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Development of Lectora Inspire Based Learning Media to Improve Learning Outcomes of Light and Its Properties

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Abstract: This research aims to determine the feasibility of Lectora Inspire-based learning media based on assessments from media experts and material experts; determine the effectiveness of using Lectora Inspire media in science subjects. This type of research is research and development (R&D) with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model. At the development stage, learning media is tested for suitability through the assessment of 1 media expert and 1 material expert. Next, the implementation stage goes through two stages, namely small-scale testing and large-scale testing. The results of the research show that the level of media appropriateness based on the assessment of media experts is in the very feasible category with a score of 91.66%, while based on the assessment of material experts it is in the category very decent with a score of 88.46%. The significance level obtained is 0.004 on a small scale and 0.00 on a large scale, which means there is a significant difference. Meanwhile, the level of effectiveness obtained on a small scale is 70% and on a large scale it is 62%, which means that the media is in the quite effective category. Therefore, the Lectora Inspire learning media is very suitable and quite effective for use in science learning, light and its properties.

Keywords: Learning media; Lectora inspire; Science

Introduction

A country's human resources depend on the quality of education in the country itself (Dialga & Ouoba, 2022). Therefore, education is the key in efforts to build and organize the Indonesian nation in a better, more advanced and quality direction. Major efforts to improve the quality of education certainly face challenges that can hinder the achievement of educational goals. This is stated in Law no. 20 of 2003 concerning the National Education System Chapter I Article 1 Paragraph 1, states: "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, morals noble, as well as the skills needed by him,society, nation and state."

Therefore, education has an important role in developing students' potential, both character, morals and skills (Sarkadi et al., 2022). Natural Sciences (IPA) is a field of science that aims to increase awareness and understanding of nature and its components. Science teaches the surrounding environment as a direct learning object (Fahmi et al., 2021). In essence, science learning has the ability to improve students' abilities which consist of four main components: attitude, including curiosity regarding objects, natural events and living creatures, as well as cause and effect relationships that produce new problems that can be solved in the right way; process, which means solving problems using scientific methods; the scientific method includes making hypotheses, designing experiments or trials, evaluating, measuring, and drawing conclusions; product, containing facts, principles, theories and laws; and application, containing the implementation of science concepts and scientific methods in everyday life (Supeno et al., 2020).

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To make modern learning more efficient, there needs to be innovation in the delivery of material. Learning media is an important element in the learning process because it helps teachers convey stimulus and achieve learning goals (Metekohy et al., 2022). According to Javaid et al. (2023), in the teaching and learning process, learning media acts as a tool to create effective learning situations; speed up the learning process and help students understand what the teacher is saying; and most importantly to improve the quality of learning. So, media can be interpreted as an intermediary for conveying information/messages from one person/group to another person/group (Karlsen & Aalberg, 2023; Lüders et al., 2022).

Media can be hardware or software. Several things to consider before choosing learning media according to Abidah (2023), including: learning objectives, type of learning material that can be evaluated based on the type of knowledge contained in it, user conditions, and environmental conditions. The challenges of education in the current era of globalization also need to be considered by a teacher where he must utilize TPACK-based learning media in the learning process (Bintoro et al., 2023; Ahmad, 2020). TPACK (Technological Pedagogical Content Knowledge) is effective basic teaching that is integrated with technology in developing educational content so that it is hoped that it makes concepts that are difficult to learn easy to learn (Lusiyani & Anindya, 2021). Therefore, in this research researchers will develop interactive learning media based on Lectora Inspire. It is hoped that the development of interactive media will be able to solve problems or meet the needs of teachers and students at SDN Cebongan 02 Salatiga.

Lectora Inspire is software development of E-learning which allows character animation, video, music and audio without requiring programming Mudinillah (2019), Audia et al. (2021), Lectora inspire has been proven to contribute to improving student learning outcomes, this statement is strengthened by research by (Prihantara & Farid Ahmadi, 2023). Lectora Inspire media has several advantages, including: creating a more interactive classroom atmosphere because students can be directly involved during the learning process (Nuha et al., 2021). Apart from that, this media provides image, audio, video and animated character features that we can apply to the design so that students can more easily understand the learning material (Coman et al., 2020). This aims to ensure that the presentation of information gives an interesting and enjoyable impression during learning so that it does not tends to be boring (Nowell et al., 2017; Roberts et al., 2018). Lectora inspire also provides other supporting applications to make it easier for users to develop a media so that it can support the learning process (Fojo & Tesfa, 2020).

Based on the results of observations by researchers at SDN Cebongan 02 Salatiga, teachers had problems with the low learning outcomes of class V students because students had difficulty understanding the material concept of the properties of light. The results of the interview showed that the fifth grade teacher at SDN Cebongan 02 experienced problems in student learning outcomes, especially in the material on the properties of light. Apart from that, the choice of learning methods used is less varied, causing some students to feel bored and want a new atmosphere, such as using interactive and varied TPACK-based learning media. Therefore, some class V students at SDN Cebongan 02 lack enthusiasm for learning science, resulting in the science learning outcomes of class V students being low. Data in the field shows that the average score of class V students, especially on the subject of light and its properties, is 71.62. This shows that the score is still below the Maximum Completeness Criteria (KKM) at the school with a score of 75.

Therefore, based on these problems, the researcher is trying to provide a solution to this problem by developing learning media based on Lectora Inspire so that the researcher hopes that this learning media will be able to improve student learning outcomes, especially class V in the science and science lesson content on the properties of light at SDN Cebongan 02, Salatiga City. .

Method

This type of research is development research (RnD). According to Wahyuningtyas et al. (2020), the research and development method is the process of developing a product, then refining and testing the level of effectiveness of the product so that it becomes a new product that is more effective and systematic. Model This development uses the ADDIE model developed by Dick and Carey consisting of, Analysis, Design, Development, Implementation, Evaluation. The research subjects were class V students at SDN Cebongan 02 Salatiga for the 2023/2024 academic year with a total of 26 students.

Data collection techniques in this research include questionnaires, interviews and written tests. The research instruments used include media and material expert validation sheets, student needs analysis questionnaires, pretest and posttest questions. Data analysis techniques used include the normality test to test the normality of the data, the paired sample T-test to test significance, and the N-gain test to test the effectiveness of product use.

Table 1. One Group Pretest- Posttest Experimental Design Scheme

Group	Pre-test	Treatment	Post-test
Experiment	O1	X	O2

Information:
X = treatment (learning using Lectora Inspire-based learning media)
O1 = pre-test (measurement of learning outcomes before treatment is given)
O2 = post-test (measurement of learning outcomes after being given treatment)

Result and Discussion

This development uses research and development steps for the ADDIE model, including: Analysis; Design (design); Development (development); Implementation (implementation); Evaluation (evaluation). These five stages will be explained:

Analysis

The first step taken by researchers is analysis. Based on the results of observations and interviews, researchers found a problem with the low learning outcomes of class V students in learning Natural Sciences (IPA) on light matter and its properties due to difficulties in understanding the concept of light matter and its properties. Based on observations and interviews that have been conducted, this is due to less varied learning methods and less interactive media in delivering material so that the classroom atmosphere seems boring because learning is only teacher-centred.

Design

The second step is for researchers to design a product design concept (storyboard). Storyboard is an overview of the entire media that will be included in interactive learning media Lectora Inspire which will later function as direction in creating media (Vivien Pitriani et al., 2021). In general, Lectora Inspire media contains, among other things: instructions for use which contain directions for using the media; a competency section which contains learning outcomes and objectives (Dalimunte & Rohani, 2022). Learning, the material section which contains exposure to light and its properties along with evaluation questions, the library section which contains a bibliography in making material such as books, learning videos and pictures, the profile section contains the developer profile and supervisor profile (Stieger & Wunderl, 2022).

In the physical design to attract the appearance of the media, researchers added backgrounds, animated characters and background sound. The animated backgrounds and characters in this media are a combination of downloads from various sources in portable network graphics (.png) format. The concept of the material that will be presented is in the form of a conversation (dialogue) so it requires animated characters as conversation figures (dialogue). Then, for background sound, researchers used sources from YouTube. The audio used in this media is instrumental music on the last page as a closing.

Development (development)

The next step is development, where the researcher creates a media until it is tested for feasibility by media experts and material experts. At this stage the researcher creates media by placing all components such as background, audio, images, navigation buttons and learning materials according to the design plan in the previous stage with Lectora Inspire (Astriani et al., 2022). In the evaluation question section, questions are created with the help of Quizizz with the link provided in the "quiz" menu located on the main menu. After the media has been created, the next step is to save the project results in awt format, but if there are no changes or improvements, the final product can be converted into an offline file or accessed online in .html format.

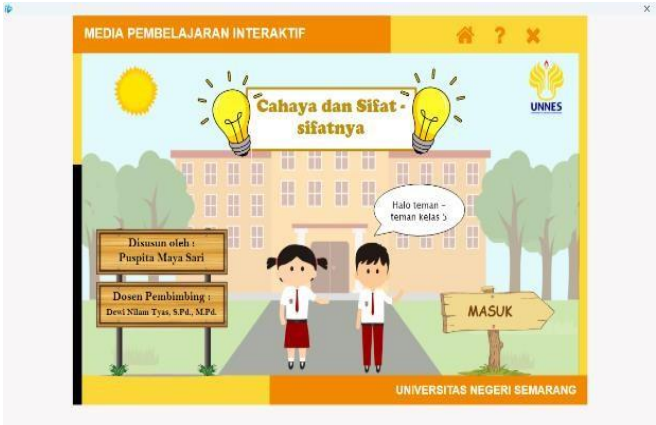

Figure 1. Front page view

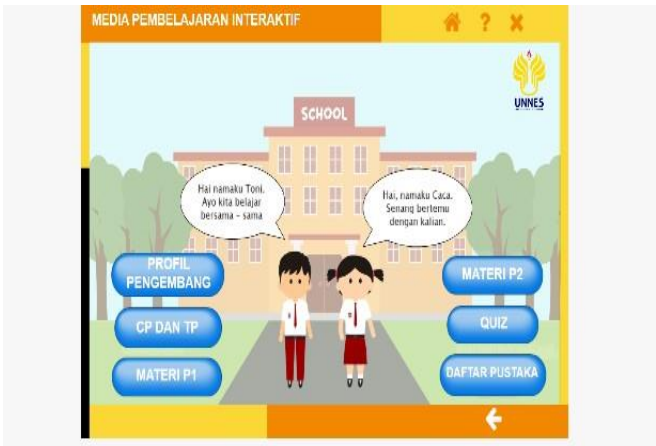

Figure 2. Main menu display

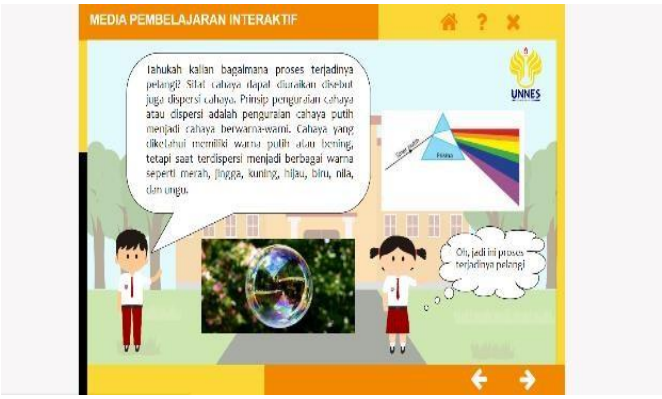

Figure 3. Material display

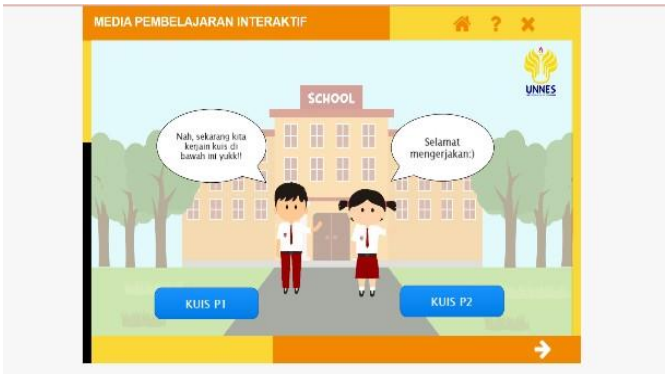

Figure 4. Quiz display

After the media creation process is complete, the next step is to test the suitability of the media-by-media experts and material experts. The following are media eligibility criteria.

Table 2. Media eligibility criteria

Percentage (%)	Category
0-25	Not really worth it
26-50	Not feasible
51-75	Worthy
76-100	Very worthy

Source: (Pabri et al., 2022)

Based on assessments from media experts in terms of general appearance, special appearance and presentation of Lectora Inspire-based learning media, they obtained a score of 44 out of a maximum score of 48, so the total percentage obtained was 91.66%. This shows that the product received the "Very worthy" category. Meanwhile, the assessment from material experts covering language aspects, material coverage, and questions received a score of 46 out of the maximum score of 52, so the total percentage obtained was 88.46%. This shows that the product obtained the appropriate "Very worthy" category with table 2.

Implementation (implementation)

The next stage is the implementation stage, at this stage 2 experiment are carried out, namely trials on a small scale and trials on a large scale. The research subjects for the small scale were 6 students and the large scale were 20 class V students at SDN Cebongan 02 Salatiga. This trial aims to determine the development of learning outcomes and the level of media effectiveness. The results of this research were then processed through 3 stages, including normality test, paired sample T-test, and N-gain test. The following are the results of this research.

Normality test

The Purpose of the normality test is to find out whether the data that has been collected is normally distributed or comes from a normal population. The following are the results of the data normality test using the Shapiro-Wilk formula.

Table 3. Data normality test results

Class	Statistic	df	Sig.
Pretest SK	.808	6	.070
Posttest SK	.912	6	.452
Pretest SB	.962	20	.588
Posttest SB	.941	20	.253

According to Permana & Ikasari (2023), if the p-value ≥ where the value is 0.05 then H0 is accepted (normal). Based on table 3, it can be concluded that if the sig value is greater than 0.05, the results of the data collected on both small and large scales are normally distributed.

Paired sample T-test

The paired T-test aims to test the increase in science learning outcomes between before being given treatment and after being given treatment (Setiawan & Soniya, 2023). If the significance coefficient is >0.05 then Ho is accepted, whereas if the significance coefficient is ≤ 0.05 then Ho is rejected (Kurniati & Nuraini, 2020). The sample paired T-test results.

Table 4. Results of paired sample T-test (small scale)

	Mean	t	df	Sig.
Before being given treatment- after being given treatment	-27.33	-5.14	5	.004

In table 4, the results of the paired sample T-test on a small scale obtained a Sig value. (2-tailed) 0.004 which means 0.004 < 0.05 (confidence level) so that Ha is accepted (has a difference significant performance) between before being given treatment and after being given treatment.

Table 5. Results of paired sample T-test (large scale)

	Mean	t	df	Sig.
Before being given treatment- after being given treatment	-28.00	-12.56	19	.000

Likewise with the results of significance on a large scale by obtaining a Sig value. (2-tailed) 0.000 then Ha is acceptable (there is a significant difference in performance) between before treatment and after treatment.

N-gain test

The results of the pretest and posttest that were carried out were tested using the N-gain test to determine the effectiveness of the media on student learning outcomes (Nuha et al., 2021). The following are categories of media effectiveness.

Table 6. Categories of media effectiveness

Percentage (%)	Category
< 40	Ineffective
40-55	Less effective
56-75	Effective enough
76- 100	Effective

Source: (Kusumawati, 2022)

Below are the results of N-gain data tests on both small and large scales.

Table 7. N-gain test results (small scale)

	N	Min	Max	Mean	Std. deviation
N-gain	6	.63	.80	.6980	.06159
Valid	6				

Comparison before using Lectora Inspire media and after using Lectora Inspire media, the results of the N-gain test show that the small scale mean is 0.70 or 70%. According to table 6, this value falls into the quite effective category.

Table 8. N-gain test results (large scale)

	N	Min	Max	Mean	Std. deviation
N-gain	20	.38	.88	.6232	.12547
Valid	20				

Meanwhile, the N-gain results on a large scale show a mean value of 0.62 or 62%, which means it is categorized as quite effective. Overall it can be concluded that the use of Lectora Inspire media is quite effective in improving student learning outcomes in science learning.

Evaluation

The final step is evaluation, at this stage the researcher compares the results of small-scale and large-scale trials to correct deficiencies in the Lectora Inspire media (Purnomo, 2021). In the N-gain test, the effectiveness of the small scale was higher than the large scale because in the small scale trial there were only 6 students so students could access the media more intensively compared to the large scale (Handoko & Ayumi, 2022; Herodotou et al., 2019; Stieger & Wunderl, 2022; Darling-Hammond et al., 2020). Lectora Inspire media helps educators in providing stimulus to students with the complete features provided by Lectora Inspire. This is in line with research conducted by Anyan et al. (2020), which states that Lectora Inspire media is very suitable for use in science learning with five senses material. Apart from that, Lectora Inspire media is able to foster students' creative character (Ristiani et al., 2020). The weakness in this research is that during large-scale trials, this media was only accessed alternately due to limited school facilities (Pokhrel & Chhetri, 2021; Yang et al., 2021; Martin et al., 2021). Therefore, improvements in this research to the Lectora Inspire media will be more effective if this media can be accessed by all students independently.

Conclusion

Based on the data analysis and discussion that has been presented, it can be concluded that the development of Lectora Inspire-based learning media in science learning on the subject of light and its properties is "very feasible" to be used as proven by assessments from media experts with average results of 91.66% and 88.46% by material experts. The implementation results of the Lectora Inspire media trial showed significance with results < 0.005 in the use of learning media using the paired sample T-test. In addition, the level of media effectiveness obtained a value of 70% on a small scale and 62% on a large scale. Overall, the Lectora Inspire learning media is "quite effective" used to improve learning outcomes in the science of light and its properties.

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Author Contributions

Conceptualization; methodology; validation; formal analysis: investigation; resources; data curation: writing—original; draft

preparation: writing—review and editing; visualization: Puspita Maya Sari.

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Conflicts of Interest
The authors declare no conflict of interest.

References

Abidah, K. H. (2023). Technology Goes to Classroom: Learning Media Application Possibilities for Writing. *SAGA: Journal of English Language Teaching and Applied Linguistics*, *4*(1), 65–76. https://doi.org/10.21460/saga.2023.41.141

Ahmad, T. (2020). Student perceptions on using cell phones as learning tools: Implications for mobile technology usage in Caribbean higher education institutions. *PSU Research Review*, *4*(1), 25–43. https://doi.org/10.1108/PRR-03-2018-0007

Anyan, A., Ege, B., & Faisal, H. (2020). Pengembangan Media Pembelajaran Interaktif Berbasis Microsoft Power Point. *JUTECH: Journal Education and Technology*, *1*(1). https://doi.org/10.31932/jutech.v1i1.690

Astriani, S., Astuti, I., & Mering, A. (2022). Learning Media Development Using Lectora Inspire for Social Science Subjects. *Sinkron*, *7*(1), 176–184. https://doi.org/10.33395/sinkron.v7i1.11268

Audia, F. A., Zakiah, L., & Utami, N. C. M. (2021). Lectora Inspire Learning Media Based on Character Education in Civics. *Jurnal Ilmiah Sekolah Dasar*, *5*(3), 549. https://doi.org/10.23887/jisd.v5i3.35949

Bintoro, T., Fahrurrozi, Kusmawati, A. P., & Dewi, R. S. (2023). The teacher strategies in teaching sign language for deaf students in special schools Jakarta. *Cogent Education*, *10*(2), 2258294. https://doi.org/10.1080/2331186X.2023.2258294

Coman, C., Ţîru, L. G., Meseşan-Schmitz, L., Stanciu, C., & Bularca, M. C. (2020). Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students' Perspective. *Sustainability*, *12*(24), 10367. https://doi.org/10.3390/su122410367

Dalimunte, R., & Rohani, R. (2022). Development of Interactive Learning Media Based on Lectora Inspire on Excretion System Materials. *Jurnal Penelitian Pendidikan IPA*, *8*(5), 2159–2167. https://doi.org/10.29303/jppipa.v8i5.2243

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Dialga, I., & Ouoba, Y. (2022). How do extractive resources affect human development? Evidence from a panel data analysis. *Resources, Environment and Sustainability*, *7*, 100046. https://doi.org/10.1016/j.resenv.2022.100046

Fahmi, Abdullah, & Irhasyuarna, Y. (2021). Empowering peat lands as a resource of learning natural science to strengthening environment care. *In 2nd International Conference on Social Sciences Education (ICSSE 2020)*, 428-431. https://doi.org/10.2991/assehr.k.210222.072

Fojo, G. A., & Tesfa, A. (2020). The khat dilemma in Jimma area: The socio-economic analysis of benefits and harms associated with kath use. *Harmoni Sosial: Jurnal Pendidikan IPS*, *7*(1), 9–21. https://doi.org/10.21831/hsjpi.v7i1.30289

Handoko, H., & Ayumi, A. (2022). Designing Synchronous and Asynchronous Activities for Interactive Learning. *Jurnal Arbitrer*, *9*(2), 164–177. https://doi.org/10.25077/ar.9.2.164-177.2022

Herodotou, C., Rienties, B., Boroowa, A., Zdrahal, Z., & Hlosta, M. (2019). A large-scale implementation of predictive learning analytics in higher education: The teachers' role and perspective. *Educational Technology Research and Development*, *67*(5), 1273–1306. https://doi.org/10.1007/s11423-019-09685-0

Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023). Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, *3*(2), 100115. https://doi.org/10.1016/j.tbench.2023.100115

Karlsen, R., & Aalberg, T. (2023). Social Media and Trust in News: An Experimental Study of the Effect of Facebook on News Story Credibility. *Digital Journalism*, *11*(1), 144–160. https://doi.org/10.1080/21670811.2021.1945938

Kurniati, A., & Nuraini, P. (2020). The Effectiveness of Group Counselling with Monopoly Game Media to Improve the Students' Self-Confidence. *Proceedings of the 1st Borobudur International Symposium on Humanities, Economics and Social Sciences (BIS-HESS 2019)*, 753-755. https://doi.org/10.2991/assehr.k.200529.159

Kusumawati, E. R. (2022). Efektivitas Media Game Berbasis Scratch pada Pembelajaran IPA Sekolah Dasar. *Jurnal Basicedu*, *6*(2), 1500–1507. https://doi.org/10.31004/basicedu.v6i2.2220

Lüders, A., Dinkelberg, A., & Quayle, M. (2022). Becoming "us" in digital spaces: How online users creatively and strategically exploit social media affordances to build up social identity. *Acta*

Psychologica, *228*, 103643. https://doi.org/10.1016/j.actpsy.2022.103643

Lusiyani, R., & Anindya, W. D. (2021). Choosing and Using Learning Media during Remote Teaching: Teachers' Thought. *Journal of English Language Teaching and Linguistics*, *6*(2), 407. https://doi.org/10.21462/jeltl.v6i2.555

Martin, A. J., Burns, E. C., Kennett, R., Pearson, J., & Munro-Smith, V. (2021). Boarding and Day School Students: A Large-Scale Multilevel Investigation of Academic Outcomes Among Students and Classrooms. *Frontiers in Psychology*, *11*, 608949. https://doi.org/10.3389/fpsyg.2020.608949

Metekohy, L. M., Daliman, M., Metekohy, B., & Ming, D. (2022). The impact of teaching and learning quality process to school and university education for sustainable future. *JPPI (Jurnal Penelitian Pendidikan Indonesia)*, *8*(1), 143. https://doi.org/10.29210/020221203

Mudinillah, A. (2019). The Development of Interactive Multimedia Using Lectora Inspire Application in Arabic Language Learning. *Jurnal Iqra' : Kajian Ilmu Pendidikan*, *4*(2), 285–300. https://doi.org/10.25217/ji.v4i2.570

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1), 160940691773384. https://doi.org/10.1177/1609406917733847

Nuha, U., Wahyuni, S., Budiarso, A. S., Hasanah, U., & Anggraini, N. E. (2021). The Effectiveness of Flipbook and Video to Improve Students' Critical Thinking Skills in Science Learning during the COVID-19 Pandemic. *Lensa: Jurnal Kependidikan Fisika*, *9*(1), 32. https://doi.org/10.33394/j-lkf.v9i1.3899

Pabri, M., Medriati, R., & Risdianto, E. (2022). Uji Kelayakan E-LKPD Berbasis Kontekstual Berbantuan Liveworksheet untuk Melatih Kemampuan Berpikir Kritis di SMA. *Jurnal Ilmiah Pendidikan Fisika*, *6*(3), 637. https://doi.org/10.20527/jipf.v6i3.6812

Permana, R. A., & Ikasari, D. (2023). Uji Normalitas Data Menggunakan Metode Empirical Distribution Function Dengan Memanfaatkan Matlab dan Minitab 19. *Semnas Ristek (Seminar Nasional Riset Dan Inovasi Teknologi)*, *7*(1). https://doi.org/10.30998/semnasristek.v7i1.6238

Pokhrel, S., & Chhetri, R. (2021). A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. *Higher Education for the Future*, *8*(1), 133–141. https://doi.org/10.1177/2347631120983481

Prihantara, U. B. & Farid Ahmadi. (2023). Lectora Inspire Interactive Media Based on Android on Class VI Elementary School Proclamation Event Material. *MIMBAR PGSD Undiksha*, *11*(3), 505–516. https://doi.org/10.23887/jjpgsd.v11i3.69859

Purnomo, B. (2021). The Development Lectora Inspire Based Learning Media for High School Students in Learning History. *Indonesian Research Journal in Education (IRJE)*, *5*(2), 360–374. https://doi.org/10.22437/irje.v5i2.10244

Ristiani, S. M., Triwoelandari, R., & Yono, Y. (2020). Pengembangan Media Pembelajaran Lectora Inspire Versi 12 Pada Mata Pelajaran IPA Berbasis STEM untuk Menumbuhkan Karakter Kreatif Siswa. *Jurnal Basicedu*, *5*(1), 30–40. https://doi.org/10.31004/basicedu.v5i1.613

Roberts, T., Jackson, C., Mohr-Schroeder, M. J., Bush, S. B., Maiorca, C., Cavalcanti, M., Craig Schroeder, D., Delaney, A., Putnam, L., & Cremeans, C. (2018). Students' perceptions of STEM learning after participating in a summer informal learning experience. *International Journal of STEM Education*, *5*(1), 35. https://doi.org/10.1186/s40594-018-0133-4

Sarkadi, Casmana, A. R., Hisyam, C. J., & Wardatussa'idah, I. (2022). Integrating Character Education Into the RECE Learning Model Through Pancasila and Citizenship Education Subjects. *Frontiers in Education*, *7*, 841037. https://doi.org/10.3389/feduc.2022.841037

Setiawan, D., & Soniya, E. (2023). Powtoon-Based Animation Video to Improve Students' Learning Outcomes on Regional Artworks. *Journal of Education Technology*, *7*(3), 564–571. https://doi.org/10.23887/jet.v7i3.60599

Stieger, S., & Wunderl, S. (2022). Associations between social media use and cognitive abilities: Results from a large-scale study of adolescents. *Computers in Human Behavior*, *135*, 107358. https://doi.org/10.1016/j.chb.2022.107358

Supeno, Astutik, S., & Lesmono, A. D. (2020). Pre-service science teachers' understanding of scientific method for studying local environmental issues. *IOP Conference Series: Earth and Environmental Science*, *485*(1), 012033. https://doi.org/10.1088/1755-1315/485/1/012033

Vivien Pitriani, N. R., Wahyuni, I. G. A. D., & Gunawan, I. K. P. (2021). Penerapan Model Addie Dalam Pengembangan Media Pembelajaran Interaktif Menggunakan Lectora Inspire Pada Program Studi Pendidikan Agama Hindu. *Cetta: Jurnal Ilmu Pendidikan*, *4*(3), 515–532. https://doi.org/10.37329/cetta.v4i3.1417

Wahyuningtyas, P., Bintartik, L., & Putra, A. P. (2020). Lectora-Based Interactive E-Book Development for Elementary Schools. *Proceedings of the 1 St International Conference on Information Technology*

and Education (ICITE 2020), 257-264. https://doi.org/10.2991/assehr.k.201214.246

Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., Joyce, C., Shah, N., Sherman, K., Hecht, B., & Teevan, J. (2021). The effects of remote work on collaboration among information workers. *Nature Human Behaviour*, *6*(1), 43–54. https://doi.org/10.1038/s41562-021-01196-4