

Development of Learning Media to Improve Students' Higher Order Thinking Skills in Circular Motion Material

Zulhelmi^{1*}, Naila Fauza¹, Dina Syaflita¹, Juli Pratiwi¹, Tommy Tanu Wijaya², Neni Hermita¹

¹ Universitas Riau, Pekanbaru, Indonesia.

² Beijing Normal Univesity, Beijing, China.

Received: February 28, 2023

Revised: April 23, 2023

Accepted: April 26, 2023

Published: April 30, 2023

Corresponding Author:

Zulhelmi

zulhelmi@lecturer.unri.ac.id

DOI: [10.29303/jppipa.v9i4.3536](https://doi.org/10.29303/jppipa.v9i4.3536)

© 2023 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: The purpose of this research is to develop learning media that can improve students' Higher Order Thinking Skills (HOTS) on the topic "circular motion". Therefore, its design is a research and development (R&D) study with 4D model (Define, Design, Develop, and Disseminate). Experts were involved to validate the products that had been developed, which are teaching props and Student Worksheets (SWS), through a validation questionnaire. The collected data were then analyzed descriptively and qualitatively. The results showed that the total average of all aspects of the assessment was 81.8 which was included in the "very good" category. Based on this result, it can be concluded that the products developed, namely learning media for "circular motion" material, is suitable for use in the learning process to improve students' higher order thinking skills.

Keywords: HOTS; Learning media; Learning props; R & D

Introduction

The essence of the whole educational process lies in the learning process. In the learning process, student participation holds a large and important role (Bovill et al., 2011; Supriyono, 2018; Magdalena et al., 2021). Student participation can be done by listening, seeing, writing, feeling, and thinking. Quality learning requires teachers who are creative and innovative (Ayob et al., 2013; Pitaloka et al., 2021) in conducting their lessons. This is so that students can easily understand the material being taught and are motivated to participate more in the learning process (Mauladani, 2021; Nikat et al., 2021).

However, the reality in the field shows that current education is still dominated by the paradigm that knowledge is memorized (Sudarsana, 2018). In addition, the role of the teacher is still considered the main source of knowledge, and lecturing remains the main method in conventional learning (Zaki et al., 2020). Teachers tend to choose this model because it is easier to implement, without the need for practical tools or materials (Hikam et al., 2020). They only need to explain concepts from

books and other learning resources (Kusumastuti et al., 2021). This leads to students not being trained to learn independently and develop their thinking skills, which is actually the key to success in today's learning (Suryono, 2022). This type of learning often makes students passive (Oktiani, 2017) and is unable to meet the demands of 21st century education which calls for students to have high-order thinking skills (HOTS) (Collins, 2014; Baroya, 2018; Hermita, 2021).

Basic knowledge and simple thinking skills are no longer sufficient outcomes of education. Instead, education needs to enable students to possess and apply the skills of the twenty-first century (Rusmining et al., 2020). In order to prepare students for success in the digital era, the Partnership for 21st Century Skills collaborated to create a 21st century learning framework (Sugiyarti et al., 2018). These fundamental 21st century talents include effective collaboration and communication (Syahputra, 2018), creative and inventive thinking (Yudha et al., 2018), critical thinking and problem solving (Butterworth et al., 2013), and so on. All of these skills are higher order thinking

How to Cite:

Zulhelmi, Z., Fauza, N., Syaflita, D., Pratiwi, J., Wijaya, T.T., & Hermita, N. (2023). Development of Learning Media to Improve Students' Higher Order Thinking Skills in Circular Motion Material. *Jurnal Penelitian Pendidikan IPA*, 9(4), 1734-1740. <https://doi.org/10.29303/jppipa.v9i4.3536>

competencies (Widiawati et al., 2018; Hastuti et al., 2021).

As stated by Kristanto et al. (2020), higher order thinking skills are skills that connect concepts and facts, evaluate, explain, and draw conclusions. Problem solving, decision making, critical and creative thinking are divisions of HOTS (Andriyani et al., 2020). Razak et al. (2021) emphasized that HOTS has an essential function in educational evaluation as it has the power to influence students' aptitude, speed, and learning efficiency. Every learner in this century is required to have HOTS skills In order to compete in the workforce and advance their nation to be able to face various future problems (Susilo et al., 2019; Raharja, 2019). Particularly for educators, higher order thinking skills are even more important to have as they are the ones who prepare the future generation with them (Szabo et al., 2020).

Based on empirical evidence, Indonesian students still lack the required higher order thinking skills (Hutagaol et al., 2020). This fact can be seen from Indonesia's low ranking on the 2018 Program for International Student Assessment (PISA), where Indonesia ranked sixth from the bottom (74th) out of 80 participating countries. This finding is certainly very alarming and shows that the academic performance of Indonesian students is significantly below expectations; even lower than other Southeast Asian countries such as Malaysia, Thailand, and the Philippines. As a solution, Budiarta et al. (2018) revealed that educators can attempt to enhance students' thinking skills by utilizing creative teaching tools or media.

The Latin word "medium", which means intermediary or introducer, is the origin of the word "media". Messages or information that the sender of the message wants to convey to the intended audience or recipient can be channeled through these media (Latifah et al., 2020). Learning media, on the other hand, is anything that can be used to convey educational concepts or materials to students, thus facilitating their participation in learning activities and achieving educational goals (Febrita et al., 2019).

Learning media is an integral part in the process of implementing education. They serve a crucial role in improving the teaching and learning process, building a good relationship between educators and students, and preventing students from getting bored while learning. According to Magdalena et al. (2021), using learning media in the classroom can boost students' enthusiasm for learning, which is an effective driving force that sustains their learning activities and guides them to achieve learning goals (Marimin et al., 2006). The higher students' motivation, the greater their chance of achieving learning objectives (Tafonao, 2018; Emda, 2017). For example, the use of learning media in the form of game-based videos can encourage students to learn

physics, including circular motion material, and to achieve better outcomes that are in accordance with competencies (Zulherman et al., 2019).

Given that it has a big contribution to the students' ability to attain the learning objectives, a good learning medium should have characteristics that can accommodate the abilities to be developed in the learning process (Andriyani et al., 2020). For example, if the main focus of learning is to improve the ability to think critically and solve problems, then the teaching materials and media used must be based on indicators of Higher Order Thinking Skills (HOTS). HOTS-themed questions are known to be able to hone students' thinking skills in solving various problems (Anisah et al., 2018; Malik et al., 2018). This is because these questions train students' ability to think deeply and broadly.

Nurfadhillah et al. (2021) suggest that learning props are used for conveying knowledge. Continuous learning can be greatly aided by the usage of learning props. Learning props, such as for the "circular motion" material, can serve as figures for actual learning concepts. The subject matter "circular motion" is mathematical and relevant to everyday life, yet there are numerous notions in it that frequently lead to misconceptions among students. Consequently, it is more effective to teach this topic through the media in order to eliminate student misunderstandings.

Based on the discussion of the value of fostering higher-order thinking abilities (HOTS) and the contribution of media to the learning process, the researchers decided to develop learning props that can enhance students' HOTS, particularly in the topic "circular motion".

Method

The research has a design of research and development (R & D), which is to create a product and test its effectiveness (Putri, 2016). To be able to do this, an analysis is carried out on the subject of the objective to determine needs and ensure that the products developed are appropriate and can be of benefit to the wider community.

The 4D development approach consisting of four steps (Define, Design, Develop, and Disseminate) was used in this research. The first stage is Define, which is also known as the needs analysis stage. The second stage is Design, which entails creating a conceptual framework for learning models and tools. The third stage is Develop, which requires conducting a validation test or evaluating the feasibility of the media. The fourth and final stage is Disseminate, which involves practicing research subjects. Because it focuses on only the

development process, this research was carried out until the develop stage (validation, evaluation, and revision).

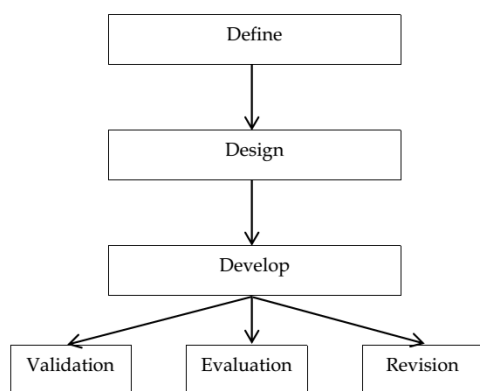


Figure 1. Research design

The validation questionnaire with Likert scale was used to collect data. Three professors and two media users who are Physics teachers validated the research product. The collected data were analyzed qualitatively through descriptive analysis. The percentage of score for each aspect was calculated using the formula (Putri, 2016) below:

$$\text{Score} = \frac{\text{obtained score}}{\text{maximum score}} \times 100\% \tag{1}$$

The percentage of the validation score was then translated into qualitative values as shown in Table 1.

Table 1. Validation Category

| Score Range (%) | Criteria |
|-----------------|-----------|
| 0 - 20 | Very Bad |
| 20 - 40 | Bad |
| 40 - 60 | Moderate |
| 60 - 80 | Good |
| 80 - 100 | Very Good |

Result and Discussion

The product developed in this research is learning props for the material 'circular motion'. In more detail, the following is an explanation of the results of each stage of the product development:

Define Stage

In the definition stage, there are a number of key steps involved, such as front-end analysis, student analysis, task analysis, concept analysis, and learning objective analysis.

The front-end analysis involves interviewing teachers at Senior High School 12 Pekanbaru to determine that there is currently no learning media available for circular motion material. Instead, the circular motion material, particularly the concept of

wheel relationships, is taught using pictures in the textbook.

The student analysis involves assessing the students' Higher Order Thinking Skills (HOTS) through testing, which revealed that students are not performing well in this area; they scored below 60. Consequently, it is necessary to provide learning aids to help students master the Physics concept, which will also help improve their critical thinking abilities.

The task analysis involves reviewing the material that would be presented to support the learning media. For instance, one of the media designed is a demonstration of wheel relationships, which includes three types of wheels-concentric, tangent, and connected by a belt. Along with that, concept analysis includes the Physics concepts contained in the demonstration.

Results should be clear and concise. The discussion should explore the significance of the results of the work, not repeat them. A combined results and discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

The learning objective analysis is the stage of formulating the learning objectives. The aim is to achieve discovery learning where students are capable of analyzing the quantities related to wheel relationships. To achieve this, students can conduct experiments using a demonstration of wheel relationships, using a Student Worksheets (SWS) that have been developed.

Design Stage

This stage encompasses the planning of the research product, which involves multiple steps in designing the learning tool, including the selection of equipment and materials, the shape of the demonstration media, and the creation of Student Worksheets.

The materials utilized consist of iron, wheels, pedals, and chains. Iron is employed to secure the wheels, providing sturdiness and durability to the media. A preliminary sketch of the learning tool was then drawn. It is important to note that the learning tool cannot stand alone and requires Student Worksheets to accompany it. The Student Worksheets were designed using the SWS format and contain subject matter tailored to "circular motion" material while emphasizing the development of Higher Order Thinking Skills to sharpen the students' higher-level thinking abilities.

Develop Stage

Product validation was carried out during the development stage. The product being assessed was the Learning Props that have been designed as a learning media. Three faculty members were involved as media experts, and two physics teachers as media users. Table 2 below shows the overall validation results obtained.

Table 2. Validation Results of the Product

| Aspect | Mean Score | Criteria |
|---------------------------------------|------------|-----------|
| Media functionality | 89 | Very Good |
| Media presentation | 81 | Very Good |
| Suitability of SWS and learning media | 75 | Good |
| Capability to improve HOTS | 76 | Good |
| Media safety | 88 | Very Good |
| Total | 81.8 | Very Good |

The validation process carried out by experts and users has shown that the research product has exceptional quality. This indicates that the designed learning props are valid and appropriate for their function, appearance, and alignment with SWS. Moreover, the learning props offer good Higher Order Thinking Skills content, enabling students to improve their higher-level cognitive abilities. The safety of this learning media is also considered excellent.

Learning media based on HOTS is an educational resource that aims to encourage and upgrade students' higher-level thinking skills. HOTS are a cognitive ability that facilitates individuals to investigate, evaluate, and incorporate information to solve intricate issues (Widana, 2017; Dosinaeng et al., 2019). These abilities are essential for success in the current job market (Miterianifa et al., 2021), where knowledge is constantly evolving and fresh challenges require innovative and analytical thinking (Hartono et al., 2020). HOTS-based learning media provides students with several advantages, including enhanced cognitive development, improved problem-solving skills, and increased motivation and involvement.

The effective teaching of circular motion can be achieved through the use of HOTS (Higher Order Thinking Skills) based learning media (Novela et al., 2019; Firdaus et al., 2020; Pratama et al., 2020). The concept of circular motion is complex and requires advanced thinking skills like analysis, evaluation, and synthesis for full comprehension (Rivalina, 2020). HOTS-based learning props can provide significant advantages in the teaching of circular motion. Such props can increase students' understanding of the concept of circular motion (Alfiah et al., 2022). Through the use of HOTS-based learning props, students can develop a deeper understanding of the concept and improve their ability to analyze, evaluate, and synthesize it. Additionally, problem-solving skills can be improved with it (Warti, 2019). Students can practice their advanced thinking skills by analyzing problems, evaluating alternative solutions, and selecting the appropriate one. Furthermore, HOTS-based learning props can increase student motivation and interest in learning (Gulo, 2018). As a result, students can have an

enjoyable and engaging learning experience that boosts their enthusiasm for learning about circular motion.

In conclusion, the use of HOTS-based learning props can bring significant benefits to the teaching of circular motion. Through such learning media, students can enhance their advanced thinking skills, deepen their understanding of circular motion, and improve their problem-solving abilities.

Conclusion

The results of the research demonstrate the validity and suitability of the HOTS-based learning props to teach students about "circular motion." This indicates that the learning media have met the standards needed for use during the learning process. This media seek to train students to think critically and creatively in solving problems, improve their metacognition skills as well as the ability to collaborate, as demanded in the 21st century. As this research is limited to the Develop stage and only focuses on validating the learning media that has been created, these HOTS-based learning props are open to other researchers who wish to continue until the fourth stage; Disseminate. After being established as valid as teaching and learning media, further researchers can then conduct a study on the efficiency of this HOTS-based learning props in the field to improve students' thinking skills.

Acknowledgments

Thanks to the faculty of teaching and education for providing research funding.

References

- Alfiah, S., & Dwikoranto, D. (2022). Penerapan model problem-based learning berbantuan laboratorium virtual PhET untuk meningkatkan HOTS siswa SMA. *Jurnal Penelitian Pembelajaran Fisika*, 13(1), 9-18. <https://doi.org/10.26877/jp2f.v13i1.11494>
- Andriyani, R., & Saputra, N. N. (2020). Optimalisasi kemampuan Higher Order Thinking Skills mahasiswa semester awal melalui penggunaan bahan ajar berbasis berpikir kritis. *Al-Khwarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam*, 8(1), 77-86. <https://doi.org/10.24256/jpmipa.v8i1.948>
- Anisah, A., & Lastuti, S. (2018). Pengembangan bahan ajar berbasis HOTS untuk meningkatkan kemampuan pemecahan masalah matematis mahasiswa. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 9(2), 191-197. <https://doi.org/10.15294/kreano.v9i2.16341>

- Ayob, A., Hussain, A., & Majid, R. A. (2013). A review of research on creative teachers in higher education. *International Education Studies*, 6(6), 8-14. <https://doi.org/10.5539/ies.v6n6p8>
- Baroya, E. H. (2018). Strategi pembelajaran abad 21. *As-Salam: Jurnal Ilmiah Ilmu-Ilmu Keislaman*, 1(1), 101-115. Retrieved from <https://journal.staiyamisa.ac.id/index.php/assalam/article/view/28>
- Bovill, C., & Bulley, C. J. (2011). A model of active student participation in curriculum design: exploring desirability and possibility. In Rust, C., *Improving Student Learning (18) Global theories and local practices: institutional, disciplinary and cultural variations* (pp. 176-188). Oxford: The Oxford Centre for Staff and Educational Development. Retrieved from <https://eprints.gla.ac.uk/57709/1/57709.pdf>
- Budiarta, K., Harahap, M. H., & Faisal, F., & Mailani, E. (2018). Potret implementasi pembelajaran berbasis High Order Thinking Skills (HOTS) di sekolah dasar kota Medan. *Jurnal Pembangunan Perkotaan*, 6(2), 102-111. Retrieved from <https://www.researchgate.net/publication/332212877>
- Butterworth, J., & Thwaites, G. (2013). *Thinking Skills: Critical Thinking and Problem Solving*. Cambridge University Press. Retrieved from <https://fitk.iainambon.ac.id/tadrisipa/wp-content/uploads/sites/6/2020/10/Cambridge-Thinking-Skills-Critical-Thinking-and-Problem-Solving.pdf>
- Collins, R. (2014). Skills for the 21st Century: teaching higher-order thinking. *Curriculum & Leadership Journal*, 12(14). Retrieved from <https://vhsteams.files.wordpress.com/2015/10/curriculum-leadership-journal-skills-for-the-21st-century-teaching-higher-order-thinking.pdf>
- Dosinaeng, W. B. N., Leton, S. I., & Lakapu, M. (2019). Kemampuan mahasiswa dalam menyelesaikan masalah matematis berorientasi HOTS. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 3(2), 250-264. <http://dx.doi.org/10.33603/jnpm.v3i2.2197>
- Emda, A. (2017). Kedudukan motivasi belajar siswa dalam pembelajaran. *Lantanida Journal*, 5(2), 172-182. Retrieved from <https://jurnal.ar-raniry.ac.id/index.php/lantanida/article/view/2838/2064>
- Febrita, Y., & Ulfah, M. (2019). Peranan media pembelajaran untuk meningkatkan motivasi belajar siswa. *Prosiding Diskusi Panel Nasional Pendidikan Matematika*, Jakarta-Indonesia, 181-187. Retrieved from <https://proceeding.unindra.ac.id/index.php/DPNPMunindra/article/view/571/160>
- Firdaus, M. A., Purwandari, P., & Yusro, A. C. (2020). Pengembangan Lembar Kerja Siswa (LKS) berbasis High Order Thinking Skills (HOTS) materi gerak melingkar. *SNPF (Seminar Nasional Pendidikan Fisika)*, Madiun-Indonesia, 1-6. Retrieved from <http://prosiding.unipma.ac.id/index.php/SNPF/article/view/1709/1458>
- Gulo, M. (2018). Meningkatkan hasil belajar fisika dengan menggunakan alat peraga sederhana pada materi gerak melingkar di kelas X-5 SMA Negeri 3 Gunung Sitoli semester ganjil tahun pelajaran 2014-2015. *Jurnal Wahana Inovasi*, 6(1), 1-14. Retrieved from <https://penelitian.uisu.ac.id/wp-content/uploads/2017/09/1.-Murnilah-Gulo.pdf>
- Hartono, R., & Pahlevi, T. (2020). Development of assessment instruments based on HOTS at Surabaya vocational high school. *JISAE: Journal of Indonesian Student Assessment and Evaluation*, 6(2), 210-218. <https://doi.org/10.21009/jisae.v6i2.15853>
- Hastuti, D., & Syukur, M. (2021). Penerapan pembelajaran abad 21 berbasis HOTS dengan menggunakan pendekatan TPACK di SMA Negeri 11 Enrekang. *Pinisi Journal of Sociology Education Review*, 1(3), 144-152. Retrieved from <https://ojs.unm.ac.id/jser/article/view/19346/13486>
- Hermita, N. (2021). *Inovasi Pembelajaran Abad 21*. Surabaya: Global Aksara Pres.
- Hikam, F. F., & Karima, S. (2020). Pengaruh contextual teaching and learning (CTL) terhadap prestasi belajar siswa pada bidang studi PAI di SDIT Insantama Banjar. *Didaktika: Jurnal Kependidikan*, 9(1), 48-59. <https://doi.org/10.58230/27454312.11>
- Hutagaol, A. S. R., & Sopia, N. (2020). Literasi Matematika dalam pengembangan LKM berbasis HOTS melalui daring di kenormalan baru. In *Prosiding Diskusi Panel Nasional Pendidikan Matematika*, Jakarta-Indonesia, 179-196. Retrieved from <https://proceeding.unindra.ac.id/index.php/DPNPMunindra/article/view/4712/729>
- Kristanto, P. D., & Setiawan, P. G. F. (2020). Pengembangan soal HOTS (Higher Order Thinking Skills) terkait dengan konteks pedesaan. *PRISMA, Prosiding Seminar Nasional Matematika*, 3, 370-376. Retrieved from <https://journal.unnes.ac.id/sju/index.php/prisma/article/view/37616>
- Kusumastuti, E. C., Prihandono, T., & Supriadi, B. (2021). Penerapan model pembelajaran kolaboratif dengan media sederhana pada pembelajaran fisika di SMP. *Jurnal Pembelajaran Fisika*, 1(2), 200-205. <https://doi.org/10.19184/jpf.v1i2.23159>
- Latifah, S., Yuberti, Y., & Agestiana, V. (2020). Pengembangan media pembelajaran interaktif berbasis HOTS menggunakan aplikasi Lectora inspire. *Jurnal Penelitian Pembelajaran Fisika*, 11(1), 9-

16. <https://doi.org/10.26877/jp2f.v11i1.3851>
Magdalena, I., Shodikoh, A. F., Pebrianti, A. R., Jannah, A. W., & Susilawati, I. (2021). Pentingnya media pembelajaran untuk meningkatkan minat belajar siswa SDN Meruya Selatan 06 Pagi. *EDISI*, 3(2), 312-325. <https://doi.org/10.36088/edisi.v3i2.1373>
- Malik, A., Setiawan, A., Suhandi, A., Permanasari, A., & Hermita, N. (2018). The effect of HOT-lab to improve critical thinking skills of prospective Physics teachers. *Advanced Science Letters*, 24(11), 8059-8062. Retrieved from <http://digilib.uinsgd.ac.id/id/eprint/20089>
- Marimin, M., & Sari, D. R. (2018). Pengaruh Kepemimpinan dan Kemampuan Berkomunikasi terhadap Motivasi Belajar Mata Pelajaran Ekonomi. *Dinamika Pendidikan*, 1(2), 10-35. <https://doi.org/10.15294/dp.v1i2.475>
- Mauladani, Y. H. (2021). *Menjadi Guru Kreatif, Inovatif dan Inspiratif*. OSF Preprints. <https://doi.org/10.31219/osf.io/u54tb>
- Miterianifa, M., Ashadi, A., Saputro, S., & Suciati, S. (2021). Higher order thinking skills in the 21st century: critical thinking. *Proceedings of the 1st International Conference on Social Science, Humanities, Education and Society Development (ICONS)*, Tegal-Indonesia. <http://dx.doi.org/10.4108/eai.30-11-2020.2303766>
- Nikat, R. F., & Sumanik, N. B. (2021). Pelatihan pembuatan e-Modul terintegrasi media pembelajaran untuk menunjang kompetensi inovatif guru di SMPN 3 Merauke. *Dedication: Jurnal Pengabdian Masyarakat*, 5(2), 273-282. <https://doi.org/10.31537/dedication.v5i2.543>
- Novela, R., Sari, S. Y., & Darvina, Y. (2019). Analisis validasi LKS berorientasi HOTS dalam model inkuiri terbimbing pada materi gerak lurus, gerak parabola dan gerak melingkar. *Pillar of Physics Education*, 12(4), 657-664. <http://dx.doi.org/10.24036/7273171074>
- Nurfadhillah, S., Setyorini, A., Armianti, I. J., Fadilla, L. N., & Adawiyah, R. (2021). Penggunaan media alat peraga pada mata pelajaran ilmu pengetahuan alam dalam upaya meningkatkan hasil belajar siswa SD Negeri Kampung Melayu III. *PENSA: Jurnal Pendidikan dan Ilmu Sosial*, 3(2), 176-186. <https://doi.org/10.36088/pensa.v3i2.1295>
- Oktiani, I. (2017). Kreativitas guru dalam meningkatkan motivasi belajar siswa. *Jurnal kependidikan*, 5(2), 216-232. <https://doi.org/10.24090/jk.v5i2.1939>
- Pitaloka, A. A. P., & Nandani, S. A. S. (2021). Guru kreatif dan inovatif. *Aku Bangga Menjadi Guru; Peran Guru dalam Penguatan Nilai Karakter Siswa (Antologi Esai Mahasiswa Pendidikan Agama Islam)*, 150.
- Pratama, D. P., Darvina, Y., & Sari, S. Y. (2020). Peningkatan pencapaian HOTS siswa pada materi gerak parabola dan gerak melingkar menggunakan LKS berorientasi model inkuiri terbimbing di SMAN 2 Pariaman. *Pillar of Physics Education*, 13(2), 225-232. Retrieved from <https://ejournal.unp.ac.id/students/index.php/pfis/article/view/8364/3933>
- Putri, F. M. (2016). Pengembangan bahan ajar Matematika dasar layanan jurusan non eksak. *FIBONACCI: Jurnal Pendidikan Matematika dan Matematika*, 2(1), 44-52. <https://doi.org/10.24853/fbc.2.1.44-52>
- Raharja, H. Y. (2019). Relevansi Pancasila era industry 4.0 dan society 5.0 di pendidikan tinggi vokasi. *Journal of Digital Education, Communication, And Arts (DECA)*, 2(1), 11-20. <https://doi.org/10.30871/deca.v2i1.1311>
- Razak, A., Santosa, T. A., Lufri, L., & Zulyusri, Z. (2021). Meta-Analisis: Pengaruh soal HOTS (Higher Order Thinking Skill) terhadap kemampuan literasi sains dan lesson study siswa pada materi Ekologi dan lingkungan pada masa pandemi Covid-19. *Bioedusiana: Jurnal Pendidikan Biologi*, 6(1), 79-87. <https://doi.org/10.37058/bioed.v6i1.2930>
- Rivalina, R. (2020). Pendekatan Neurosains meningkatkan keterampilan berpikir tingkat tinggi guru pendidikan dasar. *Kwangsan: Jurnal Teknologi Pendidikan*, 8(1), 83-109. <https://doi.org/10.31800/jtp.kw.v8n1.p83--109>
- Rusmining, R., & Yuwaningsih, D. A. (2020). Pelatihan pembuatan soal matematika berbasis HOTS di SMP Muhammadiyah Se-Kecamatan Pleret. *Prosiding Seminar Nasional Hasil Pengabdian Kepada Masyarakat Universitas Ahmad Dahlan*, Yogyakarta-Indonesia, 187-192. Retrieved from <http://seminar.uad.ac.id/index.php/senimas/article/view/5080>
- Sudarsana, I. K. (2018). Pengaruh model pembelajaran kooperatif terhadap peningkatan mutu hasil belajar siswa. *Jurnal Penjaminan Mutu*, 4(1), 20-31. <https://doi.org/10.25078/jpm.v4i1.395>
- Sugiyarti, L., Arif, A., & Mursalin, M. (2018). Pembelajaran Abad 21 di Sekolah Dasar. *Prosiding Seminar Dan Diskusi Pendidikan Dasar*, Jakarta-Indonesia, 439-444. Retrieved from <https://journal.unj.ac.id/unj/index.php/psdspd/article/view/10184/6600>
- Supriyono, S. (2018). Pentingnya media pembelajaran untuk meningkatkan minat belajar siswa SD. *Edustream: Jurnal Pendidikan Dasar*, 2(1), 43-48. <https://doi.org/10.26740/eds.v2n1.p43-48>
- Suryono, I. G. (2022). Pengaruh model pembelajaran jarak jauh terhadap hasil belajar Matematika dengan materi Statistika pada kelas XII IPA 1 SMA Negeri 1 Susukan tahun pelajaran 2020/2021. *Jurnal Pendidikan dan Teknologi Indonesia*, 2(3), 127-135.

- <https://doi.org/10.52436/1.jpti.160>
- Susilo, A., & Sarkowi, S. (2019). Peran guru Sejarah abad 21 dalam menghadapi tantangan arus globalisasi. *Historia: Jurnal Pendidik dan Peneliti Sejarah*, 2(1), 43-50. <https://doi.org/10.17509/historia.v2i1.11206>
- Syahputra, E. (2018). Pembelajaran abad 21 dan penerapannya di Indonesia. *Prosiding Seminar Nasional Sains Teknologi Humaniora dan Pendidikan (SINASTEKMAPAN)*, Medan-Indonesia, 1276-1283. Retrieved from <https://www.researchgate.net/publication/331638425>
- Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. *Sustainability*, 12(23), 10113. <https://doi.org/10.3390/su122310113>
- Tafonao, T. (2018). Peranan media pembelajaran dalam meningkatkan minat belajar mahasiswa. *Jurnal komunikasi pendidikan*, 2(2), 103-114. <https://doi.org/10.32585/jkp.v2i2.113>
- Warti, E. (2019). *Pembelajaran HOTS Melalui Penerapan Berbagai Metode Pembelajaran*. Malang: Media Nusa Creative (MNC Publishing).
- Widana, I. W. (2017). Higher order thinking skills assessment (HOTS). *JISAE: Journal of Indonesian Student Assessment and Evaluation*, 3(1), 32-44. <https://doi.org/10.21009/jisae.v3i1.4859>
- Widiawati, L., Joyoatmojo, S., & Sudiyanto, S. (2018). Higher order thinking skills as effect of problem based learning in the 21st century learning. *International Journal of Multicultural and Multireligious Understanding*, 5(3), 96-105. Retrieved from <https://rb.gy/ux117>
- Yudha, F., Dafik, D., & Yuliati, N. (2018). The analysis of creative and innovative thinking skills of the 21st century students in solving the problems of "locating dominating set" in research based learning. *International Journal of Advanced Engineering Research and Science*, 5(3), 163-176. Retrieved from <https://rb.gy/tefxt>
- Zaki, A., & Yusri, D. (2020). Penggunaan media pembelajaran untuk meningkatkan prestasi belajar siswa pada pelajaran PKN SMA Swasta Darussaadah Kec. Pangkalan Susu. *AlIkhthibar: Jurnal Ilmu Pendidikan*, 7(2), 809-820. <https://doi.org/10.32505/ikhthibar.v7i2.618>
- Zulherman, Z., Pasaribu, A., Wiyono, K., Saparini, S., & Oktor, W. (2019). Pengembangan video pembelajaran berbasis permainan tradisional pada materi gerak melingkar. *Prosiding Seminar Nasional Pendidikan Fisika (MOTOGPE)*, Banjarmasin-Indonesia. Retrieved from <https://rb.gy/8ub2y>