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A GI-TYPE COOPERATIVE LEARNING MODEL ASSISTED WITH SPACE 4D+ AR PLAYING CARDS TO IMPROVE LEARNING OUTCOMES

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ABSTRACT

This research aims to address the challenges in improving students' cognitive learning outcomes in science education, particularly in understanding complex topics like the Earth and Solar System. The objectives are twofold: (1) to enhance students' cognitive learning outcomes by implementing the Group Investigation (GI) cooperative learning model supported by Space 4D+ augmented reality (AR) playing cards, and (2) to compare the effectiveness of this model with traditional teaching methods. This research targeted 7th-grade students at SMP Negeri 4 Pekanbaru, consisting of 392 students distributed across 10 classes during the 2022–2023 academic year. Data collection was conducted through posttests, and the analysis revealed a statistically significant improvement in cognitive learning outcomes, with a mean difference of 18.6 points favoring the experimental group over the control group. These findings highlight the potential of integrating AR technology into cooperative learning models to bridge gaps in conceptual understanding, offering promising implications for broader applications in science education.

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1. INTRODUCTION

Indonesia's educational system is entering a new era of innovation, driven by advancements in technology (Khairani et al., 2019:158). Learning innovation is something new in certain social circumstances to solve problems in learning activities (Ahmad et al., 2018:278). The survival of the nation and state in Indonesia can be guaranteed through education. Improving the standards of primary, secondary, and senior education is a necessary first step in improving the quality of human resources. Aiming to produce high-quality human resources is the ultimate purpose of education, which is why it is an intentional process. Education can provide several benefits, including increasing understanding and knowledge and improving one's insight to hone skills. One

alternative view is that education is a lifelong process that begins at a young age (Neolaka & Grace, 2017:51).

The Minister of Education and Culture is currently echoing the educational motto "Freedom to Learn!", This is intended so that the concept of independent learning can accelerate Indonesian education reform, which is currently considered to be slowly withering away. The Minister of Education and Culture even coined the term "education deregulation" because so far education laws have been seen as hampering the implementation of educational changes that would improve Indonesia's educational standards. Merdeka Belajar is a Technology Research initiative of the Ministry of Education and Culture that aims to improve the learning environment for educators and students. Merdeka Belajar can be understood as the application of a curriculum that prioritizes pleasant situations in the learning process, as well as increasing the innovative thinking of educators (Fathan. 2020:1).

In an effort to shake up what has been an uninteresting national education system, Merdeka Belajar represents a new beginning. The Indonesian Ministry of Culture and Education has launched a new program called Merdeka Belajar to promote enjoyable learning. It is hoped that the national education system, which has been boring so far, can be changed through this program. Therefore, to achieve the necessary goals, educators must encourage innovative thinking (Nasution, 2020:9).

Natural Sciences (IPA) is one of the subjects that students must obtain at school. The science learning process carried out in class must focus on an experimental process to connect students' initial knowledge with the material to be studied (Nahdi, 2018:10). Earth and the solar system are material in the last chapter of semester 2 of class VII which includes four sub-chapters. In reality, students are still unable to fully understand the Earth and Solar System material. According to research (Sari, 2019:1-17), students have difficulty observing celestial objects during the day. Then they also have difficulty understanding phenomena surrounding the Solar System such as the apparent annual motion of the Sun (Sari, 2019:1-17).

Moreover, based on pre-research at SMP Negeri 4 Pekanbaru, class VII students had difficulty learning material on the Earth and Solar System. The reason they have difficulty learning is that the location of celestial bodies is so far away that it is difficult for them to imagine them, so learning is less than optimal. Evidence of less-than-optimal student learning outcomes is certainly due to a cause. One of them is the lack of development of student learning outcomes because science material is taught through the lecture method (Wahyudi, 2019:29). Keeping with this, the implemented learning model has failed to produce the desired results for students' education, and it is clear that students rely heavily on their teachers (teacher-centered) while they study (Heryati, 2019:69).

One of the alternate approaches proposed to address this issue is the cooperative learning model, particularly the Group Investigation learning model. According to (Maspupah et al., 2021:52), students can improve their learning outcomes through the Group Investigation learning model that is aided by interactive multimedia. Students' learning outcomes can be enhanced through the Group Investigation learning model, as demonstrated by (Komala et al., 2020:9). Apart from that, (Wahyudhi, 2019:29) in his research found that Group Investigation (GI) can improve learning outcomes. Lastly (Heryati, 2019:69) His study indicated that compared to students taught using the discussion method, those taught using a cooperative learning model based on group investigations performed better.

Students will use this model to make better use of learning media to improve their outcomes when studying topics related to the Earth and Solar System. Briggs in (Trini Prastati (2005) quoted by (Sutirman, 2013:15) said that media is a physical means. The purpose of this research is to evaluate the effectiveness of the Group Investigation (GI) cooperative learning model, assisted by Space 4D+ augmented reality playing cards, in improving students' cognitive learning outcomes and to compare these outcomes with those achieved through conventional teaching methods.

2. METHOD

SMPN 4 PEKANBARU conducted this study during the odd semester of Class VII of the 2022–2023 school year. For the academic year 2022–2023, all 392 pupils in class VII SMPN 4 PEKANBARU which consists of 10 classes are included in the population. Using random sampling procedures, the study's sample was selected. Based on the drawing findings, two classes were identified: a control class in class VII 5 that employed the direct instruction learning model, and an experimental class in class VII 4 that used the Group Investigation assisted by Space 4D+ augmented reality cards and LKPD. posttest-only control group design and a quasi-experimental methodology are used in this study.Table 1 displays the Control Group Design for the post-test alone. Experimental research is what this study is all about.

Table 1. Posttest-only Control Group Design

Group	Treatment	Posttest
Experiment	X_1	O_1
Control	-	O_2

(Source: Sugiyono, 2022:76)

Following the completion of the learning process, these two classes will get a posttest in the form of a 20-item HOTS question test, which will be administered as multiple choice questions using a cognitive learning outcomes exam sheet as an instrument. Following the acquisition of the post-test results for the experimental class (O1) and the control class (O2), descriptive and inferential analytic methods will be used to examine these scores. The data analysis technique in this research was carried out descriptively and inferentially. The descriptive analysis in question is cognitive learning outcomes which are calculated based on a benchmark assessment, with the formula:

$$Student\ grades = \frac{Total\ score\ obtained}{Maximum\ score} x\ 100 \quad (1)$$

Cognitive learning outcome data is analyzed by calculating the comparison between the scores achieved by students and the specified maximum score. The cognitive learning outcome score categories obtained by students are as in Table 2.

Table 2. Cognitive Learning Outcome Score Scale Categories

Mark	Category
$80 \leq x \leq 100$	Very Good
$60 \leq x \leq 79{,}99$	Good
$40 \leq x \leq 59{,}99$	Quite
$20 \leq x \leq 39{,}99$	Poor
< 20	Very Poor

(Source: Purbaningrum, 2017: 45)

Through hypothesis testing, inferential analysis was performed to ascertain the variations in cognitive learning outcomes between students who utilized the Group Investigation assisted by Space 4D+ augmented reality cards and LKPD and those who employed the conventional learning model in the control class.

3. RESULTS AND DISCUSSION

The study titled "Application of the GI Type Cooperative Learning Model Assisted by Space 4D+ AR Playing Cards to Improve Cognitive Learning Outcomes of Students at SMP Negeri 4 Pekanbaru on Earth and Solar System Material" presents a two-part analysis, with the GI cooperative learning model, with the help of Space 4D+ AR Playing Cards, serving as the independent variable and cognitive learning outcomes as the dependent variable. The GI cooperative learning model, with the help of the Space 4D+ AR Playing Card, was used to conduct this study's treatment on a single experimental class.

Descriptive and inferential statistics are employed in this study. Class 7.4 students at SMPN 4 Pekanbaru used the Group Investigation Learning Model with the help of Space 4D+ AR Playing Cards to study science, while class 7.5 students did not use the model, and the cognitive learning outcomes of both groups are described using descriptive analysis. Table 3 shows the distribution of the data from the critical thinking ability test acquisition (7.5).

Table 3. Description of Number of Student Learning Outcomes

Value	Classification	Experimental Class		Control Class	
		The number of students	Percentage (%)	The number of students	Percentage (%)
$80 \leq x \leq 100$	Very Good	20	50	3	7,5
$60 \leq x \leq 79{,}99$	Good	19	47,5	18	45
$40 \leq x \leq 59{,}99$	Quite	1	2,5	18	45
$20 \leq x \leq 39{,}99$	Poor	0	0	0	0
< 20	Very Poor	0	0	1	2.5
Total		40	100	40	100

(Source: Processed Data)

Contains the results of the hypothesis testing independent t-test that was conducted using the SPSS version 27 application. The results are significant with a p-value of 0.000, a 95% confidence level, and an average difference of 18.62. Class groups that utilized the Group Investigation Learning Model with the help of Space 4D+ AR Playing Cards and those that did not were compared using hypothesis testing to find out whether the two groups were significantly different. The results of the post-test from the independent t-test, which was used to test the null hypothesis (H0), were a significance value of p = 0.000. Conclusions drawn from the independent t-test are based on these criteria. Based on the results ($p < 0.05$), we can reject H0 and accept H1. This means that the research found a significant difference in cognitive learning outcomes between the experimental class and the control group after learning about the solar system and earth using the Group Investigation Learning Model with the help of Space 4D+ AR Playing Cards.

Make sure you're ready to use the Independent sample T-Test by checking the necessary conditions. H0 is accepted if the results of statistical hypothesis testing are p, and H0 is rejected if the results are $p < 0.05$, as stated in (Sugiyono, 2022:77) reference. That is, the decision making criteria are adjusted accordingly. The results of the Independent Sample T-Test using the SPSS version 25 program showed a significance value of p = 0.000. This means that after learning about the Earth and solar system with the help of the Group Investigation Learning Model and the Space 4D+ AR Playing Card, there is a significant difference in cognitive learning outcomes between the experimental and control classes.

The findings from descriptive and inferential statistics show that compared to traditional learning methods, the Group Investigation Learning Model with the help of the Space 4D+ AR Playing Card produces better cognitive learning outcomes for students. Students are encouraged to take a more active role in exploring learning in groups with the help of Space 4D+ AR Playing Cards, as part of the Group Investigation Learning Model. AR can also integrate virtual environments into real-looking or 3D virtual objects (Pai et al., 2016:203). So AR can be interpreted as a real object in real time with virtual objects that appear when applying the device to a real object with the help of a camera (Siahaan et al., 2019:91-98).

Augmented Reality is interactive which allows students to see the situation in a real and direct way and to imagine the learning process provided by the educator. Because of the enhanced visual appeal, students are more motivated to participate in experimental procedures when they use the Group Investigation Learning Model with the Space 4D+ AR Playing Card. Utilizing the augmented reality (AR) technology supplied by Space 4D+ AR Playing Cards and LKPD, each student explores the solar system's planets in terms of their shape and properties. Three distinguishing features characterize augmented reality: the capacity to merge physical and digital elements, the availability of real-time interaction, and the applicability to three-dimensional objects. (Socrates & Mufit, 2022:96-101). In order to foster a love of collaborative learning, the experiment requires each student to play an active part in their group's investigation and analysis of the findings. Students can also discuss with friends and students have the right to ask the teacher about things they don't understand and about difficulties encountered when working on experiments so that learning is more effective.

Conventional learning requires students to be more active in paying attention to the teacher when explaining. Conventional learning has limitations in learning media which only uses textbooks. Conventional learning is considered boring, thereby reducing students' interest in learning and also making students less likely to learn cooperatively. Conventional learning on

earth and solar system material means students can only see pictures in textbooks without being able to see 3D simulations. This causes students to only be able to imagine through their thoughts so that learning is less effective. After the lesson, the students who will serve as the subjects of this study took a post-test to gauge how much they had learned conceptually. Comparison of the two treatment groups' posttest data shows that, as shown in Figure 1, the two groups' cognitive learning outcomes varied across all indicators.

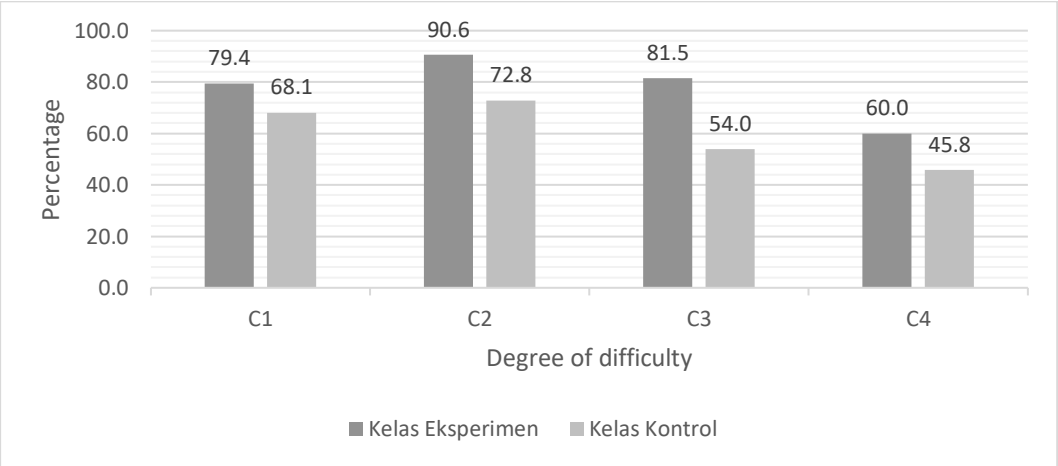

Figure 1. Shows that the overall average score for the cognitive learning outcomes of experimental class students in all questions is higher than that of the control class, starting from C1 to C4.

3.1 Knowing (C1)

Knowing is the lowest cognitive level. The experimental class as a whole has mastered the material because it can be seen that the percentage of the class got 79.4%. Meanwhile, the control class only got 68.1%. Since both the experimental and control groups of students have a similar amount of knowledge about the topics covered, there is little to no difference in the average difference between the two groups at level C1 (Knowing). This is also in line with research by (Dwikurnia et al., 2023:43), experimental class students were superior because the class students apply Group Investigation Learning Model with the help of the Space 4D+ AR Playing Card assistance to improve learning outcomes at each meeting.

3.2 Understanding (C2)

One definition of understanding is the capacity to apply previously learned knowledge to new situations. Consequently, knowing is more important than memorization. In the end, 90.6% of the students in the experimental class got the questions for level C2 (Understanding) right. The control group, meanwhile, had 72.8% accuracy. Students in both the experimental and control groups have a similar degree of comprehension of the studied material, as seen by the fact that the percentages of the two groups are very close. In line with research (Sofian et al., 2022:183) that this research is to test students' understanding of facts and material concepts. So the experimental class is superior because it is assisted Group Investigation Learning Model with the help of the Space 4D+ AR Playing Card to improve students' understanding.

3.3 Applying (C3)

Applying what one has learned in order to resolve issues that arise in actual scenarios. What we mean by "application" in this context is taking previously established rules, formulae, procedures, and principles and applying them to new fields. marked disparity in the experimental group's performance on the C3 standard. With a correct percentage of 81.5%, the experimental class outperformed the control class, which had 54.0%. This is because the use of the Space 4D+ AR Playing Card Assisted Group Investigation Learning Model in the experimental class means that students can immediately apply the material they have learned using Augmented Reality technology.

This is consistent with (Adyan's study et al., 2019:153), which shows that the experimental class's advantage is really caused by The learning motivation of the experimental group was greater than that of the control group. Outside internal and external factors of students, learning motivation of class students experiments are better because students are more enthusiastic about it learning using devices.

3.4 Analyzing (C4)

The ability to analyze can be interpreted as the ability of students to determine the parts that make up a particular form, object or problem so that students are able to show their relationship to each other. The analyzing category includes breaking down a problem or object into its constituent elements and determining how they are related to each other. between the constituent elements and their large structure. Overall, at the C4 question difficulty level, the experimental class had a percentage of 60% higher than the control class with a percentage of 48.5%. These results do not show as much of a gap as in questions with difficulty C4.

The explanation above shows that the experimental class analysis indicators have better average cognitive learning outcomes than the control class. This is because the questions given emphasize more on active participation to solve the questions, so before finding the questions, students must first analyze the questions in order to answer the questions that are stated correctly (Solehat, Devi., Alatas, Fathiah., Oktora, 2020: 123).

Findings reveal statistically significant differences between experimental and control group students' learning outcomes as measured by average scores. There has been evidence that using AR-based learning media can enhance students' academic performance. A study by (Acesta & Nurmaylany, 2018:346-352) reached a similar conclusion which states that Augmented Reality learning media improves student learning outcomes. Students benefit greatly from being actively involved in their own learning and expanding their knowledge base through group study when the Group Investigation Cooperative Learning Model is used in conjunction with Space 4D+ AR Playing Cards. This is evidenced by the fact that student learning outcomes are enhanced. Additionally, Augmented Reality media is appropriate for usage and can pique students' interests, leading to improved learning outcomes (Syawaludin et al., 2019:289). Thus, with the help of Space 4D+ AR Playing Cards, a Group Investigation-type Cooperative Learning Model can enhance cognitive learning outcomes related to solar system and Earth-related content.

4. CONCLUSION

If the problem or research objective cannot be answered, then the conclusions will not be adequate. Might offer some suggestions or implications. The preferred style of writing is paragraphs, not lists or numbers. Results from research carried out in seventh grade at SMPN 4 Pekanbaru led to the following conclusions: Students achieve better cognitive learning results when they use the Group Investigation cooperative learning model with the help of Space 4D+ AR Playing Cards. The fact that the experimental group outperformed the control group on the posttest provides conclusive evidence of this. Compared to students who utilize more traditional methods, those who utilize the Group Investigation cooperative learning model with the help of Space 4D+ AR Playing Cards achieve better cognitive learning outcomes. The disparity is 22.5%, which is statistically significant. Therefore, students' cognitive learning outcomes on earth and solar system material at SMPN 4 Pekanbaru can be enhanced through the use of the Group Investigation cooperative learning model, assisted by Space 4D+ AR Playing Cards.

REFERENCES

Acesta, A., & Nurmaylany, M. (2018). Pengaruh Penggunaan Media Augmented Reality Terhadap Hasil Belajar Siswa. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, *4*(2), 346–352. https://doi.org/10.36989/didaktik.v4i2.79

Adyan, F. B., Purwanto, A., & Nirwana, N. (2019). Upaya Meningkatkan Motivasi Dan Hasil Belajar Siswa Dengan Model Discovery Learning Berbantuan Virtual Laboratory. Jurnal Kumparan Fisika, 2(3), 153–160. https://doi.org/10.33369/jkf.2.3.153-160

Ahmad, K., Harahap, H., & Nasution, W. N. (2018). Inovasi Pembelajaran Pendidikan Agama Islam (Pai) Di Sekolah Dasar Negeri 097523 Perumnas Batu Vi Kecamatan Siantar Kabupaten Simalungun. *Edu Riligia*, *2*, 275–290.

Amos Neolaka dan Grace Amialia Neolaka. (2017). *Landasan Pendidikan: Dasar Pengenalan Diri Sendiri menuju Perubahan Hidup*.

Dwikurnia, D. S., Komala, C., Sugilar, H., Hatta, J. S., & Bandung, G. K. (2023). Analisis Hasil Belajar Peserta didik Kelas X Pada Materi Fungsi Kuadrat Ditinjau Melalui Ranah Kognitif Revisi Taksonomi Bloom. Gunung Djati Conference Series, 31, 39–46.

Heryati, T. (2019). *Meningkatkan kemampuan berpikir kreatif peserta didik denganmodel pembelajaran kooperatif tipe investigasi kelompok. . 7*((2)), 69–90.

Khairani, M., Sutisna, S., & Suyanto, S. (2019). Meta-analysis study of the effect of learning videos on student learning outcomes. *Journal of Biological Education and Research*, *2*(1), 158.

Komala, R., Lestari, D. P., & Ichsan, I. Z. (2020). Group investigation model in environmental learning: An effect for students' higher order thinking skills. *Universal Journal of Educational Research*, *8*(4A), 9–14. https://doi.org/10.13189/ujer.2020.081802

Maspupah, M., Muhlas, M., Rahmawati, D., Alawiyah, R. N., Juniardi, H., & Nurlaela, A. A. (2021). Student creative thinking skills of environmental change material using group investigation learning model with interactive multimedia. *IOP Conference Series: Materials Science and Engineering*, *1098*(5), 052078. https://doi.org/10.1088/1757-899x/1098/5/052078

Nahdi, D. S. (2018). Keterampilan Proses Saintifik Pembelajaran IPA. *Jurnal Cakrawala Pendas*, *4*((1)), 10–16.

Nasution, A. G. J. (2020). Diskursus Merdeka Belajar Perspektif Pendidikan Humanisme. *Jurnal Pendidikan Bahasa Dan Sastra Arab*.

Pai, Y. S., Yap, H. J., Md Dawal, S. Z., Ramesh, S., & Phoon, S. Y. (2016). Virtual Planning, Control, and Machining for a Modular-Based Automated Factory Operation in an Augmented Reality Environment. *Scientific Reports*, *6*(June), 1–19. https://doi.org/10.1038/srep27380

Purbaningrum, K. A. (2017). Kemampuan Berpikir Tingkat Tinggi Siswa Smp Dalam Pemecahan Masalah Matematika Ditinjau Dari Gaya Belajar. *Jurnal Penelitian Dan Pembelajaran Matematika*, *10*(2), 40–49. https://doi.org/10.30870/jppm.v10i2.2029

Sari, I. M. (2019). Peningkatan Keterampilan Generik Sains pada Materi Tata Surya melalui Pembelajaran Berbantuan Aplikasi Solar System Scope untuk Siswa SMP. *Journal of Teaching and Learning Physics*, *4*(2), 1–17. https://doi.org/10.15575/jotalp.v4i2.4294

Siahaan, A. D., Medriati, R., & Risdianto, E. (2019). Menggunakan Teknologi Augmented Reality Pada Materi. *Jurnal Kumparan Fisika*, *2*(2), 91–98.

Socrates, T. P., & Mufit, F. (2022). Efektivitas Penerapan Media Pembelajaran Fisika Berbasis Augmented Reality: Studi Literatur. *EduFisika: Jurnal Pendidikan Fisika*, *7*(1), 96–101. https://doi.org/10.59052/edufisika.v7i1.19219

Solehat, Devi., Alatas, Fathiah., Oktora, R. (2020). Pengaruh Model Pembelajaran Kooperatif Teams Games Tournament (TGT) Berbantuan Media Kokami Terhadap Hasil Belajar Siswa Pada Konsep Fluida Statis. Prosiding Seminar Nasional Fakultas Ilmu Tarbiyah Dan Keguruan UIN Syarif Hidayatullah, 113–125.

Sofian, S. R. A., Subchan, W., & Sudarti, S. (2022). Penerapan Model Discovery Learning Berbantuan Google Lens Untuk Meningkatkan Aktivitas Dan Hasil Belajar Siswa Pada Materi Klasifikasi Makhluk Hidup. Jurnal Teknologi Pendidikan, 11(2), 176–189. https://doi.org/10.32832/tek.pend.v11i2.5972

Solehat. (2022). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: Alfabeta

Sutirman. (2013). *Media & Model-model Pembelajaran Inovatif*. Yogyakarta: Graha Ilmu.

Syawaludin, A., Gunarhadi, & Rintayati, P. (2019). Enhancing elementary school students' abstract reasoning in science learning through augmented reality-based interactive multimedia. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 288–297. https://doi.org/10.15294/jpii.v8i2.19249

Wahyudhi, S. (2019). The effect of prosedural scaffolding in group investigation on creative and critical thinking ability of students with high and low prior knowledge. *INVENTOR: Jurnal Sains Dan Teknologi*, *2*(1), 28–38. http://journal.unugiri.ac.id/index.php/INVENTOR/article/view/129