



# HeatnBomb Bingo Media Based on PBL Learning Model for Science Learning in Grade V Elementary School

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## ABSTRAK

Pengenalan konsep Ilmu Pengetahuan Alam dan Sosial (IPAS) perlu dilakukan dengan metode berbasis masalah dan permainan sederhana yang menarik minat siswa. Namun, fenomena di lapangan menunjukkan bahwa guru cenderung menggunakan metode pembelajaran yang sulit diimplementasikan, disertai penugasan berat yang menyebabkan siswa kesulitan memahami konsep IPAS secara mendalam. Penelitian ini bertujuan untuk mengembangkan dan menganalisis efektivitas media HeatnBomb Bingo untuk pembelajaran IPAS pada siswa kelas V Sekolah Dasar. Penelitian ini menggunakan metode penelitian dan pengembangan (Research and Development) dengan subjek siswa kelas V. Teknik analisis data mencakup uji Kolmogorov-Smirnov test untuk normalitas, uji paired sample t-test untuk membandingkan hasil belajar sebelum dan sesudah penggunaan media, serta uji N-Gain untuk melihat peningkatan hasil belajar. Hasil validasi ahli menunjukkan bahwa media HeatnBomb Bingo sangat valid dengan skor 85,93%. Uji paired sample t-test menunjukkan nilai signifikansi  $0,000 < 0,05$ , yang berarti terdapat pengaruh signifikan penggunaan media HeatnBomb Bingo terhadap hasil belajar siswa. Hasil uji N-Gain sebesar 0,5997 menunjukkan peningkatan hasil belajar sebesar 59,97%. Dengan demikian, media HeatnBomb Bingo valid dan efektif digunakan dalam pembelajaran IPAS. Media ini dapat meningkatkan partisipasi aktif siswa melalui diskusi dan pemecahan masalah yang menarik, sehingga memperkuat pemahaman konsep secara mendalam.

## ABSTRACT

The introduction of Natural and Social Sciences (IPAS) concepts should be conducted through problem-based and simple game-based methods to engage students effectively. However, field observations reveal that teachers often employ complex teaching methods accompanied by heavy assignments, causing students to struggle in comprehensively understanding IPAS concepts. This study aims to develop and analyze the effectiveness of HeatnBomb Bingo media for IPAS learning in fifth-grade elementary students. The research method used is Research and Development, with fifth-grade students as the subjects. Data analysis techniques include the Kolmogorov-Smirnov test for normality, paired sample t-test to compare pre-test and post-test results, and N-Gain test to measure learning improvement. Media validation by experts indicates that HeatnBomb Bingo is highly valid, with a score of 85.93%. The paired sample t-test shows a significance value of  $0.000 < 0.05$ , indicating a significant impact of using HeatnBomb Bingo on students' learning outcomes. The N-Gain test result of 0.5997 reflects a 59.97% improvement in learning outcomes. Thus, HeatnBomb Bingo is valid and effective for IPAS learning. The media fosters active student participation by engaging them in discussions and problem-solving activities, enhancing their conceptual understanding in a more profound and enjoyable way.

## 1. INTRODUCTION

Learning media plays a very important role for elementary school students aged 7-12 years. Children aged 7-12 years are in the concrete operational stage (Arifin et al., 2023; Usman & Basyiruddin, 2022). This means that children can already think logically, but still with the help of real or concrete objects. This is also supported by those who state that media can make learning centered on students in addition to teachers providing materials (Hasan et al., 2021; Mu'min, 2013). With the use of learning media, students

can master learning materials that are still abstract which are delivered in concrete form with the help of learning media. The use of learning media is closely related to the cone. This is based on the developmental stage of students who are at the concrete operational stage. Learning media is very much needed by educators to facilitate the delivery of materials. Many materials are not possible to be presented directly and a medium is needed to present the material in learning. Thus, learning media can be an alternative to bridge abstract material into concrete material. The government continues to make efforts to improve the education system in Indonesia, including improving the previous curriculum to an independent curriculum that also adapts to current developments. This curriculum emphasizes meaningful learning through many learning resources. In helping this process, learning media is needed to help students understand the material and achieve the desired goals. Learning media can help educators in delivering material and become a learning resource for students (Apriliani & Radia, 2020; Usman & Basyiruddin, 2022). Thus, learning media becomes an important component in implementing the independent curriculum.

The implementation of learning requires a medium to make learning meaningful, including in the subject of Natural and Social Sciences (IPAS). IPAS itself is related to the environment around students to be systematically investigated accompanied by a process of discovery. Direct learning is the most concrete learning (Selsabila & Pramudiani, 2022). Although close to students' lives, the implementation of science learning still requires learning media to be able to present materials that cannot be brought to students directly. In addition, the use of media can help to implement student-centered learning. Media development by integrating games is one of the innovations in efforts to improve science learning. Thus, students can be helped to understand and master the material in science learning. At elementary school age, children still like to play in learning something. In their cognitive development, children go through a series of stages (Santos-Meneses et al., 2023; Syafdaningsih et al., 2023). When they reach the concrete operational stage, which usually occurs between the ages of 7 and 11, they begin to be able to think logically about objects and events in real life. Even so, they still find pleasure in playing because the activity helps them understand the world and develop their imagination. This is the basis for the author to develop media based on games. The use of game-based learning media has a positive impact on learning. Other studies show that the use of TTS learning media has a positive effect on learning science in class VI MI Al Karim Surabaya (Juhaeni et al., 2022). This is also supported by research by research which shows that student learning outcomes and learning motivation can be increased through the use of the snakes and ladders game (Siahaan et al., 2020). In line with this, similar research shows that developing media based on monopoly games can make learning more enjoyable (Siti & Lia, 2020). In line with this, similar research found that student learning outcomes increased with the use of game-based learning media (Mahesti & Koeswanti, 2021).

Based on the results of interviews with homeroom teachers of grade V, it was obtained that the learning process in grade V was not optimal. Disrupted learning due to the characteristics of grade V elementary school students who are still at an age that likes to play is one of the causes of the quality of learning not being achieved optimally. This is proven that students are more enthusiastic when learning is carried out while playing and using something concrete. This is also supported by the learning outcomes of grade V students which are still low in the subject of science and natural sciences. The value data obtained by the author is that there are still many students whose scores are below the minimum completion criteria. The Minimum Completion Criteria (KKM) for the subject of science and natural sciences refers to 75. Student learning outcomes show that 13 out of 28 students in 1 class (46%) get scores below the KKM. The problem underlies this research by developing media based on games. Innovative media based on games developed by the author is a learning media based on bingo games. In addition, the author also considers the benefits of learning media based on bingo games. The benefits of bingo games in learning include, students become happy and understand the material; create positive interaction between students and teachers; students can learn about respecting other people's opinions and attitudes of tolerance; and make learning more fun and not scary (Oktaviani, Sulistya Dewi, et al., 2019). The benefits of using learning media in practice, namely helping to explain the material to students; increasing student motivation; overcoming learning limitations; and providing direct experience to students (Sadida & Bahfen, 2024; Usman & Basyiruddin, 2022). Thus, the development of bingo game-based media is expected to be used by teachers to support optimal learning.

The use of bingo game media has a positive impact on learning. This is supported by similar research showing that the use of the bingo method can increase students' interest and learning achievement in thematic learning (Masrohah et al., 2019). Then another study showed that the implementation of Treasure Bingo can improve 4C abilities in students (Pangestu & Pratama, 2022). This game is a modification of the commonly used bingo game media as a learning medium and emphasizes the material that will be taught by the teacher as a learning support to help students understand the material. Other related research explains that the use of the bingo game method can improve the achievement of fifth grade mathematics learning at Kedungjenar Blora State Elementary School (Oktaviani, Rita, et al., 2019). In line

with this, similar research shows that the use of Bingo can improve the learning achievement of fifth grade students at SDN Pamotan (Hidayati et al., 2022). In addition, it is also supported by similar research which shows that the implementation of bingo can make learning centered on students and increase mathematics learning achievement by 89.18% in class IV SDN Pakis 5 Surabaya (Setiawan, 2018).

In relation to learning models, teachers still have difficulty in selecting and implementing appropriate learning models that are able to improve learning outcomes, especially beyond the minimum completion criteria. As recommended by the school, Problem Based Learning (PBL) and Project Based Learning (PjBL) are learning models that can be applied in classroom learning. Teachers still have difficulty in implementing both learning models so they rarely use them in learning activities. In addition, students who tend to be passive make it difficult for class teachers to implement a learning model optimally in the classroom. Class teachers emphasize more on student learning based on direct experience by utilizing the surrounding environment. However, teachers do not use learning using direct experience in each material. This is due to the lack of readiness in preparing learning devices and other tasks by class teachers.

Problem Based Learning (PBL) can develop various abilities in students. In line with this, problem-based learning aims to develop affective, (cognitive, and psychomotor) abilities by linking students' knowledge to real life (Ade & Hasan, 2017; Kumala, 2016). The use of PBL has a significant influence on learning. Research on the use of the PBL model shows that the use of the PBL model can influence students' motivation and learning achievement in social studies learning (NK Mardani et al., 2021). In line with this, similar research shows that there is an influence of PBL on the learning outcomes of science in class V of SDN 1 Setia Aceh Barat Daya (Zulfa et al., 2023). In addition, it is also supported by similar research showing that the implementation of PBL influences the improvement of students' understanding of the concept of science in grade V of elementary school (Pratiwi et al., 2020). In line with this research, similar research shows that the PBL model has an effect on science cognitive abilities in integrated thematic learning (Lendeon & Poluakan, 2022). Other research by Amalia & Hardini (2020) which shows that the PBL model is effective in improving the learning outcomes of the Science subject of class V of SD Negeri 03 Urut Sewu. Thus, this is the background for the author to use the PBL learning model in the research activities carried out.

Based on the explanation above, the solution that can be done is to develop game-oriented learning media based on PBL. This is done to adjust to the limitations of media with elementary school age who still like to play and the less than optimal use of PBL in learning. The purpose of this study is to develop HeatnBomb media and analyze the effectiveness of developing HeatnBomb media for science learning in Grade V Elementary School. By developing HeatnBomb media, it can help improve student learning outcomes. This study presents HeatnBomb media as a new innovation in learning, which has not been widely explored before. This media integrates gamification elements with an interactive approach that aims to increase student participation and develop critical thinking skills. In addition, HeatnBomb is designed to combine learning concepts with real-life situation simulations, which can motivate students to be more active in learning and help them understand the material more deeply compared to traditional learning methods.

## 2. METHOD

This study uses the research and development (R&D) method. This research method is used to produce a product and test its effectiveness. The implementation of this study uses the development model by Sugiyono. The researcher uses eight steps in the development model by Sugiyono. The schematic image is available in Figure 1, and is continued with the media and material validation sheet grid in Table 1 and Table 2, then the percentage of media validity in Table 3, and the teacher response questionnaire grid in Table 4.

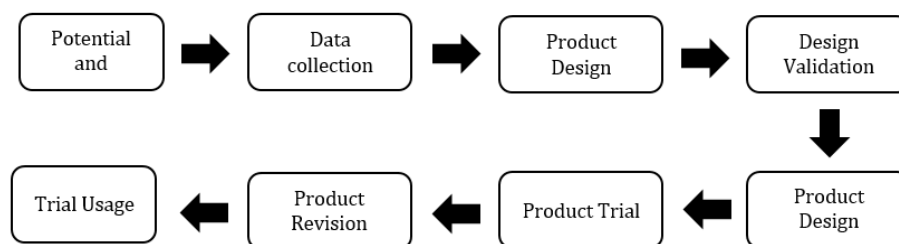


Figure 1. Research Procedure Scheme

**Table 1.** The Validation Sheet Grid by Media Expert

Aspect	Indicator
Learning objectives	Clarity of title, content, achievements, and learning objectives
Technical quality	Media quality, flexibility and durability
Media view	Font size, text, color and images
Language	Clarity of language
<b>Amount</b>	

**Table 2.** The Validation Sheet Grid by Subject Matter Expert

Aspect	Indicator
Learning	Achievement with learning components
Language	Clarity of language
Contents of the material	Suitability of media content with learning materials
<b>Amount</b>	

**Table 3.** Media Validity Percentage

Coefficient interval	Criteria
85% - 100%	Very valid
71% - 85%	Valid
56% - 70%	Quite valid
41% - 55%	Less valid
25% - 40%	Invalid

**Table 4.** The Teacher Response Questionnaire Grid

Aspect	Indicator
Science Learning	Suitability for science and science learning
Initial conditions for learning science	Use of science and science learning resources and media
Contents of the material	Suitability of media content with learning materials
HeatnBomb Bingo	Teachers' responses to the HeatnBomb Bingo media
Media Content	Suitability of media content with science learning
Media view	Suitability of fonts, images, colors and language
<b>Amount</b>	

This study used instruments in the form of teacher needs analysis questionnaires, expert validation sheets, and teacher response questionnaires. The research subjects used in this study were class V of SD 3 Karangmalang. The types of data used were qualitative data and quantitative data. Qualitative data in the form of information collected through observation and interviews with the principal and class teachers. Quantitative data were obtained through expert validation sheets and pretest and posttest questions. Data collection techniques were carried out using test and non-test techniques. The test technique was carried out using pretest and posttest question instruments. Non-test techniques were carried out using observation, interview, questionnaire, and documentation activities. In this study, data analysis was carried out using the Kolmogorov Smirnov Test to determine the normality of data distribution, the Paired Sample T-Test test, and the N-Gain test using IBM SPSS Statistic 25 to determine the effectiveness of using HeatnBomb Bingo media in learning.

### 3. RESULT AND DISCUSSION

#### Result

In accordance with the problem identification process, the problem found is that teachers have not been optimal in using media during learning activities. This is because the learning media used is still limited in learning, especially in science learning. In addition, teachers have never developed related learning media and still use conventional learning media. The development of HeatnBomb Bingo is a solution provided by researchers. HeatnBomb Bingo is used to help students more easily understand and master material about environmental problems. This media can also improve the ability to work together in groups and compete healthily. Through this game media, students can solve environmental problems in everyday life with fun. The results of the development of HeatnBomb Bingo are presented in [Figure 2](#).

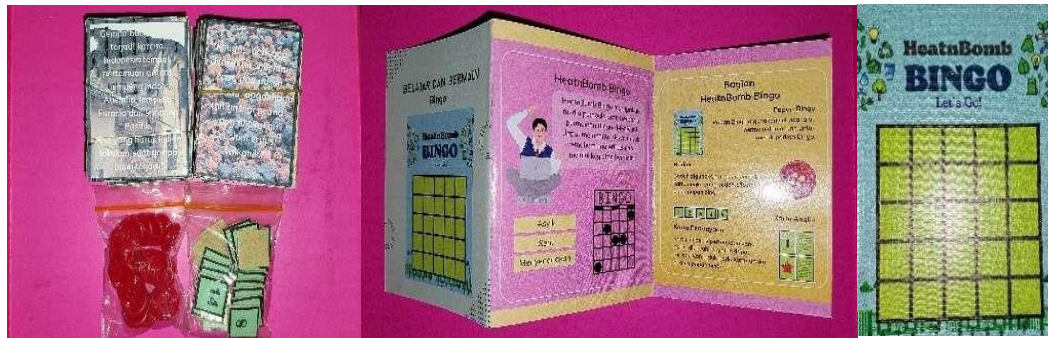


Figure 2. HeatnBomb Bingo Development Results

The HeatnBomb Bingo media prototype was validated by experts to determine the feasibility of the media. The media design was thoroughly evaluated by experts (media and materials) to ensure that all aspects have been properly considered and there are no significant deficiencies. Based on feedback from the validation stage, the design can be revised and improved to correct any weaknesses found. This aims to ensure that the quality of the final product is optimal and can provide maximum benefits to end users. The results of the revision are presented in Figure 3, along with the instrument validation table in Table 5.



Figure 3. HeatnBomb Bingo Media Revision Based on Material Expert Validation

Table 5. The Validity Results by Experts

No	Instrument Validation	Percentage	Category
1.	Media expert validation	85.93%	Very valid
2.	Validation of material experts' stage I	80%	Valid with revision
3	Validation of material experts' stage II	91.67%	Very valid

The validation stage is carried out when the media prototype has been created. The media is developed based on the teacher needs analysis questionnaire. The validation step is carried out by experts. This stage aims to ensure that the HeatnBomb Bingo media can provide accurate and reliable results. Based on the validation results by experts, the HeatnBomb Bingo media is included in the very valid category. The results of the validation test by media experts show that the HeatnBomb Bingo media is very valid, which consists of an assessment of the aspects of learning objectives, technical quality, media appearance, and language used in the learning media. The learning objective aspect consists of the suitability of the media with the learning objectives to be achieved. The technical quality aspect consists of the quality, flexibility and durability of the use of the media in various situations and does not cause harm. The media appearance aspect consists of the clarity, size, and color of the images used in the learning media. In this step, the data obtained is in the form of a percentage to determine the validity of the HeatnBomb Bingo media.

The results of the validation test by material experts were carried out in two stages. The results of the first stage showed that the HeatnBomb Bingo media was valid, but required revision with suggestions and input from material experts. The results of the second stage showed that the HeatnBomb Bingo media was very valid. The assessment by material experts was based on aspects of learning, language, and content. The learning aspect consists of suitability to learning objectives that are integrated with the learning process and the language aspect consists of suitability to user characteristics. The content aspect consists of material coverage, suitability to learning indicators, ease of understanding the material, clarity of material description, and the relevance of the material to everyday life. In this step, the data obtained is in the form of a percentage to determine the validity of the media that has been developed. Then, data in the form of suggestions and input from material experts is used by researchers to improve and enhance the HeatnBomb Bingo media. The results of the Kolmogorov Smirnov Test are presented in [Table 6](#).

**Table 6. The Kolmogorov Smirnov Test Results**

Statistical Parameters		Unstandardized Residual
N		21
Normal Parameters a, b	Mean	0.000000
	Std. Deviation	4.34413458
Most Extreme Differences	Absolute	0,151
	Positive	0,110
	Negative	-0,151
Test Statistics		0,151
Asymp. Sig. (2-tailed)		0,200

Based on [Table 6](#), the significance value is  $0.200 < 0.05$ , so it can be concluded that the residual value is normally distributed. This shows that the subsequent data analysis meets the requirements of parametric statistics, namely normally distributed data. Then, the researcher conducted a Paired Sample T-Test. The T-Test is used to determine the difference in learning achievement on the average pretest and posttest on the use of HeatnBomb Bingo media.

The next stage is the trial of the HeatnBomb Bingo media. Previously, researchers had created 5 sets of HeatnBomb Bingo media by adjusting the needs of students in learning. The product trial was conducted by 6 students of grade V of SD 3 Karangmalang. The results of the trial showed that the HeatnBomb Bingo media could be used by students as they should. The teacher response questionnaire was given to teachers to determine the teacher's response to the HeatnBomb Bingo media. Based on the results of the teacher response questionnaire, the seventh stage was not carried out because there was nothing that needed to be revised from the HeatnBomb Bingo media.

The usage trial was conducted with a wider scope. In line with this, the developed product can be applied to a wider scope after the product testing is successful. The usage trial was conducted by 21 students of grade V of SD 3 Karangmalang, regardless of the students who had participated in the product trial. At this stage, the data obtained in the form of pretest and posttest scores were analyzed to determine the effectiveness of the HeatnBomb Bingo media that had been developed. The data obtained were tested for normality to determine the normality of the data distribution. This stage was carried out to determine the statistical method used in the next stage. Based on the normality test using the Kolmogorov Smirnov Test, the results obtained showed that it was normally distributed with a significance value of  $0.200 < 0.05$ . Thus, the researcher used parametric statistics for further testing. The results of the Paired Sample T-Test are presented in [Table 7](#).

**Table 7. The Paired Sample T-Test Results**

Paired Group	Mean	Std. Deviation	95% Confidence Interval of the Difference			t	df	Sig. (2-tailed)
			Std. Error Mean	Lower	Upper			
Pre-Test-Post-Test	-19.429	9.897	2.160	-23.934	-14.923	-8.996	20	0.000

Based on [Table 7](#), the t-test test obtained a significance value (2-tailed) of  $0.000 < 0.05$ . Then, the results were  $8.996 \geq 2.086$  so it can be concluded that there is a significant difference between the pretest and posttest scores. Furthermore, the researcher conducted an N-Gain test to test the increase in the average learning outcomes of students before and after participating in learning using the HeatnBomb Bingo learning media in the subject of Social Sciences. In parametric statistical testing, the researcher used

the paired sample t-test. Based on data analysis using the paired sample t-test, the results obtained were that the significance value (2-tailed) was  $0.000 < 0.05$ . This indicates that there is a significant difference between the pre-test and post-test values. In line with these results, the results of the calculated  $t_{value} \geq t_{table}$ , namely  $8.996 \geq 2.086$ . Thus, it can be concluded that there is a significant influence on the differences in treatment given, namely before and after the use of the HeatnBomb Bingo media. The researcher conducted an N-Gain test to test the average increase in students' learning achievement before and after using the HeatnBomb Bingo media in the science subject. Based on the results of the N-Gain test, the N-Gain value was 0.5997. In other words, there was an increase in the average learning outcomes between before and after using the HeatnBomb media. In line with these results, the N-gain percentage was 59.97%. This means that there was an increase in the average learning achievement of 59.97% between before and after using the HeatnBomb Bingo media. In accordance with Table 9. N-Gain Value Criteria, the results showed that the N-Gain value of 0.5997 was in the interval  $0.3 \geq N-Gain \geq 0.7$  which is included in the moderate category. Thus, the HeatnBomb Bingo media is effective for use in science learning. The results of the N-Gain test and the N-Gain value criteria are presented in Table 8 and Table 9.

**Table 8. N-Gain Test Results**

	N	Minimum	Maximum	Mean	Std. Deviation
N-Gain	21	0.32	0.70	0.59	0.09
N-Gain percent	21	32.51	70.00	59.97	9.37

**Table 9. N-Gain Value Criteria**

Coefficient interval	Criteria
N-Gain < 0.3	Low
$0.3 \geq N-Gain \geq 0.7$	Currently
N-Gain $\geq 0.7$	High

Based on Table 8, the N-Gain value is 0.5997. This shows that there is an increase in the average learning outcomes between before and after the use of HeatnBomb Bingo media by 59.97%. According to Table 9. N-Gain Value Criteria, the results show that the N-Gain value is included in the moderate criteria. Thus, HeatnBomb Bingo media is effective for use in science learning.

**Discussion**

Bingo media encourages students to actively participate in learning. Students are involved in finding answers, interacting with fellow students, and discussing the concepts of science being studied. In addition, Bingo can be played in groups or teams, so that students can work together and learn from each other. This encourages collaboration between students and strengthens students' social skills. Bingo media provides variation in the learning methods used in the classroom. This can help break up boredom and maintain students' interest in science learning. In the context of the Bingo game, competition can encourage students to actively participate and increase students' motivation to learn. The use of bingo game media has a positive impact on learning. This is supported by other studies that show that the use of the bingo method can increase students' interest and learning achievement in thematic learning (Masrohah et al., 2019). Then further research shows that the implementation of Treasure Bingo can improve 4C abilities in students (Pangestu & Pratama, 2022). This game is a modification of the commonly used bingo game media as a learning medium and emphasizes the material that will be taught by the teacher as a learning support to help students understand the material. Other research on the bingo game method explains that the use of the bingo game method can improve the achievement of fifth grade mathematics learning at Kedungjenar Blora State Elementary School (Oktaviani, Rita, et al., 2019). In line with this, research by Hidayati shows that the use of Bingo can improve the learning achievement of fifth grade students at SDN Pamotan (Hidayati et al., 2022). In addition, it is also supported by other research which shows that the application of bingo can make learning centered on students and increase mathematics learning achievement by 89.18% in class IV SDN Pakis 5 Surabaya (Wahyuningsih et al., 2018).

Problem Based Learning (PBL) can develop various abilities in students. In line with this, problem-based learning aims to develop affective, cognitive, and psychomotor abilities by linking students' knowledge to real life (Ade & Hasan, 2017; Kumala, 2016). The use of PBL has a significant influence on learning. Similar research shows that the use of the PBL model can affect student motivation and learning achievement in social studies learning (NK Mardani et al., 2021). In line with this, other similar studies show that there is an influence of PBL on the learning outcomes of science in class V of SDN 1 Setia Aceh Barat Daya (Zulfa et al., 2023). In addition, it is also supported by similar research which shows that the

implementation of PBL influences the improvement of students' understanding of the concept of science in grade V of elementary school (Pratiwi et al., 2020). In line with this research, other research shows that the PBL model has an effect on science cognitive abilities in integrated thematic learning (Lendeon & Poluakan, 2022). Other similar studies show that the PBL model is effective in improving the learning outcomes of the Science subject in grade V of SD Negeri 03 Urut Sewu (Amalia & Hardini, 2020). Thus, this is the background for the author to use the PBL learning model in the research activities carried out. The results of this study are in accordance with previous studies. Research that discusses similar matters shows that math bingo is valid and practical to use in learning in elementary schools (Marleni et al., 2021). Other research shows that Roulette Bingo media is very practical to use as a learning medium with a score of 88.27% (Julaiha July, Nurul Farhaini, Rollin fadilah Hasibuan, 2022). In line with this, similar research shows that bingo games can improve students' mathematics learning outcomes by 49% (Hastuti et al., 2023). Thus, the HeatnBomb Bingo media is very valid and effective for science learning.

Previous research tends to use presentation media, videos, and simulation media in learning (Abelenda et al., 2023; Anggraeni et al., 2023). When compared to these media, HeatnBomb Bingo media offers more direct interaction than presentation media which is usually more passive. Presentation media tends to focus on delivering information, while HeatnBomb Bingo encourages active understanding through student involvement in the game. HeatnBomb Bingo can attract students' attention more with game elements and competition, while presentation media may need variation to keep students interested.

Learning videos typically offer powerful visualizations of complex concepts, while Bingo allows for direct interaction and understanding of concepts through questions asked. Learning videos can provide in-depth context for a particular topic, while HeatnBomb Bingo can be more effective in honing students' cognitive and social skills (Lee & Jo, 2023). Bingo has the advantage of allowing active student involvement, whereas learning videos are more passive (Marcela et al., 2022; Nurhadi, 2022). Then, simulation media and methods can provide a practical and visual immersive experience in learning, while HeatnBomb Bingo offers a simpler and more direct approach. Simulations often require greater technical resources than Bingo which can be played easily with cards and number covers (Loneragan et al., 2022). Simulations may be better suited for complex concepts or processes that are difficult to understand, whereas HeatnBomb Bingo is more effective for practicing and consolidating concepts that have already been learned.

The originality of this study lies in strengthening the concept of science and natural sciences with a simple game, namely the HeatnBomb Bingo game media. Relevant to PBL, in the HeatnBomb Bingo media, students must understand the concept of science and natural sciences to be able to find the correct answer. This strengthens students' understanding of the subject matter, because students must apply these concepts in the context of the game facilitated by the HeatnBomb Bingo media. Playing HeatnBomb Bingo involves cognitive processes such as information processing, problem solving, and decision making. This helps develop students' cognitive skills actively.

Although HeatnBomb Bingo Media can be an interactive tool, there is a possibility that some students may not be fully engaged in the game, especially if they are less interested or feel less confident. This can reduce the effectiveness of the learning. Every student has different learning styles, including visual, auditory, and kinesthetic styles. HeatnBomb Bingo Media may be more suitable for students with visual or auditory learning styles, while kinesthetic students may feel less engaged. Also, although HeatnBomb Bingo can be played in groups, the game tends to be more competitive than collaborative. This can reduce the opportunity for students to work together, discuss, and learn from each other. Therefore, it is very important for teachers to understand the learning styles and learning needs of each student and also adjust them to their learning objectives.

#### 4. CONCLUSION

HeatnBomb Bingo media is a media developed in the subject of Science in grade V with environmental problems material. HeatnBomb Bingo media is a learning tool that encourages active participation among students by involving them in discussions and problem solving. HeatnBomb Bingo media can be played in groups or teams, fostering collaboration and strengthening social skills. HeatnBomb Bingo media is a simple game that strengthens the concept of Science by requiring students to understand the concept of science to find the correct answer in line with the use of PBL in it. This cognitive process helps develop cognitive skills and improve student learning outcomes.

#### 5. REFERENCES

Abelenda, A. M., Aiouache, F., & Moreno-Mediavilla, D. (2023). Adapted business model canvas template and primary market research for project-based learning on management of slurry. *Environmental*



- Technology & Innovation*, 30(May). <https://doi.org/https://doi.org/10.1016/j.eti.2023.103106>.
- Ade, H., & Hasan, S. (2017). Model & Pendekatan Pembelajaran Inovatif (Teori dan Aplikasi). *Lintas Nalar*, xvi+396.
- Amalia, G. R., & Hardini, A. T. A. (2020). Efektivitas Model Problem Based Learning Berbasis Daring terhadap Hasil Belajar IPA Kelas V Sekolah Dasar. *Jurnal Ilmiah Wahana Pendidikan*, 6(3), 424–431. <https://doi.org/10.5281/zenodo.3977422>.
- Anggraeni, D. M., Prahani, B. K., Suprpto, N., Shofiyah, N., & Jatmiko, B. (2023). Systematic review of problem based learning research in fostering critical thinking skills. *Thinking Skills and Creativity*, 49(September). <https://doi.org/https://doi.org/10.1016/j.tsc.2023.101334>.
- Apriliani, S. P., & Radia, E. H. (2020). Pengembangan Media Pembelajaran Buku Cerita Bergambar Untuk Meningkatkan Minat Membaca Siswa Sekolah Dasar. *Jurnal Basicedu*, 4(4), 994–1003. <https://doi.org/10.31004/basicedu.v4i4.492>.
- Arifin, K., Febriananda, F., Satria, I. B., Natfi, A., Yarni, L., Sjech, U. I. N., & Djambek, M. D. (2023). *Perkembangan Anak Usia Dini*. 2(5), 340–349. <https://www.jurnal.anfa.co.id/index.php/seroja/article/download/1523/1429>.
- Hasan, M., Milawati, Darodjat, Khairani, H., & Tahrir, T. (2021). Media Pembelajaran. In *Tahta Media Group*.
- Hastuti, I. D., Muhdar, S., & Rahman, N. (2023). Pengaruh Metode Permainan B ingo Terhadap Hasil Belajar Matematika Siswa Kelas III SD. *Seminar Nasional Paedagoria*, 3, 380–389. <https://journal.ummat.ac.id/index.php/fkip/article/viewFile/16824/pdf>.
- Hidayati, F. M. N., Dewi, G. K., & Wibowo, S. (2022). Pengembangan Media Bingo Materi Bangun Ruang Pada Siswa Kelas V SDN Pamotan. *Jurnal Ilmiah Mandala Education*, 8(3), 2308–2314. <https://doi.org/10.58258/jime.v8i3.3721>.
- Juhaeni, J., Wiji, S., Wadud, A. J., Saputra, H., Azizah, I. N., & Safaruddin, S. (2022). Pengaruh Media Pembelajaran Teka Teki Silang Terhadap Hasil Belajar IPA Materi Perkembangbiakan Tumbuhan. *Journal of Instructional and Development Researches*, 2(6), 241–247. <https://doi.org/10.53621/jider.v2i6.176>.
- Julaiha Juli, Nurul Farhaini, Rollin fadilah Hasibuan, N. A. S. (2022). Pengembangan Media Pembelajaran Roulette Bingo Pada Pembelajaran Bahasa Indonesia Kelas IV SD. *Jurnal Pendidikan Dan Konseling*, 4, 1349–1358. <https://journal.universitaspahlawan.ac.id/index.php/jpdk/article/view/5232/3671>.
- Kumala, F. N. (2016). Pembelajaran IPA Sekolah Dasar. In *Journal of Chemical Information and Modeling* (Vol. 8, Issue 9).
- Lee, N., & Jo, M. (2023). Exploring problem-based learning curricula in the metaverse: The hospitality students' perspective. *Journal of Hospitality, Leisure Sport & Tourism Education*, 32(June). <https://doi.org/https://doi.org/10.1016/j.jhlste.2023.100427>.
- Lendeon, G. R., & Poluakan, C. (2022). Pengaruh Model Problem Based Learning (PBL) Terhadap Kemampuan Literasi Sains Siswa. *SCIENING: Science Learning Journal*, 3(1), 14–21. <https://doi.org/10.53682/slj.v3i1.1076>.
- Lonergan, R., Cumming, T. M., & O'Neill, S. C. (2022). Exploring the efficacy of problem-based learning in diverse secondary school classrooms: Characteristics and goals of problem-based learning. *International Journal of Educational Research*, 112. <https://doi.org/10.1016/j.ijer.2022.101945>.
- Mahesti, G., & Koeswanti, H. (2021). Pengembangan Media Pembelajaran Permainan Monopoli Asean untuk Meningkatkan Hasil Belajar Tema 1 Selamatkan Makhluk Hidup Pada Siswa Kelas 6 Sekolah Dasar. *MIMBAR PGSD Undiksha*, 9(1), 30. <https://doi.org/10.23887/jjpsd.v9i1.33586>.
- Marcela, R., Idris, M., & Aryaningrum, K. (2022). Pengembangan Media Permainan Ular Tangga dalam Pembelajaran IPS Siswa Kelas IV SD Negeri 138 Palembang. *Journal on Teacher Education*, 4(1).
- Marleni, A. J., Friansah, D., & Satria, T. G. (2021). Pengembangan Media Pembelajaran Math Bingo Pada Mata Pelajaran Matematika Materi Pecahan Kelas Iv Sd. *AULADUNA: Jurnal Pendidikan Dasar Islam*, 8(2), 160. <https://doi.org/10.24252/auladuna.v8i2a4.2021>.
- Masrohah, K., Wiarsih, C., & Irawan, D. (2019). Penerapan Metode Permainan Bingo untuk Meningkatkan Minat dan Prestasi Belajar Siswa dalam Pembelajaran Tematik. *Madrasah: Jurnal Pendidikan Dan Pembelajaran Dasar*, 11(2), 64–74. <https://doi.org/10.18860/madrasah.v11i2.7113>.
- Mu'min, S. A. (2013). Teori Pengembangan Kognitif Jian Piaget. *Jurnal AL-Ta'dib*, 6(1), 89–99. <https://doi.org/10.31332/atdb.v6i1.292>.
- N.K. Mardani, N.B. Atmadja, & I.N.Suastika. (2021). Pengaruh Model Pembelajaran Problem Based Learning (Pbl) Terhadap Motivasi Dan Hasil Belajar Ips. *Jurnal Pendidikan IPS Indonesia*, 5(1), 55–65. <https://doi.org/10.23887/pips.v5i1.272>.
- NURHADI, N. N. (2022). Pengembangan E-Modul Berbasis Discovery Learning Untuk Meningkatkan Kemampuan Peserta Didik Mata Pelajaran Ips Kelas Vi Di Madrasah Ibtidaiyah Kota Pekanbaru. *El-*

- Ibtidaiy: Journal of Primary Education*, 5(1), 43. <https://doi.org/10.24014/ejpe.v5i1.15256>.
- Oktaviani, T., Rita, E., & Dewi, S. (2019). Permainan Bingo Untuk Meningkatkan Hasil Belajar Matematika. *Jurnal Mimbar Ilmu*, 24(1), 47–52. <https://doi.org/10.23887/mi.v24i1.17409>.
- Oktaviani, T., Sulistyia Dewi, E. R., & . K. (2019). Penerapan Pembelajaran Aktif Dengan Metode Permainan Bingo Untuk Meningkatkan Hasil Belajar Matematika. *Mimbar Ilmu*, 24(1), 47. <https://doi.org/10.23887/mi.v24i1.17409>.
- Pangestu, S., & Pratama, M. M. A. (2022). Implementasi Treasure Bingo untuk Meningkatkan 4C (Critical, Creative, Collaborative, and Communicative Thinking Skill Peserta Didik SDN Wonoayu Kabupaten Malang. *Jurnal Pasopati*, 4(2), 129–138. <https://doi.org/10.14710/pasopati.2022.11980>.
- Pratiwi, D. A., Djumhana, N., & Hendriani, A. (2020). Penerapan Model PBL Untuk Meningkatkan Pemahaman Konsep IPA Siswa Kelas V SD. *Jurnal Pendidikan Guru Sekolah Dasar*, 5(1), 11–18. <https://doi.org/10.17509/jpgsd.v5i1.30045>.
- Sadida, D. K., & Bahfen, M. (2024). Strategi Mengatasi Tantangan Motivasi Belajar di Kelas 8 melalui Penggunaan Media Permainan Kartu Uno. *Seminar Nasional Dan Publikasi Ilmiah*, 2425–2430. <https://jurnal.umj.ac.id/index.php/SEMNASFIP/article/view/24157/11153>.
- Santos-Meneses, L. F., Pashchenko, T., & Mikhailova, A. (2023). Critical thinking in the context of adult learning through PBL and e-learning: A course framework. *Thinking Skills and Creativity*, 49(September). <https://doi.org/https://doi.org/10.1016/j.tsc.2023.101358>.
- Selsabila, V., & Pramudiani, P. (2022). Pengembangan Media Pembelajaran Interaktif Articulate Storyline Berbasis Literasi Digital Pada Pembelajaran IPS bagi Siswa Madrasah Ibtidaiyah Negeri. *Jurnal Paedagogy*, 9(3), 458. <https://doi.org/10.33394/jp.v9i3.5372>.
- Setiyawan, H. (2018). Metode Permainan Bingo Matematik pada Materi Operasi Hitung Pecahan Terhadap Hasil Belajar Siswa Kelas IV. *Matematika Dan Pembelajaran*, 6(2), 101. <https://doi.org/10.33477/mp.v6i2.662>.
- Siahaan, K. W. A., Sinaga, J., & Simanjuntak, M. (2020). Pengaruh Metode Think Phare and Share Dengan Alat Permainan Edukatif Ular Tangga Terhadap Motivasi Belajar Anak Sekolah Dasar (SD). *Intelektiva: Jurnal Ekonomi, Sosial Dan Humaniora*, 2(2), 1–10. <https://www.jurnalintelektiva.com/index.php/jurnal/article/view/272>.
- Siti, N., & Lia, K. (2020). Pengaruh Media Permainan Ular Tangga tentang CTPS terhadap Pengetahuan dan Sikap dalam Upaya Pencegahan Diare ( Studi Pada Siswa Kelas 4 SDN 003 Palaran Kota Samarinda ). *Borneo Student Research*, 1(2), 1204–1209. <https://journals.umkt.ac.id/index.php/bsr/article/view/431/438>.
- Syafdaningsih, S., Hasmalena, H., Rukiyah, R., Sofnidar, S., Pagarwati, L. D. A., Siregar, R. R., Zulaiha, D., Stevany, D., & Safitri, M. I. (2023). Manfaat Kegiatan Outbound dalam Stimulasi Perkembangan kognitif Anak Usia Dini dari Perspektif Guru. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(6), 6700–6708. <https://doi.org/10.31004/obsesi.v7i6.5382>.
- Usman, A., & Basyiruddin, M. (2022). *Media Pembelajaran*. Ciputat Pers.
- Wahyuningsih, Y., Rchmawati, I., Setiawan, A., & Ngazizah, N. (2018). HOTS (Higher Order Thinking Skills) dan Kaitannya dengan Keterampilan Generik SAINS dalam Pembelajaran IPA SD. *Prosiding Seminar Nasional Pendidikan Dasar*, 227–234. <https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/11203/32.pdf?sequence=1&isAllowed=y>.
- Zulfa, T., Tursinawati, T., & Darnius, S. (2023). Pengaruh Model Problem Based Learning (PBL) terhadap Hasil Belajar IPA Siswa di Sekolah Dasar. *Jurnal Basicedu*, 7(4), 2111–2120. <https://doi.org/10.31004/basicedu.v7i4.5451>.