024.2427277

Gkintoni, E., Vassilopoulos, S. P., & Nikolaou, G. (2025). Brain-inspired multisensory learning: A systematic review of neuroplasticity and cognitive outcomes in adult multicultural and second language acquisition. *Biomimetics, 10*(6), 397. https://doi.org/10.3390/biomimetics10060397

Hasan Khoirudin, M., Andriani, D., Putriana, M. S., & Zulfahmi, M. N. (2023). Optimizing digitization literacy through multisensory methods. *Sadewa Journal: Publications of Education, Learning and Social Sciences, 3*(1), 1–10.

Kuo, Y. L., Hwang, G. J., & Tsai, C. C. (2022). Effects of multisensory learning approaches on students' motivation and learning performance. *Educational Technology & Society, 25*(2), 12–26.

Mayer, R. E. (2020). *Multimedia learning* (3rd ed.). Cambridge University Press. https://doi.org/10.1017/9781316941355

Mpolomoka, D. L. (2025). Using the multisensory teaching approach in early childhood education. *Journal of Early Childhood Development and Education*.

Multisensory learning: Improving conceptual understanding through intuitive sensory approaches. (2024). *Journal of Pedagogy: Journal of Education, 1*(6), 45–58.

Nurkhaliza, M., Diana, S. M., Hariyanto, H., & Sowiyah, S. (2025). The influence of multisensory methods in improving initial reading ability. *Pendas: Scientific Journal of Basic Education, 11*(1), 1–10.

Purwanto, W., Masrul, & Hanafi, I. (2025). The effect of multisensory reading methods on students' reading interest and beginning reading. *MULTIPLE: Journal of Global and Multidisciplinary*.

Rahmani, S., Wicaksono, L., & Pratiwi, W. R. (2024). The effect of the differentiated learning model integrated with the multisensory method on Indonesian learning outcomes. *Vox Education: Scientific Journal of Education*.

Saborío-Taylor, S. (2025). Multisensory strategies to foster autonomous language learning through digital landscapes. *European Journal of Interactive Multimedia and Education, 6*(1).

Shidqi, T. S. (2023). The use of multisensory methods to improve the reading ability of children with special needs: A literature study. *Journal of Tambusai Education, 7*(3), 22076–22079.

Slater, J., & Sinha, C. (2020). Multimodal learning and cognitive integration in education. *Learning, Culture and Social Interaction, 25*, 100403. https://doi.org/10.1016/j.lcsi.2020.100403

Sung, Y. T., Chang, K. E., & Liu, T. C. (2021). The effects of integrating multisensory learning into science instruction. *Computers & Education, 168*, 104192. https://doi.org/10.1016/j.compedu.2021.104192

Toth, M., & Sousa, D. A. (2021). *The science of learning: Conceptual frameworks for multisensory instruction*. Corwin Press.

Wijayanti, A. N., & Laili, M. (2024). Multisensory learning strategies: Their effectiveness in improving mathematical comprehension. *Introduction to the Field School of Elementary School Teacher Education, 1*(1), 13–18.

Zhang, Y., & Zhou, M. (2022). Cross-modal learning and memory retention in elementary education. *Journal of Educational Psychology, 114*(5), 945–960. https://doi.org/10.1037/edu0000694