**JDIME : Journal of Development and Innovation In Mathematics Education**
Volume 1, Number 2, October 2023, pp. 25-38
P-ISSN: 2986-2744 E-ISSN: 2986-402X
Open Access: http://dx.doi.org/10.32939/jdime.v1i2.2982

# Development Design of Liveworksheet Based Numbered Head Together (NHT) Cooperative Model to Improve Students' Mathematical Problem Solving Ability

**Junaidi[1*], Ulfa Lu'luilmaknun[2]**
[1,2] Universitas Mataram, Mataram, Indonesia
Email : junaidi88@unram.ac.id

**ARTICLE INFO**

**Article history:**
Available online October 30, 2023

***Kata Kunci:***
*LKPD, Liveworksheet, NHT, Pemecahan Masalah, Matematika*

**Keywords:**
Student Worksheets, Liveworksheet, NHT (Numbered Head Together), Problem-solving, Problems, Mathematics



***Abstrak***

*Penelitian ini dilatarbelakangi oleh pentingnya pengembangan LKPD yang disesuaikan dengan tuntutan era teknologi dan siswa jarang mendapatkan LKPD software yang dapat mempermudah dalam memahami materi dan mudah dibawa kemana-mana. sehingga peneliti mengembangkan LKPD elektronik berbasis liveworksheet dengan model kooperatif Numbered Head Together (NHT). Pengembangan ini dilakukan untuk meningkatkan kemampuan pemecahan masalah matematis siswa dalam materi bangun ruang sisi lengkung. Adapun model pengembangan yang digunakan oleh peneliti yaitu model pengembangan ADDIE (Analysis, Design, Development, Implementation, Evaluation) yang merupakan model pengembangan sistenatis, terstruktur, terarah dan terencana. Penelitian ini mengguanakan intrumen penelitian yang berupa angket yang di berikan kepada siswa-siswi sekolah menengah pertama (SMP) kelas IX. Angket yang dibagikan bertujuan untuk mengetahu karakteristik peserta didik, kebutuhan peserta didik terhadap LKPD yang dikembangkan. hasil analisis kebutuhan, peneliti berhasil mengembangkan LKPD berbasis elektronik menggunakan platform Liveworksheet. Produk LKPD ini memiliki keunggulan efisiensi dan efektivitas, serta melibatkan unsur audio visual dan diskusi siswa untuk membangun pemahaman dan kemampuan pemecahan masalah. Diharapkan pengembangan ini dapat memberikan pengalaman belajar yang interaktif, menarik, dan membantu siswa dalam mengembangkan kemampuan pemecahan masalah matematis.*

**Abstract**

This research is motivated by the importance of developing Student Worksheets (LKPD) tailored to the demands of the technological era, as students rarely encounter software-based LKPD that facilitates understanding of the material and is easily portable. Therefore, the researcher developed electronic LKPD based on Liveworksheet with the cooperative model Numbered Head Together (NHT). This development aims to enhance students' mathematical problem-solving abilities in the material of curved surface space. The development model employed by the researcher is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), known for its systematic, structured, directed, and planned development process. The study utilized a research instrument in the form of a questionnaire distributed to ninth-grade students in junior high school (SMP). The questionnaire aimed to identify the characteristics of participants and the needs of students regarding the developed LKPD. Based on the analysis of these needs, the researcher successfully developed electronic-based LKPD using the Liveworksheet platform. This LKPD product exhibits advantages in terms of efficiency and effectiveness, incorporating audio-visual elements and student discussions to build understanding and problem-solving skills. It is anticipated that this development will provide an interactive, engaging learning experience and assist students in developing mathematical problem-solving skills.

## INTRODUCTION

In learning, instructional materials are highly essential. Instructional materials encompass all systematically organized materials that enable students to learn independently and are designed in accordance with the applicable curriculum (Magdalena, 2020). The development of Student Worksheets (LKPD) tailored to the demands of the technological era is crucial, considering that students seldom encounter software-based LKPD that facilitates understanding of the material and is easily portable. The development of instructional materials

*Corresponding author.
E-mail addresses: junaidi88@unram.ac.id

is necessary due to the continuously evolving needs in the field of education. The development of LKPD is adjusted to the demands of the technological era. Students rarely find software-based LKPD that eases understanding of the material and is easily portable. As expressed by Oktaviyanthi & Herman in (Lestari, 2018), using interactive teaching materials, especially in integrating mathematics software, can facilitate students in understanding concepts. By developing instructional materials, teachers can update and enhance the relevance and effectiveness of the learning material delivered to students. The development of instructional materials can also help address changes in curriculum demands and new educational standards (Suprihatin & Manik, 2020). Depdiknas in (Supriatna, et al., 2022) also states that instructional materials can assist teachers by emphasizing student involvement, facilitating students in understanding the material, providing tasks for student practice, and simplifying the learning process.

By leveraging technology, we can create a conducive learning environment as it accelerates and simplifies students' tasks, enhancing their ability to utilize technological advancements (Ambarwati, 2021). Furthermore, by harnessing technology and the latest research, we can integrate innovative learning approaches, more efficient teaching methods, and more engaging resources into instructional materials. This will help students become more engaged, strengthen their understanding, and facilitate the achievement of better learning objectives. Thus, the development of instructional materials becomes a crucial necessity for the education sector to enhance educational quality and achieve effective teaching and learning activities (Wahyudi, 2022).

One of the much-needed instructional materials is Student Worksheets (LKPD). Student Worksheets serve as a learning medium containing material, summaries, and instructions for learning tasks that students need to complete. LKPD can cover both theoretical and practical aspects, aligning with the basic competencies that students are expected to achieve (Trisna, 2021). Often found in print form, LKPD is essential in electronic form, known as E-LKPD, to facilitate access for all students and meet their learning needs.

According to Ramlawati et al. in (Hidayati & Zulandri, 2021), electronic Student Worksheets (LKPD) represent a form of interactive learning material, encompassing exercises for students that can be completed digitally in a systematic and continuous manner over a specified period. One platform suitable for developing E-LKPD is Liveworksheet. Liveworksheets serve as an electronic media platform presenting text, images, animations, and videos aimed at making learning more engaging, preventing student boredom (Khikmiyah, 2021). By utilizing Liveworksheet, interactive and dynamic LKPD can be created and presented. Features such as multimedia content, interactive quizzes, and animated images enrich the student learning experience, enhance their engagement, and motivate them to learn (Andriyani et al., 2020). Additionally, leveraging online technology allows LKPD to be accessed and used by students anywhere and anytime, enabling effective distance learning (Gitriani et al., 2018).

The appropriate learning model in developing Liveworksheet-based LKPD with the goal of enhancing students' mathematical problem-solving abilities is the Numbered Head Together (NHT) cooperative learning model (Noor & Megawati, 2014). In the NHT model, each student is assigned a unique number, and they collaborate within groups to solve problems or answer questions. Employing the Numbered Head Together (NHT) model in LKPD development offers significant benefits. NHT is a collaborative method that enhances students' independence and strengthens their responsibility to contribute optimally to their group (Khoiriyah, 2018). Consequently, each student feels a sense of responsibility and engagement in the learning process. Furthermore, the NHT model helps reduce the dominance of students who tend to be more active in the classroom. In several studies, the use of the NHT model in LKPD development has proven effective in enhancing students' mathematical problem-solving abilities. As expressed by Hartati (2015), the NHT learning model effectively improves mathematical problem-solving skills in curved surface space.

Through NHT, each group member is assigned a number and faces the same question or task. This encourages productive group discussions, enabling students to build shared knowledge and deepen their understanding. The model also fosters active participation from

each group member, developing collaboration and communication skills, as well as students' problem-solving abilities.

Improving a student's mathematical problem-solving skills holds significant benefits, not only in an academic context but also in everyday life. Mulyati (2016) emphasizes that problem-solving is a crucial skill that students should master after learning mathematics. Therefore, teachers must ensure that students possess adequate problem-solving skills by providing appropriate problem-solving exercises. As students develop this skill, they can confidently and effectively face mathematical challenges. Mathematical problem-solving abilities help students cultivate critical thinking skills essential for interpreting information, analyzing situations, and making sound decisions. Additionally, mathematical problem-solving trains students to identify problems, formulate solution strategies, and test the solutions they discover.

Enhancing mathematical problem-solving in the development of NHT-based Student Worksheets (LKPD) offers significant advantages in mathematics learning. Mathematical problem-solving is a critical skill involving creative, analytical, and logical thinking. By integrating mathematical problem-solving into NHT-based LKPD, students actively engage in finding solutions and applying mathematical concepts in real-world contexts. This helps them develop critical and analytical thinking skills, as well as problem-solving skills applicable in daily life. Furthermore, collaboration within NHT groups allows students to share problem-solving approaches and strategies, enhancing their understanding and perspectives. As expressed by Tinambunan et al. (2020), the implementation of the NHT cooperative learning model improves the mathematical problem-solving abilities of junior high school students. This learning model involves students in small group discussions and mutual assistance in solving mathematical problems.

## METHOD

The development of Liveworksheet-based Student Worksheets (LKPD) utilizes the ADDIE model. This is because the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) provides a systematic and structured approach that can enhance the efficiency and quality of the development process. First, the Analysis stage aids in a comprehensive understanding of the needs and characteristics of the target audience and the learning context. By conducting a thorough analysis, researchers can identify problems or challenges that need to be addressed in the learning process and formulate clear objectives.

The ADDIE model, schematically designed by Branch in (Hidayat & Muhammad, 2021), outlines the instructional system design as follows:

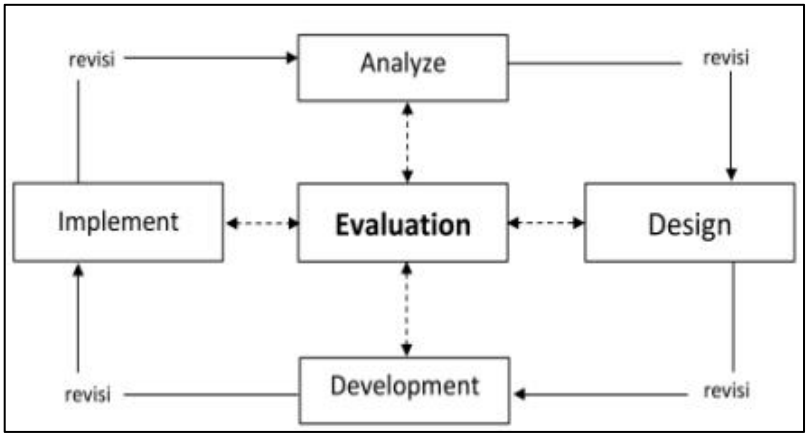



**Figure 1.** ADDIE models Prosedure

The Design stage involves planning the structure and content of learning centered around learning objectives. In this step, the determination of the learning method or strategy to be used is made, along with the selection of the learning model to be implemented in instructional materials such as Student Worksheets (LKPD) (Harjanta & Bambang, 2018).

According to Rustandi & Rismayanti (2021), in the design phase, it begins with creating a flowchart, storyboard, compiling materials, assessment instruments, and gathering supporting materials. Through careful design, researchers can create a logical sequence of learning, select appropriate methods and media, and integrate effective learning strategies. The Development stage involves creating learning materials in accordance with the designed plan. In this stage, researchers develop instructional materials, conduct testing, and make revisions to ensure the quality and suitability of the learning materials to be used.

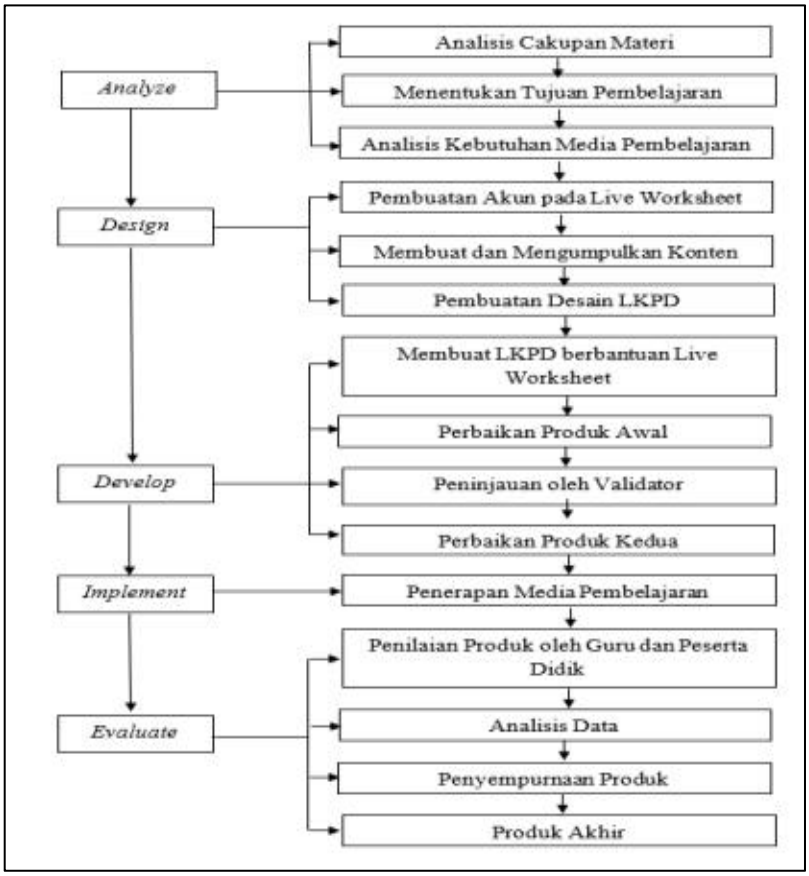



**Figure 2.** Development Prosedure of ADDIE (Marlina, 2022)

The Implementation stage involves the application of developed learning materials in a real-world context. In this stage, the developed content is applied in the learning process to evaluate its impact on the quality of learning, including effectiveness, attractiveness, and learning efficiency (Puspasari & Tutut, 2019). Researchers can observe the interaction and response of students to the learning materials, identify shortcomings, and make adjustments if necessary. Implementation is done in small groups to obtain feedback as material for improving the product draft.

The Evaluation stage allows researchers to assess the effectiveness of the learning materials and make improvements. The evaluation stage is conducted in two forms: formative evaluation and summative evaluation (Nareswari et al., 2021). Evaluation can be carried out using various methods such as tests, surveys, or observations. The evaluation results provide valuable insights for enhancing and refining the developed learning materials.

By using the ADDIE model, development can be conducted in a structured and planned manner. This model ensures that each crucial stage in instructional material development is carefully considered, thereby enhancing the efficiency and quality of the development process (Susanto & Ayuni, 2017). Furthermore, with a systematic approach, researchers can adjust and improve learning materials based on feedback and evaluation, resulting in more effective learning materials that align with students' needs.

## RESULT AND DISCUSSION

### *Needs Analysis Results*

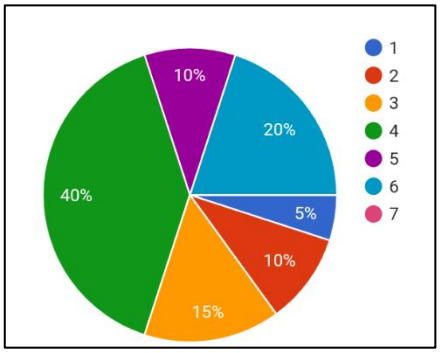



**Figure 3.** Student's favorite animation

Based on the questionnaire results regarding learners' preferred animations, it can be concluded that cartoon animation dominates as the top choice. Most learners show a preference for cartoon animation, which can be attributed to the visual appeal, playfulness, and simple narrative often found in the genre (Bryant, 2019). In addition, research by Anderson and Dill (2000) supports that animations, particularly those with comedic elements and humorous characters, can create an enjoyable experience for learners, which in turn increases the attraction and retention of information. In the context of mathematics education, teaching approaches through cartoon animation can be integrated to visually facilitate the understanding of mathematical concepts (Moyer-Packenham et al., 2016). Therefore, the use of cartoon animation in an educational context can be considered an effective strategy to increase learners' interest and understanding of mathematical materials.

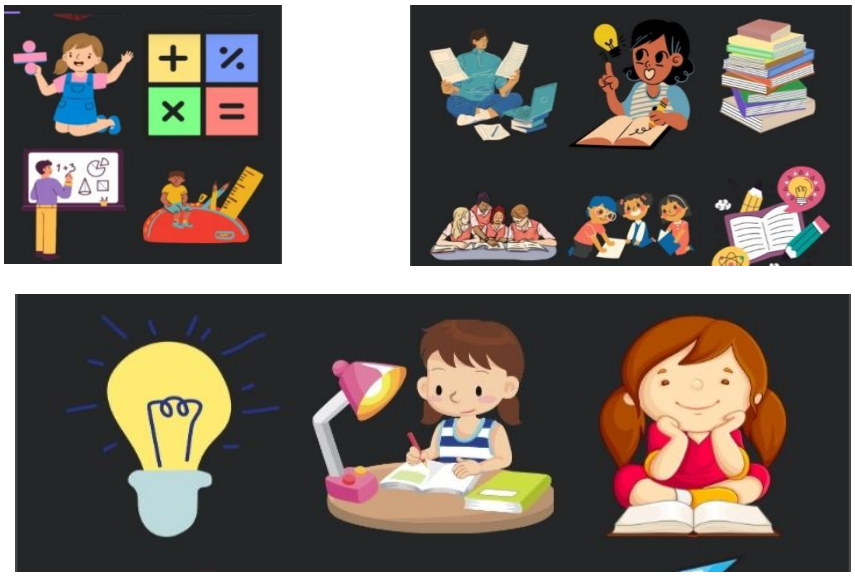


**Figure 4.** Student animation options

Figure 5, which reflects learners' preferences for font types, shows that on average learners tended to favor fonts number 2 and 4, with a participation of 13 people. This preference can be interpreted through several factors, one of which is the clarity and visual relief possessed by the font type (Smith et al., 2018). Previous research in the field of cognitive psychology shows that the clarity and readability of fonts can affect the understanding and retention of information (Bernard, Lida, & Riley, 2014). More readable fonts can increase the effectiveness of visual communication, especially in educational contexts, where clarity of information is crucial (Huang & Mayer, 2019). Therefore, the results of the diagram can be used as a guideline in the

selection of font types in mathematics education materials to ensure that the message can be conveyed well and optimally received by learners.

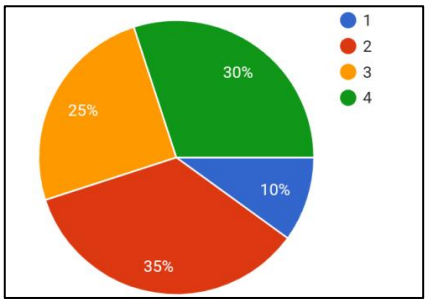



**Figure 5**. learners' preferences for font types

Based on the questionnaire results, illustrated in Diagram 6, it can be concluded that there is no resistance from learners to the idea that Learner Worksheets (LKPD/LKS) will be more attractive if they have the right color composition and harmony that can create a comfortable feeling when looking at them. This approach is in line with research findings showing that the use of color in learning can significantly increase learners' interest in the material (Doolittle & Hicks, 2003). Color can also act as a supporting factor in increasing learners' focus on the material presented, creating a more engaging learning environment (Moyer-Packenham et al., 2016). In addition, Purnama (2010) notes that color can also affect learners' psychological state, creating positive emotional responses and increasing learners' engagement in the learning process.

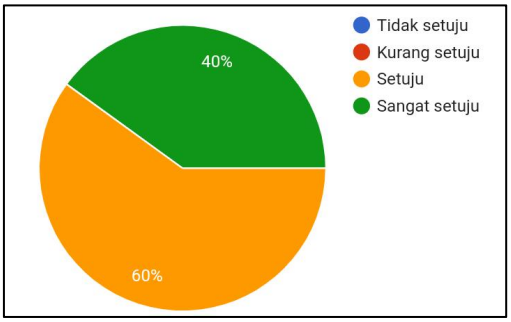



**Figure 6**. learners' preferences for font types

The questionnaire results as illustrated in Diagram 7 show the awareness of students regarding the importance of adjusting the language on the Learner Worksheet (LKPD/LKS) to their level of understanding. This is in line with research findings which emphasize that the use of language that is appropriate to the cognitive level of learners can facilitate understanding and increase learning effectiveness (Wenda, 2019). The appropriateness of language to learners' level of understanding can help create an inclusive and supportive learning environment, minimize potential comprehension difficulties, and improve information retention (Mayer, 2001). Therefore, language adjustment efforts on LKPD (LKS) are a strategic step in supporting the success of mathematics learning.

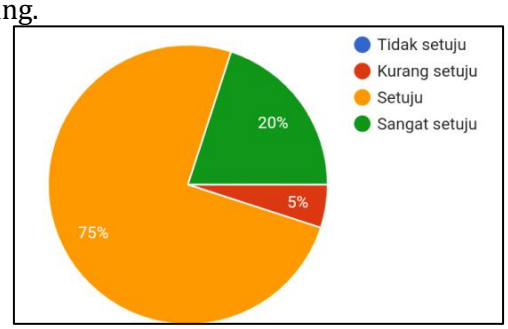



**Figure 7.** Use of language in the LKPD

The questionnaire results reflected in Diagram 8 show that the majority of learners have access to and the ability to use smartphones and laptops, especially after online learning experiences during the COVID-19 pandemic (Salsabila et al., 2020). This phenomenon creates significant opportunities in the development of Learner Worksheets (LKPD/LKS) that can be accessed through these technologies. Research by Salsabila et al. (2020) noted that during the online learning period, learners rely on tools such as smartphones and laptops to access online learning. Therefore, making LKPD (LKS) by considering accessible formats through this technology can expand the accessibility and flexibility of learning, allowing learners to more easily support their learning process.

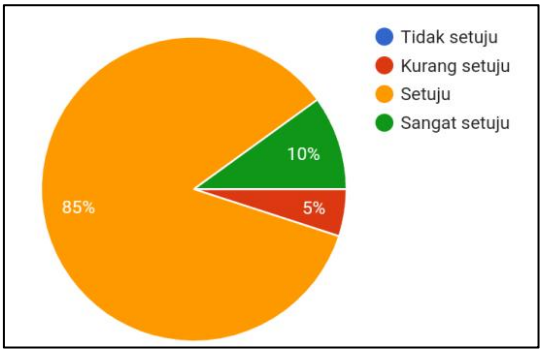



**Figure 8.** Use of smartphones or laptops by students

The questionnaire results, which reflect a percentage of 70% of students who need electronic Learner Worksheets (LKPD/LKS), especially in mathematics, indicate a significant need for digital learning resources in supporting mathematics learning. The success of mathematics learning is often faced with the perception of difficulty felt by students. The understanding that math lessons are considered difficult by some students is in line with previous findings (Hannula, 2012). Therefore, the provision of electronic LKPD can provide an effective solution, given the tendency of learners to better respond to and understand mathematics material through the use of digital technology (Moyer-Packenham et al., 2016). Thus, the implementation of electronic LKPD can be an effective alternative in improving learners' understanding and problem-solving skills in mathematics.

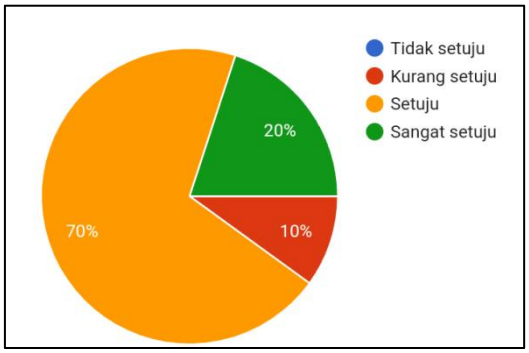



**Figure 9**. Math lessons needed by students

The questionnaire results reflected in Diagram 10 indicate that the use of colors in the previous Learner Worksheets (LKPD/LKS) did not have the right color composition, except for the initial appearance of the LKPD (LKS). This finding highlights the importance of considering the right color composition in the development of learning materials. Previous research shows that choosing the right color can affect learners' mood, focus, and information retention (Huang & Mayer, 2019). Therefore, improvements in the color composition of all parts of the LKS can be a critical step in improving the visual appeal, readability, and communication effectiveness of mathematics learning materials.

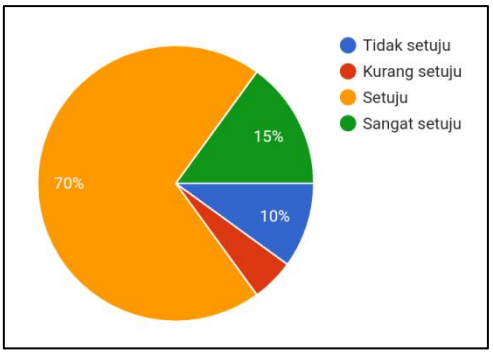



**Figure 10.** Color composition on the previous LKPD (LKS)

***Learner Worksheet Design Results (LKPD)***

At the design stage there are several things that need to be designed including Flowchart, storyboard and then make the LKPD design. According to Prastowo (2013) that there are four important points that are the objectives in the preparation of LKPD, namely:

- Presenting learning material in a way that makes it easier for students to interact with the material being taught. Therefore, researchers provide learning videos that involve audio and visuals so that they are easy to understand.
- Presenting various types of tasks that can help improve students' understanding of the material being studied. Through the syntax of the NHT learning model also provides problems and some exercises in order to help students' understanding and mathematical problem solving.
- Assist teachers in giving assignments to students more easily. Live worksheet which is an online learning platform makes it easier for teachers to give assignments and help students in building their own knowledge.
- Train students to be able to learn independently.

In developing LKPD, there are six main elements that must be present, as stated by Asmaranti et al. (2018) that these elements include, the title which is the title of the LKPD. Learning instructions, which provide guidance to students on how to use LKPD and follow learning activities. Basic competencies or subject matter, which contains an explanation of the skills or knowledge to be learned in the LKPD. Supporting information, which includes additional information or explanations that support students' understanding of the learning material. Tasks or work steps, which contain instructions or activities that students must do to master the material being studied.

Furthermore, according to Batubara, H. H. (2018), one of the steps taken in designing teaching materials is compiling a flowchart. Flowchart is an overview of the flow of teaching materials developed (Findawati, 2014).

After designing the flowchart, continue with designing the storyboard. As stated by Rustandi and Rimayandi (2021) that after designing the flowchart, then proceed with designing the storyboard. Designing a storyboard after designing a flowchart is an important step in the development of a project, especially in the context of mathematics education. Rustandi and Rimayandi (2021) emphasize the importance of proceeding from flowchart to storyboard as an integral part of the design process. Storyboards can provide a visual representation of how each step in the flowchart will be realized in visual or multimedia form, providing a holistic view of the structure and flow of the project (Miller, 2019). In the context of mathematics education, storyboards can be used to illustrate the use of visual, animated, and interactive elements in LKPD (LKS) to improve students' understanding of mathematical concepts (Moyer-Packenham et al., 2016). Thus, storyboard design is a crucial stage in ensuring that the mathematics learning design achieves the desired goals.

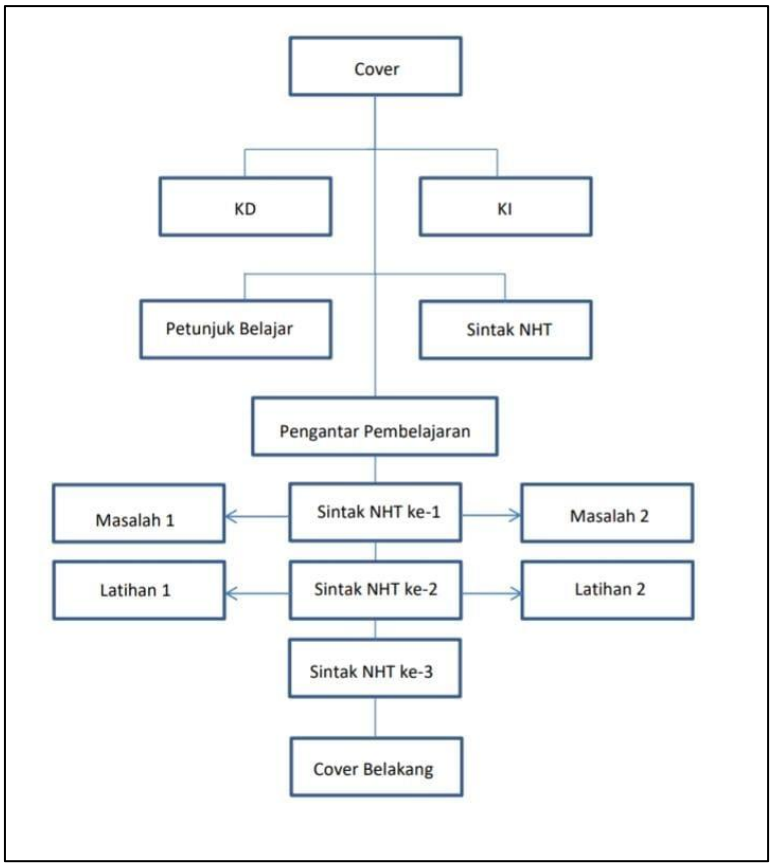
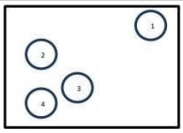
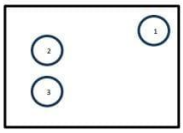
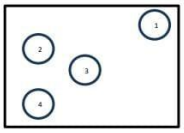
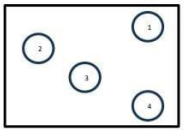
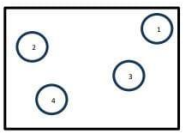



**Figure 11.** Flowchart of LKPD Based on Live Worksheet

| No | VISUAL | KETERANGAN |
|---|---|---|
| 1 |  | 1. Logo<br>2. Animasi<br>3. Judul<br>4. Biodata Siswa |
| 2 |  | 1. Animasi<br>2. Kompetensi Dasar<br>3. Kompetensi Inti |
| 3 |  | 1. Animasi<br>2. Petunjuk belajar<br>3. Sintak NHT<br>4. Animasi |
| 4 |  | 1. Judul bangun ruang sisi lengkung<br>2. Petunjuk dan animasi<br>3. Video pembelajaran<br>4. Animasi |
| 5 |  | 1. Animasi<br>2. Petunjuk<br>3. Pesan untuk berdoa<br>4. Doa sebelum belajar dan animasi |

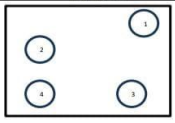
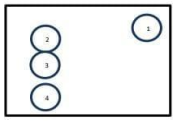
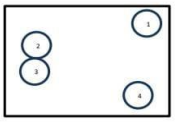
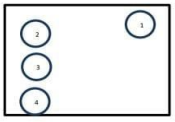
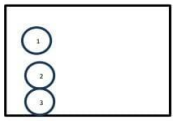
| No | VISUAL | KETERANGAN |
|---|---|---|
| 6 |  | 1. Jenis bangun ruang Tabung<br>2. Sintak NHT yang ke-1<br>3. Masalah 1 dan Animasi<br>4. Animasi |
| 7 |  | 1. Animasi<br>2. Memahami masalah<br>4. Langkah pengerjaan<br>5. Animasi |
| 8 |  | 1. Sintak NHT yang kedua<br>2. Latihan 1<br>3. Langkah pengerjaan<br>4. Animasi |
| 9 |  | 1. Animasi<br>2. Sintak NHT yang ke-3<br>3. Animasi dan kesimpulan<br>4. Animasi |
| |  | 1. Animasi<br>2. Judul<br>3. Kelas |

**Figure 12.** Storyboard of LKPD based on Liveworksheet

Based on the flowchart and storyboar designed, the LKPD design is produced which is then presented on the liveworksheet. The following are the results of the liveworksheet-based LKPD design with the Numbered Head Together (NHT) Cooperative Model learning model to improve students' mathematical problem solving skills.

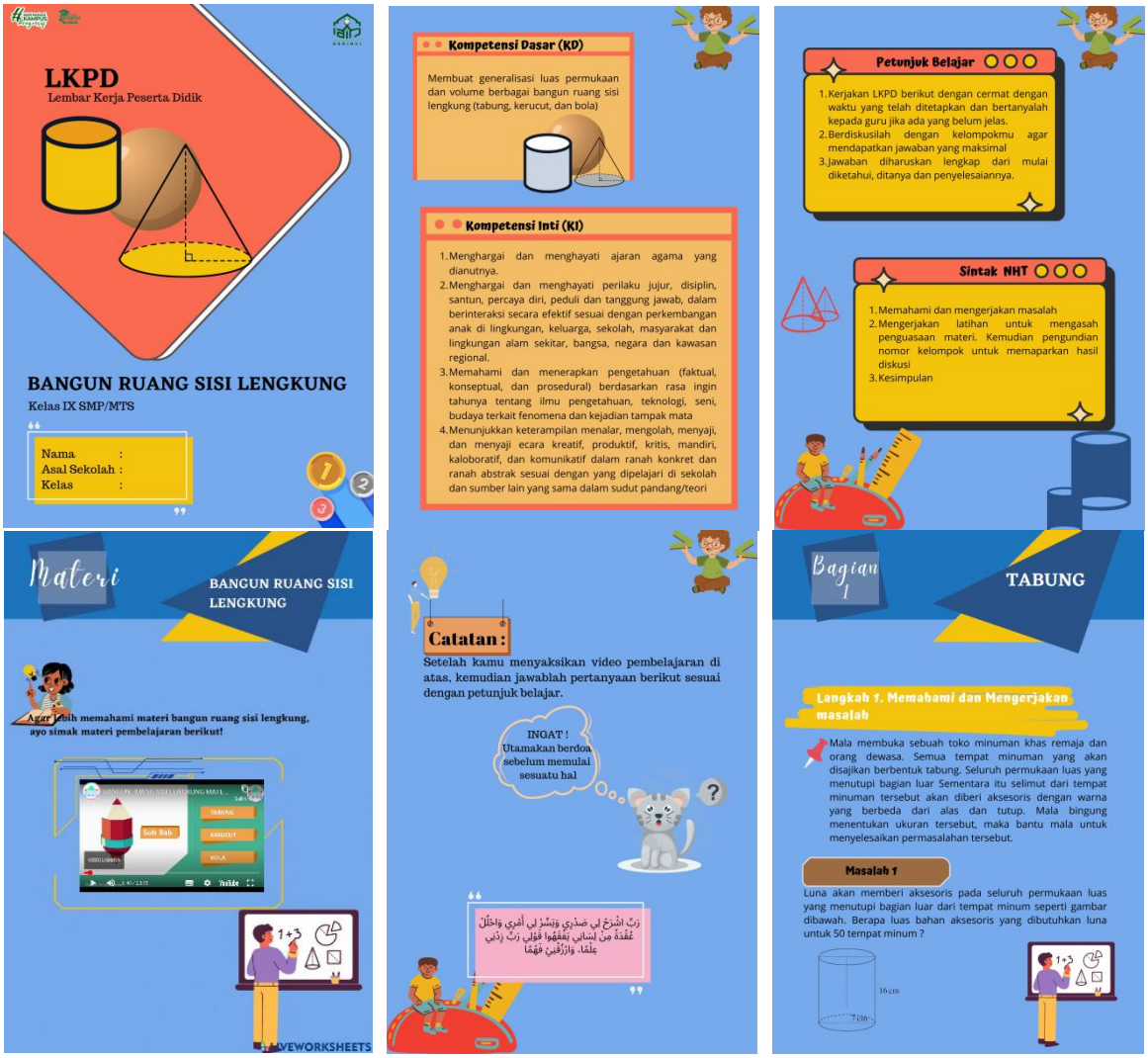



**Figure 13**. Example of NHT-based Learner Worksheet Design Results

The Implementation stage involves the application of developed learning materials in a real-world context. In this stage, the developed content is applied in the learning process to evaluate its impact on the quality of learning, including effectiveness, attractiveness, and learning efficiency (Puspasari & Tutut, 2019). Researchers can observe the interaction and response of students to the learning materials, identify shortcomings, and make adjustments if necessary. Implementation is done in small groups to obtain feedback as material for improving the product draft.

The Evaluation stage allows researchers to assess the effectiveness of the learning materials and make improvements. The evaluation stage is conducted in two forms: formative evaluation and summative evaluation (Nareswari et al., 2021). Evaluation can be carried out using various methods such as tests, surveys, or observations. The evaluation results provide valuable insights for enhancing and refining the developed learning materials.

By using the ADDIE model, development can be conducted in a structured and planned manner. This model ensures that each crucial stage in instructional material development is carefully considered, thereby enhancing the efficiency and quality of the development process

(Susanto & Ayuni, 2017). Furthermore, with a systematic approach, researchers can adjust and improve learning materials based on feedback and evaluation, resulting in more effective learning materials that align with students' needs.

***Discussion***

Based on the needs analysis, data from student responses to Liveworksheet-based Student Worksheets (LKPD) indicates a significant demand, especially in mathematics education. This is due to the fact that 90% of students express a need for LKPD, with 70% agreeing and an additional 20% strongly agreeing. The detailed breakdown of percentages for each aspect within the LKPD is as follows: color compatibility, with 60% agreement and 40% strong agreement; language usage in LKPD adjusted to the students' maturity level, with 75% agreement and 20% strong agreement; students' ability to operate smartphones or laptops, with 85% agreement and 10% strong agreement; usage of LKPD instructions, with 85% agreement and 15% strong agreement; electronic LKPD needs, with 70% agreement and 15% strong agreement.

Based on the needs analysis, the researcher develops an instructional material product in the form of electronically-based LKPD (Student Worksheets). This development choice is made because electronically-based LKPD is highly needed in the 21st century. To achieve this goal, the researcher utilizes the Liveworksheet platform to support LKPD development. The LKPD development process is carried out using the tried-and-tested ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Additionally, the chosen instructional model is the cooperative Numbered Head Together (NHT) type, aimed at enhancing students' problem-solving skills in mathematics. The developed LKPD product excels compared to others, being more efficient and effective, attributes achieved through the use of electronically-based LKPD. Moreover, the developed LKPD involves audio-visual elements, such as summary videos on curved surface spatial structures. It also includes various problems for student discussions to achieve better understanding. In the discussion process, students draw their own conclusions, enhancing their problemsolving skills and building deeper understanding. In development, the researcher considers the use of colors tailored to the characteristics of students. Additionally, animations are added to align with the developed content, aiming to make LKPD more engaging and assist students in understanding the taught mathematical concepts.

The development of instructional materials in the form of Student Worksheets (LKPD) using technology such as Liveworksheet aims to enhance the mathematical problem-solving abilities of ninth-grade students in junior high school (SMP/MTs). This is because the LKPD is structured using the Numbered Head Together (NHT) Cooperative Learning Model. The developed LKPD is equipped with instructional videos that are easy for students to understand, presented in a light manner. The LKPD utilizes interactive technology involving audio-visual displays, animations, appropriate color compositions, creating a harmonious and comfortable viewing experience. The use of color in learning can increase students' interest in studying the material. The development of this LKPD is tailored to the curriculum needs of the students, namely the 2013 curriculum.

A study conducted by Amalia & Lestyanto (2021) developed scientifically based LKPD with the assistance of live worksheets for the understanding of mathematical concepts in social arithmetic that are valid, effective, and practical. The key differences between this study and previous research lie in the use of the 4D development model, which does not involve audio-visual displays such as instructional videos on the applied material. Additionally, there is a lack of appropriate color combinations, resulting in the predominantly white-colored LKPD with the addition of orange, making it less visually appealing. Furthermore, the animations used in the LKPD are not aligned with the subject matter being applied.

A previous study by Marlina (2022) also developed Liveworksheet-based LKPD on the topic of permutation and combination, obtaining data that the use of Liveworksheet-based LKPD is effective for enhancing students' mathematical problem-solving abilities. In Marlina's developed LKPD, there are several differences compared to the researcher's LKPD. These include the use of the Problem-Based Learning model in Marlina's LKPD, the absence of audio-

visual displays such as instructional videos, the dominant white color with an inappropriate combination of purple and blue, and the absence of animations to make the LKPD more engaging.

Therefore, the researcher developed Liveworksheet-based LKPD because several previous studies found that Liveworksheet-based LKPD is effective for learning. In developing this LKPD, the researcher took a different approach, utilizing the ADDIE development model. This choice is made because the ADDIE model is a systematic and structured development model, ensuring that each stage in instructional material development is carefully considered, providing a more directed and planned development. As expressed by Nurcahyo, B., Muhfahroyin, M., & Sujarwanta, A. (2021), the ADDIE development model is easy to implement with systematically organized stages, resulting in effective, creative, and efficient products. Cooperative learning using the Numbered Head Together (NHT) model is also applied in development to enhance mathematical problem-solving abilities. The LKPD is complemented with instructional videos, allowing students to be more independent in their learning. The LKPD is designed with a dominant blue color, accompanied by educational animations and the use of appropriate color compositions to create comfort for students' eyes.

## CONCLUSION

Based on the needs analysis of the Liveworksheet-based Learner Worksheets (LKPD) in mathematics learning, the learner response data shows a high level of need, with 90% of students agreeing or strongly agreeing to the use of LKPD. These results indicate that LKPD has an important role in improving the quality of mathematics learning. The development process of electronic-based LKPD is carried out through the Liveworksheet platform, supported by the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) and the Numbered Head Together (NHT) type cooperative learning model. The advantages of this product lie in its efficiency and effectiveness, where the use of electronic-based LKPD allows the integration of audio-visual elements, such as learning videos, and discussion stimulation to improve student understanding. The use of colors and animations that are adapted to the characteristics of students is also a consideration in the development, aiming to make the material more interesting and facilitate understanding of mathematical concepts. Therefore, the Liveworksheet-based LKPD not only meets students' needs efficiently but also effectively improves the quality of mathematics learning in the 21st century era.

## REFERENCES

Amalia, A. D., & Lestyanto, L. M. (2021). LKS berbasis saintifik berbantuan Live Worksheets untuk memahamkan konsep Matematis pada Aritmetika Sosial. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *5*(3), 2911-2933.

Ambarwati, D., Wibowo, U. B., Arsyiadanti, H., & Susanti, S. (2021). Studi literatur: Peran inovasi pendidikan pada pembelajaran berbasis teknologi digital. *Jurnal Inovasi Teknologi Pendidikan*, *8*(2), 173-184.

Anderson, C. A., & Dill, K. E. (2000). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. Journal of personality and social psychology, 78(4), 772.

Andriyani, N., Hanafi, Y., Safitri, I. Y. B., & Hartini, S. (2020). Penerapan Model Problem Based Learning Berbantuan Lkpd Live Worksheet Untuk Meningkatkan Keaktifan Mental Siswa Pada Pembelajaran Tematik Kelas Va. *Prosiding Pendidikan Profesi Guru, September*, 122-130.

Asmaranti, W., Pratama, G. S., & Wisniarti, W. (2018). Desain Lembar Kerja Peserta Didik (LKPD) Matematika dengan Pendekatan Saintifik Berbasis Pendidikan Karakter.

Bernard, M., Lida, B., & Riley, D. (2014). Designing effective multimedia for physics education: An evidence-based review. Computers & Education, 75, 55–65.

Bryant, J. (2019). Children's understanding of television: Research on attention and comprehension. Academic Press.

Doolittle, P. E., & Hicks, D. (2003). Constructivism as a theoretical foundation for the use of technology in social studies. Theory & Research in Social Education, 31(1), 72-104.

Findawati, Y. (2014). Bahan ajar multimedia interaktif kewirausahaan SMK menggunakan model pembelajaran problem based learning. *Jurnal Nasional Teknik Elektro dan Teknologi Informasi*, *3*(4), 257-263.

Gitriani, R., Aisah, S., Hendriana, H., & Herdiman, I. (2018). Pengembangan Lembar Kerja Siswa Berbasis Pendekatan Kontekstual pada Materi Lingkaran Untuk Siswa SMP. *JRPM (Jurnal Review Pembelajaran Matematika)*, *3*(1), 40-48.

Hannula, M. S. (2012). Attitude toward mathematics: Emotions, expectations, and values. In G. Grootenboer, R. Zevenbergen, & M. Chinnappan (Eds.), Identities, cultures and learning spaces (pp. 249-267). Springer.

Harjanta, A. T. J., & Herlambang, B. A. (2018). Rancang bangun game edukasi pemilihan gubernur jateng berbasis android dengan model ADDIE. *Jurnal Transformatika*, *16*(1), 91-97.

Hidayati, B. N., & Zulandri, Z. (2021). Efektifitas LKPD Elektronik sebagai Media Pembelajaran pada Masa Pandemi Covid-19 untuk Guru di YPI Bidayatul Hidayah Ampenan. *Jurnal Pengabdian Magister Pendidikan IPA*, *4*(2).

Huang, W., & Mayer, R. E. (2019). The influence of font type on learning and performance with text. Educational Psychology Review, 31(4), 1-19.

Huang, W., & Mayer, R. E. (2019). The influence of font type on learning and performance with text. Educational Psychology Review, 31(4), 1-19.

Jundi, M., & Solong, N. P. (2021). Analisis Kesesuaian Indikator dan Kompetensi Dasar Bahasa Arab KMA 183. *Tatsqifiy: Jurnal Pendidikan Bahasa Arab*, *2*(1), 61-70.

Khikmiyah, F. (2021). Implementasi web live worksheet berbasis problem based learning dalam pembelajaran matematika. *Pedagogy: Jurnal Pendidikan Matematika*, *6*(1), 1-12.

Khoiriyah, S. (2018). Implementasi Model Pembelajaran Kooperatif Tipe Nht Dalam Pembelajaran Matematika. *JURNAL e-DuMath*, *4*(2), 30-35.

Lestari, I. (2018). Pengembangan bahan ajar matematika dengan memanfaatkan GeoGebra untuk meningkatkan pemahaman konsep. *GAUSS: Jurnal Pendidikan Matematika*, *1*(1), 26-36.

Magdalena, I., Sundari, T., Nurkamilah, S., Nasrullah, N., & Amalia, D. A. (2020). Analisis bahan ajar. *Nusantara*, *2*(2), 311-326.

Marlina, M. (2022). Pengembangan LKPD Online Berbantuan Live Worksheet pada Materi Permutasi Kombinasi. *JOEAI (Journal of Education and Instruction)*, *5*(1), 247-258.

Mayer, R. E. (2001). Multimedia learning. Cambridge University Press.

Miller, M. (2019). Creating a Digital Storyboard. Retrieved from https://www.noupe.com/design/how-to-create-a-storyboard-120255.html

Moyer-Packenham, P. S., Bolyard, J. J., & Kitsantas, A. (2016). An investigation of the effects of an integrated technology method on mathematics achievement. Journal of Research on Technology in Education, 48(1), 1-15.

Moyer-Packenham, P. S., Bolyard, J. J., & Kitsantas, A. (2016). An investigation of the effects of an integrated technology method on mathematics achievement. Journal of Research on Technology in Education, 48(1), 1-15.

Moyer-Packenham, P. S., Bolyard, J. J., & Kitsantas, A. (2016). An investigation of the effects of an integrated technology method on mathematics achievement. Journal of Research on Technology in Education, 48(1), 1-15.

Moyer-Packenham, P. S., Salkind, G., & Bolyard, J. J. (2016). Examining the effects of animations and feedback in mathematics apps on mathematics achievement. Journal of Research on Technology in Education, 48(4), 272-286.

Mulyati, T. (2016). Kemampuan pemecahan masalah matematis siswa sekolah dasar. *EduHumaniora| Jurnal Pendidikan Dasar Kampus Cibiru*, *3*(2).

Nareswari, N. L. P. S. R., Suarjana, I. M., & Sumantri, M. (2021). Belajar Matematika dengan LKPD Berbasis Kontekstual. *Mimbar Ilmu*, *26*(2), 204-213.

Noor, A. J., & Megawati, M. (2014). Model Pembelajaran Kooperatif Tipe Numbered Heads Together (NHT) pada Pemecahan Masalah Matematika di Kelas VIII SMP. *EDU-MAT: Jurnal Pendidikan Matematika*, *2*(1).

Nurcahyo, B., Muhfahroyin, M., & Sujarwanta, A. (2021). PENGEMBANGAN LKPD BERBASIS STEM UNTUK MEMFASILITASI AKTIVITAS SISWA PADA MATERI EKOSISTEM DI SMP NEGERI 40 BANDAR LAMPUNG. *JURNAL LENTERA PENDIDIKAN PUSAT PENELITIAN LPPM UM METRO*, *6*(1), 114-122.

Prastowo, A. (2013). Pengembangan Bahan Ajar Tematik. Yogyakarta : Diva Press.

Purnama, S. (2010). Elemen warna dalam pengembangan multimedia pembelajaran agama Islam. *Al-Bidayah: jurnal pendidikan dasar Islam*, *2*(1).

Purnama, S. (2010). Pengaruh warna terhadap psikologi manusia. Jurnal Desain dan Seni, 7(1), 39-47.

Puspasari, R. (2019). Pengembangan Buku Ajar Kompilasi Teori Graf dengan Model Addie. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang*, *3*(1), 137-152.

Rustandi, A. (2021). Penerapan model ADDIE dalam pengembangan media pembelajaran di SMPN 22 Kota Samarinda. *Jurnal Fasilkom*, *11*(2), 57-60.

Rustandi, I., & Rimayandi, A. (2021). Multimedia: Konsep dan Aplikasi. Deepublish.

Salsabila, U. H., Lestari, W. M., Habibah, R., Andaresta, O., & Yulianingsih, D. (2020). Pemanfaatan teknologi media pembelajaran di masa pandemi covid-19. *Trapsila: Jurnal Pendidikan Dasar*, *2*(2), 1-13.

Smith, A. N., Smith, N., & Piezunka, H. (2018). Too famous to infl uence? The impact of perceived media attention on celebrity endorsements. Strategic Management Journal, 39(7), 1871–1893.

Supriatna, A. R., Siregar, R., & Nurrahma, H. D. (2022). Pengembangan E-LKPD Berbasis Problem Based Learning pada Muatan Pelajaran Matematika pada Website Liveworksheets di Sekolah Dasar. *Edukatif: Jurnal Ilmu Pendidikan*, *4*(3), 4025-4035.

Suprihatin, S., & Manik, Y. M. (2020). Guru menginovasi bahan ajar sebagai langkah untuk meningkatkan hasil belajar siswa. *PROMOSI: Jurnal Program Studi Pendidikan Ekonomi*, *8*(1).

Susanto, F., & Ayuni, I. R. (2017). Pengembangan perangkat pembelajaran model kooperatif tipe NHT dengan strategi pemecahan masalah (problem solving) sistematis bagi peserta didik SMP di Kabupaten Pringsewu. In *PROSIDING SEMINAR NASIONAL & INTERNASIONAL*.

Tinambunan, D. D., Fathurrohman, M., & Khaerunnisa, E. (2020). Pengaruh model pembelajaran kooperatif tipe numbered head together (NHT) terhadap kemampuan pemecahan masalah matematis siswa SMP. *TIRTAMATH: Jurnal Penelitian dan Pengajaran Matematika*, *2*(1).

Triana, N. (2021). *LKPD Berbasis Eksperimen: Tingkatkan Hasil Belajar Siswa*. Guepedia.

Wahyudi, A. (2022). Pentingnya Pengembangan Bahan Ajar Dalam Pembelajaran Ips. *JESS: Jurnal Education Social Science*, *2*(1), 51-61.

Wenda Sari, M. E. K. A. (2019). *Penggunaan Bahasa Pengantar Guru Dalam Pengembangan Kemampuan Berbahasa Anak Didik Di Sd Negeri 84 Kota Bengkulu* (Doctoral Dissertation, Iain Bengkulu).

Wenda, R. O. (2019). Development of student worksheet based on scientific approach with local wisdom to improve scientific literacy. Journal of Physics: Conference Series, 1402(3), 033066.

Yolanda, F., & Hasanah, A. (2022). Pengembangan Perangkat Pembelajaran Matematika dengan Model Pembelajaran Kooperatif Tipe Numbered Heads Together pada Materi Aritmatika Sosial. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *6*(1), 1039-1051.