PIONIR Jurnal Pendidikan
P-ISSN 2339-2495
E-ISSN 2549-6611

PIONIR: JURNAL PENDIDIKAN
VOLUME 14 No 2 2025
P-ISSN 2339-2495/E-ISSN 2549-6611

DEVELOPMENT OF THE POTAR BUNGKERLA MEDIA TO DISCOVER THE VOLUME FORMULAS IN GRADE VI AT MIN 22 ACEH BESAR

Nida Jarmita*

*Universitas Islam Negeri Ar-Raniry Banda Aceh, Indonesia

nida.jarmita@ar-raniry.ac.id

Zikra Hayati

Universitas Islam Negeri Ar-Raniry Banda Aceh, Indonesia

zikra.hayati@ar-raniry.ac.id

Rachmawati

Universitas Islam Negeri Ar-Raniry Banda Aceh, Indonesia

200209133@student.ar-raniry.ac.id

Muhammad Afif Narfi

Universitas Islam Negeri Ar-Raniry Banda Aceh, Indonesia

200209036@student.ar-raniry.ac.id

Received 22 April 2025, Accepted 25 July 2025, Published 29 July 2025

Abstract

Teachers need a simple teaching aid that aligns with the topic of three-dimensional shapes and can be reused over a long period. This research is motivated by students' difficulties in understanding the elements of three-dimensional shapes, as well as their confusion in determining the volume formulas of curved-sided solids that are relatively similar. Therefore, this study aims to develop an appropriate instructional media to help address these student learning difficulties. Therefore, research and development are necessary to produce the Potar Bungkerla media, which is adapted from the environment. R&D *(Research and Development)* with a model ADDIE *(analysis, design, development, implementation* and *evaluation)* used in this research. The instruments consist of expert validation sheets for media and content experts, as well as teacher and student response questionnaires. The final results obtained from media expert validation scored 93.6%, while content expert validation scored 83%, both classified as "highly feasible." Meanwhile, the teacher response scored 95%

with a "very interesting" classification, and the student response scored 88.75%, also classified as "very interesting." As a result, this study successfully developed a learning media that can be used by students to overcome difficulties in discovering the volume formulas of curved-sided solids. These figures indicate that this media is highly feasible and captures students' interest. Therefore, the research has been completed, and the media can be used in Grade VI at MIN 22 Aceh Besar.

Keywords: Potar Bungkerla Media, Curved-Surface Three-Dimensional Shapes.

Abstrak

Guru membutuhkan sebuah media sederhana yang sesuai dengan materi bangun ruang dan juga media yang kemudian bisa digunakan kembali dalam jangka waktu panjang. Dilatarbelakangi dari siswa yang kesulitan dalam memahami unsur-unsur pada bangun ruang kemudian timbulnya keraguan dari dalam menentukan rumus volume bangun ruang sisi lengkung yang hampir sama, oleh karena itu tujuan penelitian ini ialah memerlukan sebuah media yang layak untuk digunakan dalam mengatasi kesulitan siswa tersebut. Diperlukan sebuah penelitian dan pengembangan yang bertujuan untuk menghasilkan media Potar Bungkerla yang diadaptasi dari lingkungan. R&D *(Research and Development)* dengan model ADDIE *(analysis, design, development, implementation* dan *evaluation)* yang digunakan dalam penelitian ini. Instrumen berupa lembar validasi ahli media dan ahli materi, serta angket respon guru dan angket respon siswa. Hasil akhir yang didapat melalui hasil validasi ahli media diperoleh 93,6% dan hasil validasi ahli materi diperoleh 83% dengan kriteria “sangat layak”. Sedangkan hasil respon guru diperoleh 95% dengan kriteria “sangat menarik” dan hasil respon siswa diperoleh 88,75% dengan kriteria “sangat menarik”. Kemudian terealisasikanlah hasil dari penelitian ini berupa pengembangan media yang dapat digunakan siswa dalam mengatasi kesulitan pada saat menemukan rumus volume bangun ruang sisi lengkung. Angka tersebut menunjukkan bahwa media ini sangat layak dan menarik perhatian siswa, oleh karena itu penelitian telah selesai dan media dapat digunakan di kelas VI MIN 22 Aceh Besar.

Kata Kunci: Media Potar Bungkerla, Bangun Ruang Sisi Lengkung.

INTRODUCTION

One of the fields of knowledge with an extensive scope is mathematics education. Ideally, the process of learning mathematics in elementary schools should be able to foster students’ enthusiasm to actively participate in learning activities. Additionally, it requires the teacher's ability to provide sufficient space for students to develop their spontaneity, creativity, and independence in accordance with their individual abilities, interests, and educational needs through approaches that are both engaging and challenging for their developmental stage. (Ketut Masana, 2022). As facilitators in delivering instructional materials, teachers are not only required to provide content that aligns with the designed learning program, but they must also be capable of facilitating the delivery of material in a manner that is engaging, easy to understand, and enjoyable for students throughout the learning process. However, creating such a learning environment is not an easy task; it requires the support of several other components to enhance the learning process so that it becomes more engaging, comprehensible, and enjoyable. One of the key factors that can facilitate students' learning is the use of instructional aids or media during the learning process. (Eliska Preliana, 2015). Instructional media are considered as any tools or means used to convey messages between teachers and students. The

presence of media is expected to stimulate students' thoughts, feelings, interests, and attention, with the main goal of enhancing learning effectiveness (Maisarah, Daniah, & Fajria, 2021).

Instructional aids serve as channels of communication through which learning materials are conveyed by teachers to students, providing visual representations of the subject matter to help students grasp abstract mathematical concepts more easily. In mathematics instruction, such aids function as supportive media that clearly, tangibly, and concretely illustrate mathematical concepts and principles operating within a well-defined context. (Fikroh Fitriah, 2022). The researcher believes that instructional aids are supportive media in the form of tangible objects used by teachers to enhance the effectiveness, innovation, and enjoyment of the learning process for students. The preliminary study was conducted by the researcher on Thursday, January 28, 2024, in Grade VI of MIN 22 Aceh Besar during a Mathematics lesson. A needs analysis was carried out using questionnaire instruments to gather responses from both teachers and students regarding the existing media in the classroom. The Guttman scale was used for the student response questionnaire, in which students checked items based on the listed aspects with 'yes' and 'no' answer choices, scored 1 and 0 respectively. Meanwhile, the Likert scale was applied for the teacher response questionnaire, with a score range from 1 to 5. The results of this analysis were then reviewed further by the researcher. The findings indicate that there are still issues related to the use of simple instructional aids in the classroom. Although mathematics teachers have utilized simple instructional aids during the learning process, these aids have not yet met the expected standards and are considered unsatisfactory by teachers in fulfilling the criteria of effective teaching media. Their form lacks visual appeal for students, as they are made solely from plain white cardboard, resulting in diminished student enthusiasm during the learning activities. The following is an illustration of the simple instructional aid used by the teacher during the lesson.

Figure 1 Simple Instructional Media

The activity of pouring sand using simple instructional media has proven to be less effective, as the media employed lacks durability and easily deforms when filled with sand, particularly because the three-dimensional shapes used are made from cardboard. Students have difficulty understanding the process of finding the volume of three-dimensional shapes, as the sand used in the media is not clearly visible due to being obscured by the color of the cardboard. In addition, the monotonous design also affects students' interest and engagement. Moreover, the learning resources utilized by the teacher are limited to the Grade VI mathematics textbook, which makes it difficult for students to understand the components of three-dimensional figures. The lack of student interest in the instructional aids provided also contributes to their confusion, particularly in identifying the formulas for curved surface volume, as these formulas tend to be

very similar.

The researcher found that the madrasah is still implementing the 2013 Curriculum (K13) and faces limitations in terms of learning facilities, which has posed challenges for teachers in delivering instructional materials effectively to students. This can be seen from the media, which consists solely of cardboard and is assisted by the use of sand. The integration of K13 and adequate facilities serves as a crucial combination in supporting effective learning and improving learning quality-particularly in mathematics, a subject often associated with abstract concepts. As is widely known, the abstract nature of mathematical objects presents various learning difficulties, particularly for elementary school students in both lower and upper grades. This is primarily due to their cognitive development, as they are not yet capable of thinking abstractly. This fact strongly supports the need for instructional media in schools that can provide students with concrete experiences through visual teaching aids, especially when both teachers and students are dealing with abstract mathematical concepts.

A relevant prior study was conducted by Mahlil Khusairi, entitled *"The Effectiveness of Using Teaching Aids on Cylinder and Cone Volume to Improve Mathematics Learning Outcomes of Grade VI Students at MIN 22 Aceh Besar."* This study focused on students' learning outcomes achieved through the use of teaching aids related to the volume of cylinders and cones. The findings of Mahlil's research indicated a significant improvement in each cycle when applying the Classroom Action Research (CAR) method. In the present study, the researcher aims to examine and further develop the teaching aids or media previously investigated by Mahlil by incorporating several different media components. This development represents an advancement over the prior research, specifically in terms of the materials to be used, the media design, and the method of implementation. Furthermore, a study by Nabila Elsa Gunawan developed an instructional media called APEME CUPANG to demonstrate the volume formula of a cone, using replicas of cylinder and cone shapes. The materials used were affordable, such as thick cardboard, crafted to closely resemble the actual shapes, enabling the final outcome of the study to successfully prove the volume formula of these solids. Lastly, Binti Maqsudah utilized sand and cord as media in teaching the volume and surface area formulas of a sphere. Her study emphasized students' conceptual understanding by embedding learning content into volume-based three-dimensional models, which had a positive impact on students and led to improvements observed in each learning cycle.

Based on the analysis of the findings, the researcher is interested in conducting a research and development (R&D) study involving a learning media called Potar Bungkerla, which is inspired by an existing simple instructional tool. This development refers to the enhancement of an existing product by integrating additional components, with the aim of creating an improved and more effective learning medium. (Suhartono, 2014). The researcher aims to develop an instructional tool named Potar Bungkerla, which is also adapted from the surrounding environment. This environmental adaptation is an initiative taken by the researcher to address the limited availability of facilities in the madrasah. The instructional focus of this media is on mathematics, specifically the topic of curved-surface three-dimensional shapes. The objectives of this study are to develop the *Potar Bungkerla* media based on local environmental resources, to assess its feasibility through expert validation, and to examine teacher and student responses toward the media's development.

When it comes to instructional tools, media serve as a crucial component for teachers in facilitating the delivery of learning materials to students. (Narfi, Jarmita and Daud, 2024). When

it comes to instructional tools, media serve as a crucial component for teachers in facilitating the delivery of learning materials to students. As a supporting tool in the learning process, media help ensure that instructional messages are effectively conveyed, thereby enabling the learning process to run more efficiently and effectively. (Lisa M., 2018). To minimize production costs, the researcher chose to innovate using materials from the surrounding environment. The 'Potar Bungkerla' media was developed from simple, low-cost, and easily accessible materials found in the local area, making them suitable for use in instructional media development. One of the topics that highly requires the support of instructional media is three-dimensional geometry, with this study focusing specifically on the topic of calculating the volume of curved-surface solid figures.

METHODS

Research and Development (R&D) was employed as the method in this study. This method is commonly used for producing specific products as well as for assessing the feasibility level of the developed product. (Sugiono 2012). The ADDIE model was utilized in this study to develop the existing product. It consists of five key elements: Analysis, Design, Development, Implementation, and Evaluation. (Yudi dan Sugianti, 2020). This study was conducted at MIN 22 Aceh Besar. The research subjects included two media experts and two subject matter experts to assess the feasibility of the environment-based Potar Bungkerla media. In addition, two mathematics teachers were involved to evaluate teacher responses, along with 12 sixth-grade students to assess student responses toward the Potar Bungkerla media adapted from the surrounding environment.

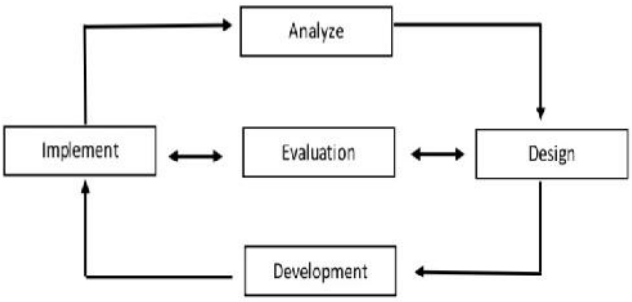


Figure 2 R&D method with the ADDIE model

The data collection technique employed in this study was a questionnaire distributed to media experts, subject matter experts, and teachers in order to obtain data on the feasibility of the developed product. The type of questionnaire used was a closed-ended questionnaire, in which the statements or questions were structured, and respondents were required to select the answer that best matched their perspective. The instruments used included a media expert validation sheet, a subject matter expert validation sheet, and teacher and student response questionnaires. The data were analyzed using descriptive statistical analysis techniques by describing and illustrating the results obtained from the completed instruments, followed by assigning scores, which were then presented in tables, scales, percentages, and ultimately summarized in a conclusion. The scoring interpretation used both the Likert and Guttman scales (Ni Nyoman, 2019). The Likert scale was applied to expert validation instruments and teacher response questionnaires, with a score range from 1 to 5, while the Guttman scale was used for student response questionnaires with 'yes' and 'no' answer choices. The data were then presented in a table, and the values were calculated using the percentage formula $P = f/n \times 100\%$, with the

results further discussed and concluded.

RESULTS AND DISCUSSION

This research was conducted at MIN 22 Aceh Besar, following a needs analysis carried out at the school. Based on the results of the study, a learning media product named *Potar Bungkerla* was developed. This media is adapted from materials found in the local environment to assist students in discovering formulas for calculating the volume of curved-surface solid figures. The media underwent a validation process by four experts two media experts and two subject matter experts and was categorized as 'highly feasible'. It was then tested with two mathematics teachers and twelve sixth-grade students, who evaluated it as 'very interesting'. The following outlines the stages of the research and development process using the ADDIE model:

1. Analysis.

   In this stage, the researcher identified several needs at MIN 22 Aceh Besar, including the requirement for a durable and reusable learning media, low student engagement during learning activities, and the lack of integration of environmental elements into the learning process. Therefore, it is necessary to develop an instructional media that is not only easy to understand but also made from safe and durable materials. The media will be designed as a teaching aid with a unique shape to encourage student engagement in the learning process and feature an attractive appearance.

2. Design.

   In the initial design stage, the researcher used Canva to create the media layout. The researcher also selected tools and materials that are easily accessible from the surrounding environment and ensured that they are safe for use during the learning process.

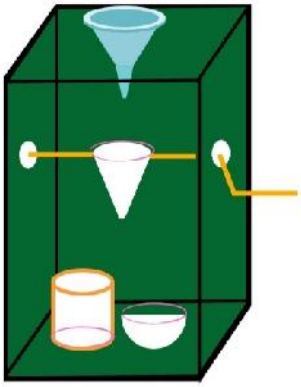
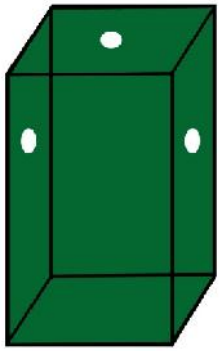
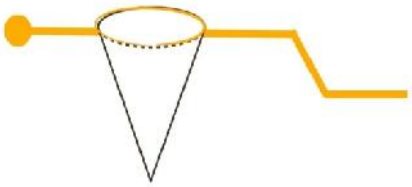
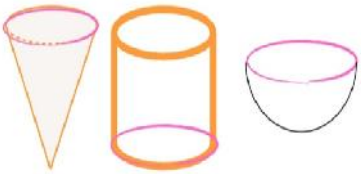


Figure 3 Potar Bungkerla Media

PIONIR: JURNAL PENDIDIKAN VOLUME 14 No 2 2025
P-ISSN 2339-2495/E-ISSN 2549-6611
Journal page is available to: https://jurnal.ar-raniry.ac.id/index.php/Pionir/index

There are several important components of this media design, including:

Table 1. Three Key Components of Potar Bungkerla

"Component of the Instructional Media"	Illustration
Potar Bungkerla Box	
Rotating Base	
Three-Dimensional Shape	

The tools and materials used must indeed be carefully selected and adjusted to suit the students. The following are among them:

Table 2. Tools and Materials

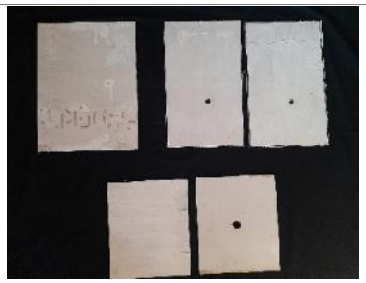
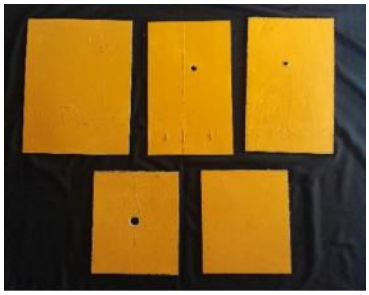
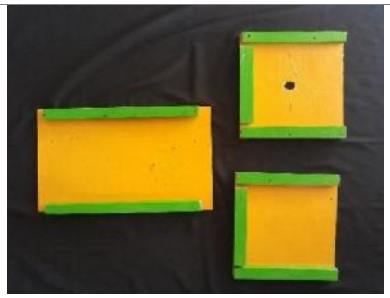
Tools	**Materials**
Scissors, rollers, pliers, matches, nails, hammers, saws, wire, sewing needles, green bean paper, pencils and markers.	) Plastic mica clear volume thickness 0.50 mm,) Plywood with a thickness of 6 mm,) Color paint (white, yellow and hujau),) Color wool yarn (pink, white and green),) Foam mading (yellow, green and purple),) Aqua bottles,) Green beans and) Foundation wood.

3. Development

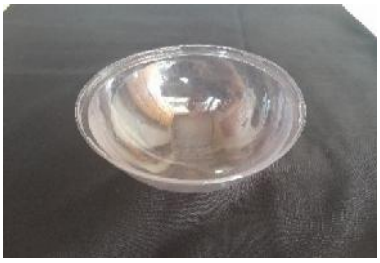
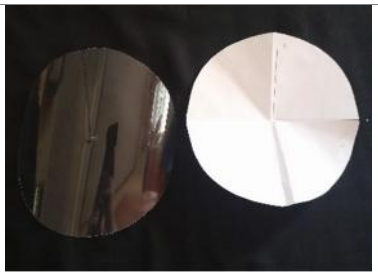
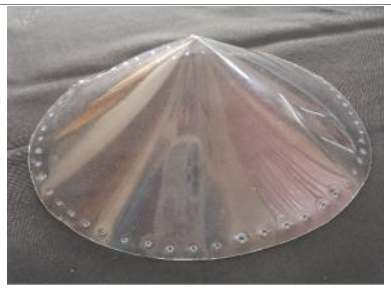
The media developed in this study was an enhancement of an existing product that had been previously researched. The researcher improved the media to make it more appealing to students by incorporating elements from the surrounding environment. There are three key

components in the construction of this media: first, the creation of the base box; second, the construction of the 3D geometric shapes; and third, the rotating foundation mechanism. The following are the steps to make Potar Bungkerla media:

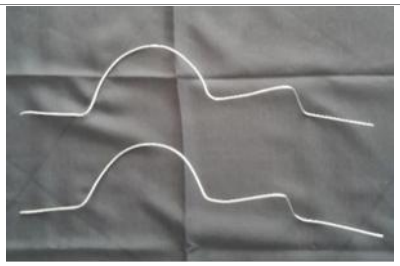
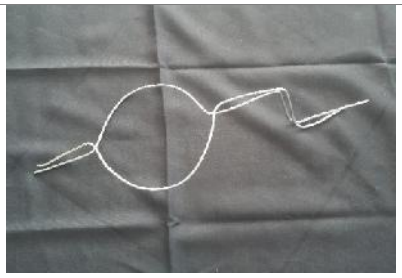
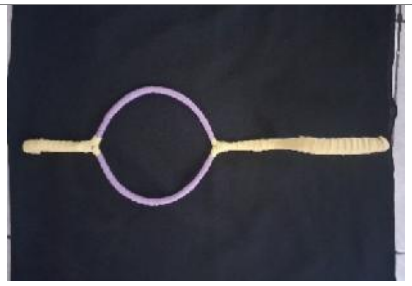
Table 1 Media Creation Steps

	Making a Bungkerla Box	
1	Prepare plywood with the size: 2 pieces measuring 35 cm x 20 cm 2 pieces measuring 25 cm x 20 cm 1 piece measuring 35 cm x 25 cm.	
2	Prepare the foundation wood with the size: 4 pieces measuring 20 cm 2 pieces measuring 30 cm. 2 pieces measuring 18 cm	
3	Plywood and foundation wood paint with different colors.	 
4	Plywood nails to the wooden foundation that has been made.	

PIONIR: JURNAL PENDIDIKAN VOLUME 14 No 2 2025
P-ISSN 2339-2495/E-ISSN 2549-6611
Journal page is available to: https://jurnal.ar-raniry.ac.id/index.php/Pionir/index

5	Join the 3 pieces of plywood that have been glued to the foundation, to form a rectangular box.	
	Creating a Build Space	
1	Prepare a semicircular cup lid, then measure the height and radius.	
2	Make cone nets with a diameter of 14 cm and a height of 7 cm	
3	Make a tube mesh with a circle diameter of 14 cm, a height of 7 cm and a rectangle of 45 cm	
4	Shape the cone meshes into a cone chamber building, put the parts together by sewing them together	
5	Shape the tube meshes into a tube chamber build, put the parts together by sewing them together	

PIONIR: JURNAL PENDIDIKAN VOLUME 14 No 2 2025
P-ISSN 2339-2495/E-ISSN 2549-6611
Journal page is available to: https://jurnal.ar-raniry.ac.id/index.php/Pionir/index

6	Decorate the space that has been formed using mading foam to make it more attractive.	
	Creating a Swivel Foundation	
1	Prepare 2 pieces of wire with a length of 45 cm.	
2	The shape of the wire corresponds to the design of the swivel foundation. The size of the left part is 8 cm, the middle (middle of the circle) is 20 cm and the right part is 22 cm.	
3	Join the formed wire together	
4	Wire wrap using mading foam to make it safer and more attractive	
5	Sewing the cone chamber build on a swivel foundation	

PIONIR: JURNAL PENDIDIKAN VOLUME 14 No 2 2025
P-ISSN 2339-2495/E-ISSN 2549-6611
Journal page is available to: https://jurnal.ar-raniry.ac.id/index.php/Pionir/index

6	Insert the swivel foundation into the holes on the left and right sides of the bungkerla box.	

After completion, the media underwent validation. The results showed a media expert validation score of 93.6% (highly feasible) and a subject matter expert validation score of 83% (highly feasible).

Table 2 Validation Results from Media and Subject Matter Experts

NO	VALIDATOR	PERCENTAGE	CRITERIA
1	Media Expert Validators	93,6 %	Highly Feasible
2	Subject Matter Expert Validators	83 %	Highly Feasible
AVERAGE PERCENTAGE		88,3 %	Highly Feasible

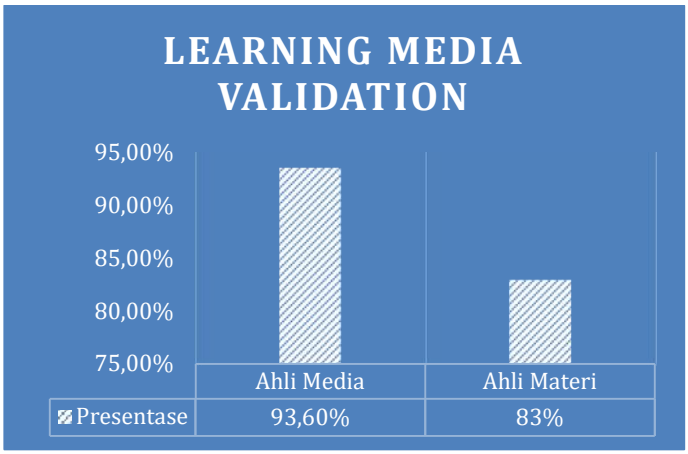


Chart 1 Validation Results from Media and Subject Matter Experts

PIONIR: JURNAL PENDIDIKAN VOLUME 14 No 2 2025
P-ISSN 2339-2495/E-ISSN 2549-6611
Journal page is available to: https://jurnal.ar-raniry.ac.id/index.php/Pionir/index

Before entering the next stage, the media is revised first after validation according to the results of validation by media and material experts:

Before Revision	After Revision
	
Description: Initially, the filling medium used in this Bungkerla Potar tool used sand and then replaced with mung beans	
	
Description: Initially, the building of the space contained in this Potar Bungkerla tool was only one size with a diameter of 14 cm, then the researcher made another building of a space with a different diameter, namely 15 cm.	
	
Description: Initially, the size of the Potar Bungkerla box was 45 cm because it was too big, then the researcher adjusted the size of the Bunkerla box to 35 cm. The researcher also changed the color of this potar bungkerla tool to a bright color to make it more attractive.	

PIONIR: JURNAL PENDIDIKAN VOLUME 14 No 2 2025
P-ISSN 2339-2495/E-ISSN 2549-6611
Journal page is available to: https://jurnal.ar-raniry.ac.id/index.php/Pionir/index

4. Implementation.

After the media was declared feasible and required no further revisions, it was implemented at MIN 22 Aceh Besar on February 29, 2024. The results of the implementation showed a teacher response score of 95%, categorized as "very interesting," and a student response score of 88.75%, also classified as "very interesting."

Table 3 Results of Teacher and Student Questionnaires

NO	RESPONSE	PERCENTAGE	CRITERIA
1	Teacher	95%	Very Interesting
2	Student	88,75%	Very Interesting

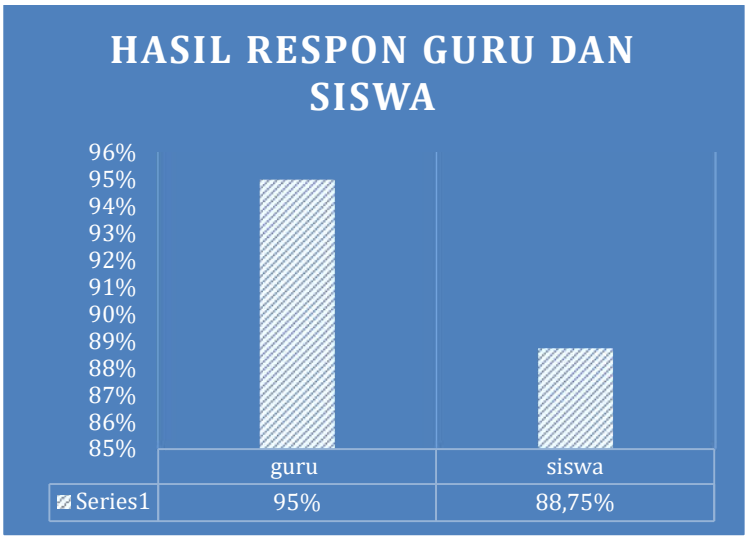


Chart 2 Results of Teacher and Student Questionnaires

5. Evaluation

In the final stage, the researcher conducted modifications to the environment-based Potar Bungkerla instructional media that had previously been tested in the learning process. The implementation of this media in the classroom allowed the researcher to review the outcomes based on students' completed responses, enabling further refinement of the product.

Based on the findings presented, several points warrant discussion. First, Potar Bungkerla is the name of an instructional media tool created by the researcher. Potar is derived from the phrase "rotating foundation" (*pondasi putar*) on the Bungkerla box. The term Bungkerla is an acronym, where *"bung"* refers to a cylinder (*tabung*), *"ker"* to a cone (*kerucut*), and *"la"* to a sphere (*bola*), representing the three types of curved-surface solid figures included in the Potar Bungkerla media. The environment offers an abundance of learning resources and materials, making it rich with objects that can be utilized for developing educational tools. Creating environmentally friendly teaching aids has multiple benefits, including cost-efficiency, ease of access, and user-friendliness.

The second design, which had been planned, underwent revisions after validation, as can be observed in the image below. Significant differences are noticeable, particularly in terms of the use of more varied colors. Additionally, the elements were changed from sand to grains because sand is prone to shifting locations and poses a safety risk if left unattended by the teacher.

Furthermore, the media was adjusted to more accurately represent the actual three-dimensional shape, making it easier to apply in practice.

Figure 4 Initial design of the media before validation

Figure 5 The media design that has been revised by media experts and content experts

The tools and materials used in the construction of this media include scissors, rollers, pliers, matches, nails, hammers, saws, wires, sewing needles, green bean paper, pencils, and markers. The materials consist of clear mika plastic sheet with a thickness of 0.50 mm, plywood with a thickness of 6 mm, paint in white, yellow, and green colors, wool thread in pink, white, and green, bulletin board foam in yellow, green, and purple, Aqua bottles, green beans, and foundation wood. The tools and materials used are in accordance with the views of Indriana, who explained that the criteria for effective teaching aids or media are as follows: first, the media used must be tangible, meaning that students should be able to touch, see, hear, and observe the media directly. Second, the use of media should serve as a form of communication or interaction between the teacher and the students. Third, the media should be applicable for learning both inside and outside the classroom. Fourth, the media used in teaching must align with the teaching method employed. (Indriana, 2001). These tools and materials refer to the requirements that must be met in the creation of a media. (Deni, K., 2014).

Based on previous research by Mahlil Khusairi, the researcher in this study developed an improvement over the previous media, where the differences are clearly visible, as shown in the image below. The most significant change is in the materials, where the cardboard was replaced with plywood for the foundation box.

Figure 6 Simple Media

Figure 7 Media Potar Bungkerla

The method of using the previous teaching aid was relatively simple, as students manually filled the cone with sand and poured the contents from the cone using their hands. In contrast, the Potar Bungkerla media, adapted from the environment for this study, differs in that to fill the cone on the rotating foundation, green beans must be poured through a funnel. Once the contents are collected in the cone, they are poured out using the rotating foundation of the teaching aid onto the three-dimensional shape, which will then be used to calculate its volume. This activity fosters interaction between the students and the teacher and helps to train students' patience and concentration.

Third, in terms of implementation, a suggestion from the teacher was that during the usage stage, students should first be engaged with instructional videos using the Potar Bungkerla media through a projector, which would spark their curiosity about the media. Afterward, the Potar Bungkerla media should be presented to the students. The evaluation of this R&D method involves reviewing the results of the study, where the focus of the research and development of the Potar Bungkerla media is on the accuracy of the quality, functionality, and material alignment. After the improvements, the Potar Bungkerla media, adapted from the environment, is deemed suitable for use in learning. According to Brog and Gall in Sugiyono's book, it is necessary to reassess the product results in research to ensure the quality of the product that has undergone revisions and modifications to correct any shortcomings. (Sugiyono, 2018). Therefore, teachers today are required to be more creative and innovative in teaching students so that the learning process can take place comfortably and enjoyably. Teachers' creativity and innovation can be applied through the development of instructional media. (Kristianingrum & Radia, 2022)

CONCLUSION

This study was successfully realized through the development of the Potar Bungkerla media, which has been validated for its feasibility and received highly positive responses from both teachers and students, categorized as very interesting. This media is highly effective in minimizing students' difficulties and uncertainties in understanding the geometric volume formulas of curved-sided solids, namely cylinders, cones, and spheres. The environment-based Potar Bungkerla media facilitates teachers in delivering instructional material and supports students in understanding the content according to their needs, as it is equipped with tangible representations of curved-sided solids that students can directly observe and touch. Furthermore, the hands-on activities conducted to demonstrate the formula for volume made the learning process enjoyable. Students were also highly enthusiastic because the Potar Bungkerla media is visually appealing. Based on the data analysis from the feasibility assessment by the expert team, teacher response questionnaires, and student response questionnaires, the Potar Bungkerla media, adapted from the environment, is deemed highly feasible and attractive. Additionally, the use of this media is not overly complicated, and it is an innovation derived from the environment—specifically, the Gayo coffee bean grinding machine, which has been developed into a classroom media, particularly for mathematics lessons on three-dimensional shapes to demonstrate the formula for curved surface volumes.

REFERENCES

Annisah, Siti. (2009). *Metode Pembelajaran Matematika Di MI.* Metro: STAIN Metro.

Anshori, Muslich dan Sri Iswati. (2009). *Buku Ajar Metodologi Penelitian Kuantitatif.* Surabaya: UNAIR.

Arsyad, Azhar. (2003). *Media Pembelajaran*, Jakarta: PT Raja Grafindo

Ferdian, Ferdian dan Ratu Ilma Indra Putri. (2016). Desain Pembelajaran Volume Kubus dan Balok Menggunakan Filling dan Packig Di Kelas V, *Jurnal Kependidikan,* 46 (2): 151

Fitriah, Fikroh. *(2022).* Pengembangan Alat Peraga dari Bahan Bekas Pada Materi Perubahan Energi Siswa Kelas IV SD. *Jurnal Edukasi Matematika dan Sains*. 11 (1): 15.

Indriana. (2001). *Tumbuh Kembang dan Terapi Bermain Pada Anak*. Jakarta: Selemba Media.

Isnanto, Agus Slamet. (2014). Pengaruh Alat Peraga Berbasis Lingkungan (APBL), *Jurnal Program Studi Guruan Universitas Muhammadiyah Purwarejo,* 4 (1): 31

Jarmita, Nida dkk. (2020). Pengembangan Media Seven In One Ditinjau dari Uji Kelayakan dan Uji Keperaktisan Di Kelas V MI/SD Di Banda Aceh, *Jurnal Ilmiah DIDAKTIKA*, 21 (1): 112

Jarmita, Nida. (2017). Penerapan Pendekatan Problem Solving Pada Materi Volume Bangun Ruang Menggunakan Alat Peraga. *Jurnal Pendidikan.* 59

Kuriawan, Dedi. Pengembangan Komik Media Matematika Terhadap Peningkatan Pemahaman Konsep Perkalian dan Pengembangan Bilangan Cacah Disekolah Dasar. 1 (2): 6

Kartikasari, Fitria Dyah. (2016). Pengembangan Modul Paket Program Pengolah Angka/ Spreadsheet Siklus Akutansi Perusahaan Dagang Sebagai Pendukung Implementasi Kurikulum 2013. *Jurnal Pendidikan Akutansi.* 4 (3): 3

Kristianingrum, Widia dan Elvira H.R. (2022). Pengembangan Media Pembelajaran Pop- Up Book Panca Indra (POPANDRA) terhadap Pemahaman Siswa pada Materi Panca Indra Kelas 1 di SD Negeri 2 Selodoko. *Pionir: Jurnal Pendidikan*. 11 (3): 123

Kurniawan, Deni. (2014). *Pembelajaran Terpadu Tematik (Teori, Praktik Dan Penilaian),* Bandung: Alfabeta.

Mahaeni. (2009). *Metode Riset Jilid 2.* Bali: Cv.Sastra Utama.

Maisarah, Daniah, & Fajria. (2021). Peningkatan Hasil Belajar Peserta Didik Melalui Media Pop Up Book pada Pembelajaran Tematik Kelas V MIN 04 Aceh Besar. *Pionir: Jurnal Pendidikan, 10*(2): 151

Maja, Ibnu. (2022). Penerapan Model Pembelajaran Kooperatif Tipe Jigsaw dengan Menggunakan Alat Peraga Pembelajaran Bangun Ruang. *Jurnal Pengabdian Kepada Masyarakat.* 2 (2): 6

Masana, Ketut. (2022). Model Pembelajaran Kooperatif Tipe Think Pair Share Meningkatkan Hasil Belajar Matematika Siswa Kelas V SD. *Jurnal Of Education Action Research*. 6 (2): 153

Mashuri, Sufri. (2019). *Media Pembelajaran Matematika*. Jakarta: Deepublish.

Mulyatiningsih, Endang. (2014). *Metode Penelitian Terapan Bidang Pendidikan*. Bandung: Alfabeta.

Musa, Lisa. (2018). *Alat Peraga Matematika*. Sulawesi Selatan: Aksara Timur

Narfi, M. A., Jarmita, N., & Daud, R. M. (2024). Utilizing Multifunctional Board Media to Improve Student Learning Outcomes in Grade IV at MIN 26 Aceh Besar. *Pionir: Jurnal Pendidikan, 13*(3), 58-69.

Pranta, Ella. (2006). Implementasi Model Pembelajaran Group Investugation Berbantuan Alat Peraga untuk Meningkatkan Kemampuan Pemahaman Konsep Matematika. *Jurnal Pendidikan Matematika Indonesia.* 1 (1): 34

Pratama, Riyo Arie dan Antomi Siregar. (2009). Pengembangan Lembar Kerja Siswa Berbasis Scaffolding To Train Concept Understanding. *Jurnal Of Science And Mathematics Education.* 2 (1): 92.

Preliana, Eliska. (2025). Pengembangan Alat Peraga Sains Fisika Berbasis Lingkungan. *Jurnal Riset dan Kajian Pendidikan Fisika*. 2 (1): 7

Sare, Yunidan. Petrus Citra. (2006). *Atropologi MA/MA XII,* Jakarta: Grasindo

Setyosari, Punaji. (2013). *Metode Penelitian Pendidikan dan Pengembangan*. Jakarta: Kencana.

Subchan, Winarni, dkk. (2018). *Buku Matematika untuk SMP/MTS*. Jakarta: Kementrian Pendidikan dan Kebudayaan.

Sudarwanto dan Ibnu Hadi. (2014). Pengembangan Alat Peraga Pembelajaran Matematika Sekolah Dasar untuk Meningkatkan Kemampuan Berfikir Matematis Siswa. *Jurnal Sarwahita*. 11 (1): 34

Sudjana, Nana. (2002). *Dasar-Dasar Proses Belajar Mengajar*. Jakarta: Madia Group.

Sugiyono. (2008). *Metode Penelitian dan Pendidikan (Pendekatan Kualitatif, Kuantitatif dan R&D).* Bandung: Alfabeta.

Sugiyono. (2012). *Metode Penelitian Kuantitatif kualitatif dan R&D.* Bandung: Alfabeta.

Sugiyono. (2018). *Metode Penelitian Kuantitatif, Kualitatif dan (R&D)*. Bandung: Alfabeta.

Suhartono. (2014). *Pengembangan Bahan Ajar.* Malang: Elang Mas.

Syah, Muhibbin. (2009). *Psikologi Belajar*. Jakarta: Raja Grafindo Persada.

Syahbana, Ali. (2013). Alternatif Pemahaman Konsep Umum Volume Suatu Bangun Ruang. *Jurnal Program Studi Pendidikan Matematika*. 3 (2): 1

Tulak, Harmelia. (2015). Penerapan Metode Koopratif Tipe Numbred Heads Together dengan Alat Peraga untuk Meningkatkan Prestasi Belajar Matematika Siswa SD, *Jurnal KIP*, 4 (1): 84

Wahyudi, Apri. (2009). Pengembangan Alat Peraga Pembelajaran Matematika Materi Perkalian Berbasisi Montessori. *Jurnal Manajemen Pendidikan Islam Al-Idrah.* 4 (2): 33

Yudi dan Sugianti. (2020). *Penelitian Pengembangan ADDIE Dan R2D2 Teori dan Praktek*,. Pasuruan: Lembaga Akademik dan Research Institute.

Yulirami, Ni Nyoman. (2019). *Metode Riset Jilid 2*. Bali: CV Sastra Utama.