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Article

Quartet Learning Media and Student Argumentation: Development Analysis and Correlation in Science Learning in Junior High Schools

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ABSTRACT

Argumentation is essential in scientific learning activities because it helps students grasp concepts and apply their knowledge in real-life situations by presenting the same notion in multiple settings. The purpose of this study is to investigate students' scientific argumentation skills using a science quartet educational game. The Research and Development approach is used in this study, along with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model phases. This study's sample consisted of class VIIIB students from SMPN 2 Sugio, with a small group trial of 15 students and a large group test of 32 students, for a total of 47 individuals. Techniques for gathering data include observation, testing, and surveys. This study included four specialists: media experts, practitioners, material experts, and linguists. The validity test, N-gain, t-test, and correlation were used to examine the data. The validity test findings demonstrated the practicality of the scientific quartet educational game with percentages of 86% and 100%, indicating extremely valid categories. The science educational game quartet had an influence on students' scientific arguments with a significant value of 0.05, as indicated by an increase in the cognitive N-gain test results and students' scientific arguments by 0.75 (high category) after evaluating the paired sample t-test. The correlation test findings revealed a link between the science quartet educational game and students' science arguments with a significance value of 0.05, placing it in the strong positive category. The findings of the study show that science quartet educational game are useful in the learning process.

INTRODUCTION

The provision of high-quality science learning can help a country's growth. Students who learn science can utilize science ideas in their daily lives. Science learning is characterized by the interplay of multiple learning components, such as learning to reach objectives through preset competences (Wisudawati & Sulistyowati, 2022). The goal of studying science is to give students the information, skills, and ideas they need to engage in scientific inquiry and think critically. To attain learning objectives, however, teachers must own or construct learning tools (Kurniawan *et al*., 2022; Dianti *et al*., 2022). Science learning will be successful if the learning system's components can collaborate to provide an effective and efficient learning process. The use of learning media is one component of scientific

learning that may assist instructors in their teaching and learning activities (Safitri Rosalina & Suhardi, 2020)

Based on observations of the learning process in class VIII State Junior High School 2 Sugio on September 14, 2022, data obtained by researchers while learning the material "Science of Human Movement Systems" shows that the learning process remains teacher-centered or traditional, namely using the lecture method. Everything is a verb in conventional learning, and the process is boring. Only the teacher talks and helps pupils record and memorize during the learning process. Students must jot down recollections throughout the exam to work with internal memory to get the designation of "smart" student (Wahyu *et al*., 2020). Learning is a two-way relationship between an instructor and a student, where both can generate a set objective through excellent and focused communication (Septaria & Rismayanti, 2022).

Learning through the traditional lecture approach is deemed repetitive and uninteresting; students are passive; 10% of 32 students do not listen to the teacher's explanation. On October 26, 2022, the researcher obtained data from observations of the science teacher's learning process for class IX at State Junior High School 2 Sugio during the science learning process for the material "Potential Differences and Electrical Energy" that the teacher only relied on the Science Package book as a learning medium and students were not given the opportunity to provide questions or answer questions from teachers or colleagues. Curiosity may be evaluated when kids ask instructors and peers questions vocally or in writing; nevertheless, inquiring activities by students are often quite infrequent (Septaria, 2022). The lecture approach is still used in education. 10% of the 24 kids are asleep and even interact with their peers. On October 11, 2022, PTS scores for Class VIII pupils at State Junior High School 2 Sugio were also observed. Researchers discovered that among 134 pupils, those with minimum completeness criteria (KKM) scores accounted for just 0.74% of class VIII students at State Junior High School 2 Sugio. The major cause was that the teacher constantly used the technique lectures, teachers exclusively used textbooks, and learning resources that may help students develop their arguing talents were not produced. Students require communication as a way of communicating knowledge, ideas, thoughts, or views between two or more individuals (Rodhiyah Zulfa *et al*., 2020).

Debate between groups to establish a relationship between ideas and logical statement evidence because it helps students better understand concepts and apply their knowledge in real life by expressing the same idea in different (Putri, 2017; Siregar & Pakpahan, 2020; Septaria, 2019). Scientific arguments in science are distinct from arguments in everyday life or other fields, particularly in terms of claims, evidence, and justifications (Imaniar & Astutik, 2019; Siregar & Pakpahan, 2020). Respiratory system material is a type of science content that may be used to help students improve their scientific reasoning skills. Students must comprehend various ideas when studying the human respiratory system, such as distinct functions and modes of operation, and they must be able to link concepts to one another (Ritonga, 2016).

An alternative to developing learning media for science quartet educational game to improve students' argumentation abilities in science, because educational games can lead to very effective communication when concepts or facts from various subjects are studied at school, educational games as an effective pedagogical tool for students of all ages in terms of increasing learning motivation (Nurmalita *et al*., 2021). The goal of educational games is to pique students' interest in learning subjects as they play, allowing them to better absorb the information (Arifin *et al*., 2015). Many advances have occurred in the area of education, one of which is a card-based instructional game. In this study, the choice of learning media based on a quartet card game was based on students' lack of enthusiasm for learning science,

causing them to be passive learners. Innovation is an important aspect of validating and expanding valuable knowledge (Sholikhah *et al*., 2023).

According to (Fatonah *et al*., 2021), the construction of a chem quartet learning medium on acid-base material produced findings that verified the chem quartet. Subsequent research by (Handayani, 2017), discovered that the creation of Indonesian cultural quartet card media for social studies topics in grade IV demonstrated that the media was deemed beneficial to learning. Subsequent research by (Prasetyaningtyas, 2020), discovered that the use of the quartet card game method to increase learning achievement and learning activity in living things classification material at Semin State Junior High School in Class VII demonstrated that this learning increased student enthusiasm and activity, resulting in improved learning outcomes.

Based on the findings of past studies, researchers chose to do more studies on the same subject. However, this study comprises updates from past studies; these revisions appear in respiratory system content and in students' scientific reasoning. The human respiratory system was chosen for this study because it contains numerous principles that students must master. Students' argumentation skills will not improve if the teacher utilizes the lecture technique on this subject. The research was carried out by constructing learning media in the form of a Quartet Science Educational Game using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development approach based on the challenges found. The goal of this study was to investigate students' scientific reasoning abilities through the use of a science quartet educational game.

METHODS

This form of study is called research and development (R&D), which is a research approach used to examine certain items in order to assess their efficacy. Many research and development strategies have been employed in the natural sciences and (Sugiyono, 2013). Using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) is a development research model with systematic stages that correspond to the product to be developed, namely the science quartet educational game, so that the product produced will later become a valid product (Cahyadi, 2019).

This study was carried out at State Junior High School 2 Sugio in January and February 2023. This survey included four specialists, including one from the media. 2) practitioners; 3) material specialists; and 4) linguists. Lamongan Islamic University employs media specialists, material experts, and linguists as lecturers, whereas State Junior High School 2 Sugio employs practitioners as scientific professors. This study's population consisted of pupils from class VIII, State Junior High School 2 Sugio. The sample came from VIIIB. Purposive random sampling, small group trials with 15 students, and large group trials with 32 students were employed in the sample selection.

Data collection techniques in this study used observation techniques, tests (pretest and posttest), and questionnaires. The components of the research instrument in this study include: (1) observations were made to obtain initial empirical data about school conditions related to the use of instructional media and to obtain data on improving students' scientific argumentation skills; (2) the test sheet, on which the researcher has compiled 10 questions that are intended as a result of the students' scientific arguments; and (3) a validation questionnaire, used to collect validation data from four test experts, namely media experts, practitioners, material experts, and language experts (Dianti et al., 2022).

The data analysis of the expert validity findings supplied by four observers will be reported using the Likert criterion developed by Setiawan (2014). Because the data utilized was from fewer than 100 respondents, the data were first submitted to the normality test of expore analysis with a significance value of Shapiro-Wilk before the cognitive and

argumentative pretest and posttest data were evaluated. Following the normalcy test, the data would be evaluated using the validity test, the N test. SPSS software version 25 was used to perform the n-gain, t-test with paired sample t-test, and rock correlation test.

RESULTS AND DISCUSSION

The first step in carrying out this study is to conduct an analysis, which is separated into two stages: performance analysis and needs analysis. Based on observations of the learning process conducted on September 14th, 2022, it is known that the learning process is still teacher-centered and employs a lecture style, making the learning process appear less fascinating. When teacher-centered learning is used, students become inert and rapidly bored. Students who are bored with learning are unlikely to pay attention to the instructions. If this occurs on a regular basis, the negative consequence is a lack of student motivation and difficulties understanding learning, resulting in a failure to meet learning objectives (Jayawardana, 2017).

On October 26, 2022, researchers observed the science teacher's learning process and discovered that the science teacher's learning medium was still book-centered, and pupils were not given the chance to ask or answer questions from the instructor or colleagues. Meanwhile, (Jayawardana, 2017), defines learning as a two-way communication process in which the instructor teaches and the pupils learn. The following observation was taken on October 11, 2022, based on the PTS scores of class VIII pupils, and the researchers discovered that just 0.74% of 134 students received the KKM score. Student motivation influences learning results. The greater the learning results, the stronger the motivation. As a result, motivation influences the intensity of student learning attempts at any moment (Andriani & Rasto, 2019).

Following that, the researcher did a requirements analysis and then created learning media to address these issues. The term "media" refers to everything that may be utilized to excite students' ideas, emotions, interests, abilities, or skills in order to aid in the learning process (Ekayani, 2017; Septaria, 2023). The respiratory system learning media material generated is interactive media based on the science quartet educational game. It is advised that students utilize this medium to train their scientific arguments so that the learning process becomes active. The produced medium takes the shape of four cards, each 8x12 cm, and is accompanied by instructions for use, making them simple to use and practical.

Learning that is solely focused on books may become tedious, and some students will become tired and chat with students' peers, affecting students' scientific reasoning abilities. Because science is the product of the formation of a theory that incorporates explanations and evidence to support these explanations (Paramita *et al*., 2019), argumentation is widely acknowledged as a crucial component in studying science. The use of science quartet educational game in the learning process might improve learning efficiency because the interactive nature of learning media allows students to participate and pose scientific questions to their peers and the teacher, therefore improving students' scientific reasoning abilities. Learning media are an important component of the learning system. Communication cannot exist without media, and learning as a communication process does not work efficiently (Ekayani, 2017).

Arguments, according to Toulmin (1958), have characteristics such as assertions, data, warrants, and supporting evidence (Paramita *et al*., 2019). Claims are scientific responses to inquiries; proof might take the form of measurement and observation of interrelationships between claims; and warrants or justifications serve as a connection between claims and evidence, explaining why particular evidence supports those claims. These elements are known as component arguments. Students must be able to integrate these components

meaningfully in order to debate or persuade peers and assess other arguments in the same manner that scientists do in academic conversations (Davidi *et al*., 2021).

Argumentation becomes the target of action and may be characterized as the capacity of the student to support, to build a connection between facts and concepts, and to transfer knowledge attainment into the context of everyday life (Erduran et al., 2004). Argumentation is the cornerstone of logical and critical reasoning. Argumentation may be used in three ways: as a conflict between two perspectives, as a discussion, and as a justification (Karlina & Alberida, 2021). Argumentation encourages students to provide valid evidence, facts, and theory to back up their viewpoints on a subject (Robertshaw & Campbell, 2013).

Using game-based learning media to increase students' scientific reasoning abilities is one technique. A sort of media that stimulates individuals to learn is game media. Game-based educational media that allows students to actively engage in their learning. The ideal sort of learning is interactive learning (Wahyuni & Hidayah, 2016). Students can participate in interactive learning using games (Khofidhoh *et al*., 2016). Based on this description, the researchers developed a scientific quartet of educational game media as an alternative medium for teaching the respiratory system. Quartet card games in general inspired this quartet scientific educational media game. The distinction between this quartet scientific educational game and others is in the sort of cards used and the game rules.

Quartet cards are a sort of game that mixes media with game strategies that are similar to conventional quartet games that have long been popular among children and teenagers; the difference is in the content and gameplay of the quartet cards (Wahyuni & Hidayah, 2016). The usage of the quartet scientific educational game learning media is consistent with a number of theories, including behaviorism, which holds that learning is a mix of stimulus and reaction (Syaripudin *et al*., 2017). Thorndike (Primary, 2019) defines learning as an interplay between input and reaction. The stimulus in this study was the usage of scientific quartet educational gaming media, and the response was student learning results.

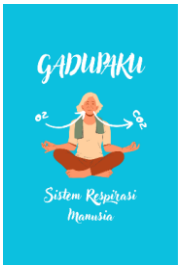
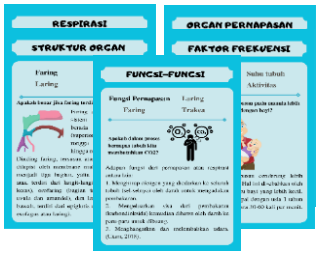
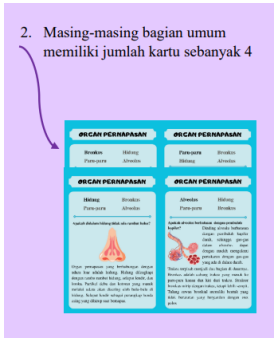
Learning, according to Brunner's constructivist theory, consists of three simultaneous procedures: acquiring new information, changing it, and judging the relevance and validity of knowledge (Syaripudin *et al*., 2017). Using information supplied from student learning results, knowledge is constructed from the contents of the respiratory system material offered in the scientific quartet educational game. Students are happy with their studies since they can create their own knowledge by working in groups. The constructivism learning model is a learning method that is focused on students' own experiences with an emphasis on process skills such as talking, cooperating, collaborating, and disputing with peers in order for students to acquire their own knowledge (Kusumawati & Maruti, 2019).

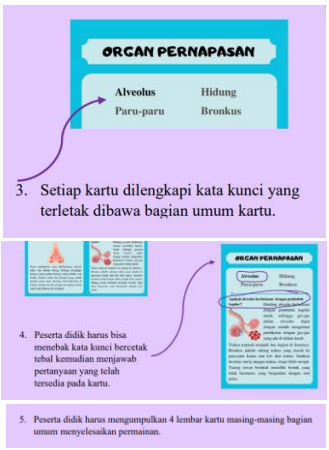
Jerome S. Bruner's cognitive learning theory divides children's cognitive development into three stages: enactive, where the person carries out activities to understand the surrounding environment; iconic, where objects or worlds are understood through pictures and verbal visualizations; and symbolic, where a person can have abstract ideas that are greatly influenced by his ability in language and logic (Widiyatmoko, 2023). The content of learning media is in the form of visualization of images that are in accordance with the substance of the material on the respiratory system. This media corresponds to the iconic stages of development proposed by Brunner as stages of cognitive development in children.

The design of learning media goods for scientific quartet educational games was the second stage. This science quartet educational game is 8 x 12 cm and is designed so that children can readily view the images on the cards. The ability to transmit messages to readers via the senses of sight is one of the benefits of visual or image media (Kusnawati, 2015).. The researcher picked blue for this learning media because selecting the proper picture and color in the media is extremely significant since these two elements draw students' attention. Blue is the hue of the sky and the sea, and it is frequently connected with depth and stability

(Basuki, 2015). At the top of each card is a concept, which is a thicker and larger word; four parts of a word consisting of one key word with a word made bold from three words of members placed at the bottom of the idea; a question with a discussion of the content in the middle of the card; and one word made bold from three words of members situated at the bottom of the concept. The card set includes five quartets about the respiratory system. Table 1 shows the design of the Scientific quartet educational game.

Table 1. Feasibility Test Results for Learning Instruments and Devices

Median Development Design Image	Information
 **Cover**	The title of the science quartet educational game (GADUPAKU) is written in Adlery Pro font size 28.6, and the content of the respiratory system is written in Adlery Swash font size 19, with graphics from Canva.
 **General Affair**	There are five general sections using the Adigiana Toybox font size of 14.3, which consists of four cards, and in each general section there are four keywords and one question and discussion using the Tex Gyre Terms font. The images used are sourced from Canva and MateriIPA.com.
 	The science quartet educational game is also equipped with instructions for use in the form of an student worksheets (LKPD) in Times New Roman size 12 font.

Median Development Design Image	Information
	**Instructions for use**

The last stage is to use Canva software to create this quartet scientific teaching game. The design stage must create the design, beginning with locating pictures for the cover to make it appealing to pupils and then determining the five major principles utilized in the four cards. Then create a quartet card with 5 major concepts, each with 4 cards having 4 member words, each with 1 keyword in bold that is positioned beneath the main concept. Each card has a question, an image, and a debate in the center of the card. The scientific quartet educational game is made up of five quartets on the respiratory system.

After the scientific quartet educational game learning media's first product creation went as planned, an expert validation approach was carried out to assess the feasibility of the emerging product. A lecturer at the Islamic University of Lamongan with the initials AS validated the learning media of the science quartet educational game, followed by practitioner validation by a science teacher at State Junior High School 2 Sugio with the initials L, material expert validation by a lecturer at the Islamic University of Lamongan with the initials M, and linguist validation by a lecturer at Lamongan University with the initials AK. The media expert is responsible for reviewing the presentation and programming of the media in order to generate exciting and interactive media for students, as well as assessing the student response questionnaire utilized in order to collect content that is in conformity with the applicable curriculum. The practitioner is responsible for offering an evaluation of the material's substance and presentation. Material experts are responsible for providing an assessment of the contents of lesson plans, worksheets, and pretest posttest questions in order to obtain concrete learning outcomes, and language experts are responsible for assessing aspects of language fluency towards lesson plans, worksheets, and pretest posttest questions in order for the learning process to run smoothly and students to understand the material presented well. Instrument feasibility tests can be seen in Table 2.

Table 2. Feasibility Test Results for Learning Instruments and Devices

Instrument	Expert	Score Obtained	Ideal Score	Percentage	Criteria
Media	Media	31	36	86%	Very Valid
	Practitioner	40	40	100%	Very Valid
Test	Material	29	32	91%	Very Valid
	Language	32	36	89%	Very Valid
Lesson Plan (RPP)	Material	33	44	80%	Very Valid
	Language	34	36	95%	Very Valid
Student worksheets (LKPD)	Material	18	24	75%	Very Valid
	Language	31	36	87%	Very Valid

Instrument	Expert	Score Obtained	Ideal Score	Percentage	Criteria
Response Questionnaire	Media	30	30	94%	Very Valid

Table 2 displays the results of each instrument's validity tests. The acquisition of a percentage of 86% of media specialists and 100% of practitioners demonstrates that media instruments are extremely valid. There is a review of the usage of pictures with higher quality so that students can see them properly. Test instruments received a percentage of 91% and 89% from materialists and linguists, respectively, indicating that they were very valid. There are certain adjustments to the test instrument regarding the correctness of the cognitive level with relation to the test and the grammar of the topic so that students may readily reply to it. RPP instruments may be used in the learning process; they are based on acquiring qualification test results, and a percentage of 80% of materialists and 95% of linguists are included in the category of extremely valid, with just minor changes in terms of grammatical accuracy. Student worksheets (LKPD) instruments received percentages of 75% and 87% from material and language experts, demonstrating that Student worksheets (LKPD) is legitimate and competent to be utilized to help the learning process.

This level involves incorporating learning material into the classroom learning process. At this implementation stage, small group trials and large group trials were conducted by incorporating students answers, media validity, influence, and association of scientific quartet educational game learning media with students' science arguments.

The produced products were verified and amended before being tested in small group trials with 15 students and large group trials with 32 students. Data from small group trials' response rates are shown in Table 3.

Table 3. Small Group Trial Results

Instrumen Item	Person Correlation R Count	R Table	Significance Value	Information
S1	0.655	0.553	0.008	Valid
S2	0.563	0.553	0.029	Valid
S3	0.671	0.553	0.006	Valid
S4	0.637	0.553	0.011	Valid
S5	0.715	0.553	0.003	Valid
S6	0.683	0.553	0.005	Valid
S7	0.676	0.553	0.006	Valid
S8	0.79	0.553	0.000	Valid

Based on the respondent's test in the small group trial displayed in Table 2, the scientific quartet educational game learning media product is declared valid with a significant value of 0.05. The product study included 15 participants, indicating that the media is appropriate for investigation in group trials. big. Table 4 displays the findings of the large-group experiment.

Table 4. Large Group Trial Results

Instrumen Item	Person Correlation R Hitung	R Tabel	Significance Value	Information
S1	0.585	0.361	0.000	Valid
S2	0.585	0.361	0.000	Valid
S3	0.746	0.361	0.000	Valid
S4	0.687	0.361	0.000	Valid
S5	0.705	0.361	0.000	Valid
S6	0.559	0.361	0.001	Valid

Instrumen Item	Person Correlation R Hitung	R Tabel	Significance Value	Information
S7	0.722	0.361	0.000	Valid
S8	0.759	0.361	0.000	Valid

The findings in Table 4 show that the student's response had a significance of 0.05 with a valid category. This quartet scientific educational game learning medium, according to student feedback, is appropriate for the learning process and quite fascinating; therefore, students love using it. In line with the function of using learning media, which is to attract students' attention, especially by using something new and interesting, to clarify when explaining material or information, to avoid misunderstandings about the material to be explained, to align differences in student learning styles, to overcome space, time, and cost constraints, and to achieve effective learning goals (Haryadi *et al*., 2021). Furthermore (Ismail *et al*., 2020), discovered that the creation of Quartet Cards as Biology Learning Media yielded the finding that Quartet Card learning media was effective for usage in biology learning.

The N-gain exam is used to assess students' cognitive knowledge development and the improvement of their scientific arguments before and after studying with the science quartet educational game learning medium. The N-gain test results are shown in Table 5.

Table 5. N-gain Test Results

Group	N	Pretest	Posttest	Gain	N-gain
Cognitive	32	64.47	91.23	26.76	0.75
Arguments	32	60	93.65	33.65	0.75

Table 5 shows that the pretest scores of students' cognitive and scientific argumentation results increased in the posttest, with cognitive pretest scores of 64.47 and 60 arguments being 91.23 in cognitive posttest scores and 93.65 in argumentation posttest scores, respectively. The results for cognitive gain and students' scientific reasoning were 26.76 and 33.65, respectively. The N-gain ratings for students' cognitive and scientific arguments, 0.75 and 0.75, are classified as high.

Students' cognitive abilities improved as well, with an n-gain score of 0.75 falling into the strong range. According to research (Baan, 2016), The Effect of Using Wall Chat Media in Improving the Ability to Write Argumentative Essays of Class X.1 Students of Sesean 1 Public High School, pictorial media can be used as a learning tool to improve students' scientific arguments. Boosting Capacity to Write Descriptions by Using Quartet Card Media in Grade IV Elementary Schools, done by (Rahayu, 2013), discovered that Quartet card media was effective in boosting the capacity to write descriptions.

Using the scientific quartet educational game media, the t-test was used to determine the difference between the average score before the pretest and the average score after the posttest. The t-test results are reported in Table 6.

Table 6. Cognitive T-test Paired Sample Test Results

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	pre - pos	-54.750	5.902	1.043	-56.878	-52.622	-52.472	31	.000

The cognitive paired t-test in Table 6 has a significance value of 0.000, showing that Ha is accepted and Ho is rejected, or that there is a substantial effect between the scientific quartet educational game learning medium and students' cognitive skills. The paired sample t-test of students' scientific reasoning is shown in Table 7.

Table 7. Paired Sample T-test Results for Student Science Arguments

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 pre - pos	-55.375	8.366	1.479	-58.391	-52.359	-37.445	31	.000

The significance value of the paired sample t-test of students' scientific argumentation in Table 7 is 0.000, indicating that Ha is accepted and Ho is rejected or that the quartet science educational game learning medium has a substantial impact on students' science arguments. According to Tables 6 and 7, the science quartet educational game media influences cognitive knowledge and strengthens students' scientific arguments, as indicated by a significant value of 0.05, which falls into the high group. Improving learning outcomes is inextricably linked to the use of learning media, which may stimulate students' ideas, emotions, interests, and participation in learning activities. The duty of the instructor is to motivate, encourage, and assist students so that they are prepared to attain the agreed-upon learning objectives (Febrita & Ulfah, 2019). According to a study done by (Na'ima *et al*., 2014), the scientific quartet educational game is one of the learning media that may boost student learning motivation. Quartet card media has an influence on inspiring students to learn so that they become engaged. According to research (Roshayanti & Priyanto, 2019), The Effect of Quartet Cards in the Stad Learning Model on Thematic Learning Outcomes of Students who achieve middling student learning outcomes.

To demonstrate the association between cognitive capacities and students' scientific reasoning abilities, the correlation test was used. The results of the product-moment correlation test are shown in Table 8.

Table 8. Product Moment Correlation Test Results

Correlations			
		PostestK	PostestAI
PostestK	Pearson Correlation	1	.813**
	Sig. (2-tailed)		.000
	N	32	32
PostestAI	Pearson Correlation	.813**	1
	Sig. (2-tailed)	.000	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

Table 8's product moment correlation test demonstrates a significant value of 0.05 between the cognitive posttest and students' scientific arguments. This suggests that, with a correlation value of 0.80r1.00, the learning media for science educational games quartet corresponds with a rise in students' scientific arguments that are favorably strong. When one variable changes and another variable changes in the same direction (directly proportional), there is a positive connection. This indicates that as one variable grows, so will the others (Mangera, 2018). This study backs up prior studies, as seen by data analysis linked to correlation, which reveals a substantial association between the four learning media and students' arguments in scientific learning. According to (Amalia *et al*., 2020), research, the Application of the Time Token Model Assisted by Quartet Card Media to Improve the learning outcomes of Elementary School Students who acquired student outcomes had a considerable rise and reached classical mastery.

The final part of this research is evaluation; based on the responses of the respondents, suggestions are made to create a video on how to utilize the science quartet educational game to make it simpler for students to play the game. The science quartet educational game was also discovered to be enjoyable to utilize during the learning process. The results of the learning process using the learning media of the science quartet educational game show an improvement in the ability of scientific argumentation as well as the cognitive abilities of the

students, proving that the science quartet educational game are effective in the learning process. According to the research findings, some obstacles appear during learning using the Science quartet educational game, namely, students have a quarter card that is distributed, and students lack understanding of the methods of using the quartet card due to a lack of literacy against the presented student worksheets (LKPD). Some students repeat the same question several times, and some students have difficulty operating the science quartet educational game. To overcome these challenges, the instructor will reaffirm the learning contract, which includes not being permitted to quarrel over the quartet cards that have been issued and teaching how to utilize the quartet scientific educational game media in a methodical manner.

CONCLUSION

Based on the study's findings, it is possible to conclude that the scientific quartet educational game is acceptable for use in the learning process, with a percentage of 86% and a 100% evaluation by media professionals and practitioners classified as extremely valid. The quartet science educational game's impact on students' scientific arguments with a significance value of 0.05 is indicated by an increase in the cognitive N-gain test results and students' scientific arguments by 0.75 in the high category after analyzing the paired sample t-test. The correlation test findings revealed a link between the science quartet educational game and students' science arguments with a significance value of 0.05, placing it in the strong positive category. According to the research findings, students' scientific argumentation abilities can be improved; similar research can be conducted, but more research is needed to obtain more concrete results, as well as monitoring in the learning process to ensure proper implementation.

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REFERENCES

Amalia, F., Roysa, M., & Aditia Ismaya, E. (2020). Naturalistic: Penelitian dan Pendidikan dan Pembelajaran. *Naturalistic: Penelitian Dan Pendidikan Dan Pembelajaran*, *5*(1), 643–649.

Andriani, R., & Rasto, R. (2019). Motivasi belajar sebagai determinan hasil belajar siswa. *Jurnal Pendidikan Manajemen Perkantoran*, *4*(1), 80. https://doi.org/10.17509/jpm.v4i1.14958

Arifin, T., Rosidin, U., & Wahyudi, I. (2015). Pengembangan Media Sains Berbasis Game Edukasi Pada Materi Tata Surya. *Skripsi* tidak diterbitkan.

Baan, A. (2016). Pengaruh Penggunaan Media Wall Chart Dalam Meningkatkan Kemampuan Menulis Karangan Argumentasi Siswa Kelas X.1 Sma Negeri 1 Sesean. *Jurnal Perspektif*, *1*(1), 2355–0538. www.journal.unismuh.ac.id/perspektif

Basuki, A. (2015). Makna warna dalam desain. *Retrieved April*, *30*, 2017.

Cahyadi, R. A. H. (2019). Pengembangan Bahan Ajar Berbasis Addie Model. *Halaqa: Islamic Education Journal*, *3*(1), 35–42. https://doi.org/10.21070/halaqa.v3i1.2124

Davidi, E. I. N., Sennen, E., & Supardi, K. (2021). Integrasi Pendekatan STEM (Science, Technology, Enggeenering and Mathematic) Untuk Peningkatan Keterampilan Berpikir Kritis Siswa Sekolah Dasar. *Schilaria: Jurnal Pendidikan Dan Kebudayaan*, *11*(1), 11–12.

Dianti, H. E. N., Febrisari, P., Ridho, A. A., & Septaria, K. (2022). The Disaster Box Mystery as a Media for Growing Disaster Preparedness and Literacy among Junior High School Students. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *10*(2), 390–398.

Ekayani, N. L. P. (2017). Pentingnya Penggunaan Media Pembelajaran Untuk Meningkatkan Prestasi Belajar Siswa. *Ganesha University of Education*. https://www.researchgate.net/publication/315105651

Erduran, S., Simon, S., & Osborne, J. (2004). TAPping into argumentation: Developments in the application of Toulmin's argument pattern for studying science discourse. *Science Education*, *88*(6), 915–933.

Fatonah, S., Subarkah, Z., & Sari, D. (2021). Pengembangan Media Pembelajaran Chem Quartet Pada Materi Asam Dan Basa Development Of Chem Quartet Learning Media On Acid And Base Materials. *Gunung Djati Conference Series*, *2*.

Febrita, Y., & Ulfah, M. (2019). Peranan media pembelajaran untuk meningkatkan motivasi belajar siswa. *Diskusi Panel Nasional Pendidikan Matematika*, *5*(1).

Handayani, N. (2017). Pengembangan Media Kartu Kuartet Pembelajaran Budaya Indonesia Untuk Mata Pelajaran Ilmu Pengetahuan Sosial Kelas Iv The Development Of Quartet Cards Indonesian Culture Learning For Social Science Subject 4 Th Grade. *E-Jurnal Prodi Teknologi Pendidikan*, *VI*(1).

Haryadi, R., Nuraini, H., & Kansaa, A. (2021). Pengaruh Media Pembelajaran E-Learning Terhadap Hasil Belajar Siswa. *AtTàlim : Jurnal Pendidikan*, *7*(1), 2548–4419. https://doi.org/10.36835/attalim

Ismail, I., Taufiq, A. U., & Hasanah, U. (2020). Print) Al asma: Journal of Islamic Education ISSN. *Al Asma: Jurnal of Islamic Education*, *2*(2).

Jayawardana. (2017). Paradigma Pembelajaran Biologi Di Era Digital. *Jurnal Bioedukatika*, *5*(1), 12–17. http://journal.uad.ac.id/index.php/BIOEDUKATIKA

Karlina, G., & Alberida, H. (2021). Kemampuan Argumentasi Pada Pembelajaran Biologi. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, *5*(1), 1–7. https://doi.org/10.23887/jipp.v5i2

Khofidhoh, F. N., Hidayati, S. N., & Indah, N. K. (2016). Respon Siswa Terhadap Media Permainan Kapafet Topik Gerak Tumbuhan Sebagai Pengatan Dalam Pembelajaran. *E-Jurnal Pendidikan Sains*, *1*(1), 0–216.

Kurniawan, R. A., Hasanah, R., Ilmu, T., Alam, P., Tarbiyah, F., Keguruan, I., Islam, U., Kiai, N., Achmad, H., Jember, S., & Artikel, I. (2022). Pengembangan Game Quarted Card pada Materi Klasifikasi Makhluk Hidup Kelas VII SMP/MTs. In *Bioeduca: Journal of Biology Education*. http://journal.walisongo.ac.id/index.php/bioeduca

Kusnawati, L. E. (2015). Pengembangan Multimedia Pembelajaran Interaktif "Struktur Dan Fungsi Organ Tumbuhan" Mata Pelajaran Biologi Untuk Siswa Kelas Viii Smp Negeri 11 Magelang. *E-Jurnal Skripsi Program Studi Teknologi Pendidikan*, *7*.

Kusumawati, N., & Maruti, E. S. (2019). *Strategi belajar mengajar di sekolah dasar*. Cv. Ae Media Grafika.

Mangera, P. (2018). Perkiraan Kebutuhan Energi Listrik Jangka Panjang Pada Pt. Pln (Persero) Wilayah Papua Dan Papua Barat Area Merauke Dengan Menggunakan Metode Regresi Linier. *MUSTEK ANIM HA*, *7*(3), 247–256. https://doi.org/10.35724/mustek.v7i3.1736

Na'ima, Q. A., Sikumbang, D., & Bintoro, A. (2014). Pengaruh Penggunaan Media Kartu Kuartet terhadap Motivasi dan Hasil Belajar Siswa. *Jurnal Bioterdidik: Wahana Ekspresi Ilmiah*, *2*(10).

Nurmalita, N., Munzil, M., & Pratiwi, N. (2021). Pengembangan game edukasi ipa kuartet sebagai media pembelajaran ipa. *Jurnal MIPA Dan Pembelajarannya*, *1*(4), 290–296. https://doi.org/10.17977/um067v1i4p290-296

Paramita, A. K., Dasna, I. W., & Yahmin. (2019). Kajian Pustaka: Integrasi Stem Untuk Keterampilan Argumentasi Dalam Pembelajaran Sains. *Jurnal Pembelajaran Kimia*, *4*(2), 92–99.

Prasetyaningtyas, S. (2020). Penerapan Metode Permainan Kartu Kwartet Untuk Meningkatkan Prestasi Belajar Dan Keaktifan Belajar Pada Materi Klasifikasi Makhluk Hidup Kelas Vii Smp N 1 Semin Application Quarter-Cards Game Of Methods To Improve Learning Achievement And Learning Activities In Classification Of Living Things At Class Vii C Smp N 1 Semin. *Jurnal Ideguru*, *5*(1).

Pratama, Y. A. (2019). Relevansi Teori Belajar Behaviorisme Terhadap Pendidikan Agama Islam. *Jurnal Pendidikan Agama Islam Al-Thariqah*, *4*(1), 38–49. https://doi.org/10.25299/al-thariqah.2019.vol4(1).2718

Putri, R. E. (2017). Meningkatkan Kemampuan Argumentasi Ilmiah Siswa SMP Kelas VII melalui Bahan Ajar IPA Terpadu dengan Tema HALO pada Topik Kalor. *Jurnal SEMESTA*, *01*(01), 34–46. http://www.semesta.ppj.unp.ac.id/index.php/semesta.

Rahayu, P. (2013). Peningkatan Kemampuan Menulis Deskripsi Dengan Menggunakan Media Kartu Kuartet Di Kelas IV Sekolah Dasar. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar*, *1*(2), 1–10.

Ritonga, N. (2016). Analisis Kesulitan Belajar Pada Materi Pokok Sistem Pernapasan Manusia Di Smp Abdi Negara Asam Jawa. *Wahana Inovasi*, *5*(2).

Robertshaw, B., & Campbell, T. (2013). Constructing arguments: Investigating pre-service science teachers' argumentation skills in a socio-scientific context. *Science Education International*, *24*, 195–211.

Rodhiyah Zulfa, A., Rosyidah, Z., & Negeri, S. (2020). *Analysis Of Communication Skills Of Junior High School Students On Classification Of Living Things Topic*. *INSECTA: Integrative Science Education and Teachig Activity Journal*, *1*(1), 78–92. https://jurnal.iainponorogo.ac.id/index.php/insecta

Roshayanti, F., & Priyanto, W. (2019). Pengaruh Kartu Kuartet Dalam Model Pembelajaran Stad Terhadap Hasil Belajar Tematik Siswa Istikholah. *Journal of Education Technology*, *3*(4), 253–259.

Safitri Rosalina, S., & Suhardi, A. (2020). Need Analysis of Interactive Multimedia Development with Contextual Approach on Pollution Material. *INSECTA: Integrative Science Education and Teachig Activity Journal*, *1*(1), 93–108. https://jurnal.iainponorogo.ac.id/index.php/insecta

Septaria, K. (2019). Mengeksplorasi Argumentasi dan Pengetahuan Pendidik Ilmu Pengetahuan Alam (IPA) Tentang Pemanasan Global. *Pedagogia : Jurnal Pendidikan*, *8*(2), 247–256. https://doi.org/10.21070/pedagogia.v8i2.2369

Septaria, K. (2022). Kemampuan Bertanya Versus Hasil Belajar Kognitif Mahasiswa: Analisis Korelasi Kemampuan Bertanya Pada Level Mahasiswa IPA. *Eduproxima: Jurnal Ilmiah Pendidikan IPA*, *4*(2), 60–71. http://jurnal.stkippgritulungagung.ac.id/index.php/eduproxima

Septaria, K. (2023). Media Ular Tangga Dan Literasi: Analisis Pengaruh Materi Mitigasi Bencana Banjir Pada Siswa Sekolah Menengah Pertama. *SEPEKTRA: Jurnal Kajian Pendidikan Sains*, *9*(1), 1–13. https://doi.org/10.32699/spektra.v9i1.263

Septaria, K., & Rismayanti, R. (2022). The Effect of Scientific Approach on Junior High School Students' Scientific Creativity and Cognitive Learning Outcomes. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, *6*(3), 173–189. https://doi.org/10.36312/esaintika.v6i3.955

Sholikhah, D. M., Subayani, N. W., & Umam, N. K. U. (2023). Development of Scrapopbox (Scrap and Pop-Up Box) Animal Metamorphosis in Elementary Schools. *INSECTA: Integrative Science Education and Teachig Activity Journal*, *4*(1), 39–51. https://jurnal.iainponorogo.ac.id/index.php/insecta

Siregar, N., & Pakpahan, R. A. (2020). Kemampuan Argumentasi Ipa Siswa Melalui Pembelajaran Argumentasi Driven Inquiry (ADI). *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *10*(2), 94–103. https://doi.org/10.24929/lensa.v10i2.113

Sugiyono. (2013). *Metode Penelitian Kuantitatif* (Sugiyono, Ed.). ALFABETA.

Syaripudin, A., Gusrayani, D., & Hanifah, N. (2017). Penggunaan Media Kuartet Cerdas Untuk Meningkatkan Hasil Belajar Siswa Kelas Iv. *Jurnal Pena Ilmiah*, *2*(1).

Wahyu, Y., Edu, A. L., & Nardi, M. (2020). Problematika Pemanfaatan Media Pembelajaran IPA di Sekolah Dasar. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 107. https://doi.org/10.29303/jppipa.v6i1.344

Wahyuni, E. S., & Hidayah, R. (2016). Pengembangan permainan chem quartet sebagai media pembelajaran pada materi sistem periodik unsur kelas x sma development of chem quartet as learning media on periodic system of element class x senior high school. *Unesa Journal of Chemical Education*, *5*(1), 83–91.

Widiyatmoko, A. (2023). *Teori Pembelajaran IPA*. Penerbit NEM.

Wisudawati, A. W., & Sulistyowati, E. (2022). *Metodologi pembelajaran IPA*. Bumi Aksara.