Enhancing Students' Cognitive Learning Outcomes Through Interactive Learning Multimedia "Lumi Education"

Wahyu Noor Aryfien, Idam Ragil Widianto Atmojo, Matsuri

Universitas Sebelas Maret
wahyunooraryfien@student.uns.ac.id

Abstract

Due to the involvement of multiple organs, the learning materials on the human respiratory system in IPAS are abstract and complicated. With an average score of 66.3, elementary school students' cognitive learning results remain below the minimal completion requirements of 70. The teacher's learning method is still conventional. This study compares the cognitive learning outcomes of students who use Lumi Education's interactive learning media with those who use conventional. This study uses a quasi-experimental design with 32 students in the experimental group and 34 students in the control group. The instrument for assessing students' cognitive learning outcomes through validity and reliability tests resulted in 15 items. Data were analyzed using the SPSS Wilcoxon and Mann-Whitney tests. The research results show an increase in the learning outcomes of the experimental group by 19% and the control group by 6%. Statistical tests indicate a difference in pretest and posttest learning outcomes for the experimental group with a p-value of 0.000 and the control group with a p-value of 0.005. There is a difference in learning outcomes between the experimental group and the control group with a p-value of 0.007. The interactive learning media Lumi Education can improve students' learning outcomes on the human respiratory system material. To implement Lumi Education, support from school policies for facilities and parents is necessary.

Keywords: *Cognitive Learning Outcomes, Interactive Learning Multimedia, Lumi Education*

Abstrak

Materi sistem pernafasan manusia pada mata Pelajaran IPAS bersifat abstrak dan kompleks karena melibatkan berbagai organ. Hasil belajar kognitif peserta didik sekolah dasar berupa nilai rata-rata yaitu 66,3 sebagai indikator pencapaian tujuan pembelajaran masih berada di bawah nilai kriteria ketuntasan minimal yaitu 70. Hal tersebut ditunjang dengan metode pembelajaran guru yang masih konvensional. Tujuan penelitian ini adalah untuk menganalisis perbedaan hasil belajar kognitif peserta didik pada pemanfaatan pemanfaatan media pembelajaran interaktif *Lumi Education* dan konvensional. Penelitian ini menggunakan kuasi eksperimen dengan 32 peserta didik kelompok eksperimen dan 34 peserta didik kelompok kontrol. Instrumen soal hasil hasil belajar kognitif peserta didik melalui uji validitas dan reliabilitas hingga diperoleh 15 butir soal. Data dianalisis menggunakan Uji SPSS Wilcoxon dan Mann Whitney. Hasil penelitian menunjukkan bahwa terdapat peningkatan hasil belajar peserta didik kelompok eksperimen sebesar 19% dan kelompok kontrol sebesar 6%. Uji statistik menunjukkan terdapat perbedaan hasil belajar pretest dan postest kelompok eksperimen dengan p value=0,000 dan kelompok kontrol dengan p value=0,005. Terdapat perbedaan hasil belajar antara kelompok eksperimen dan kelompok kontrol dengan p value= 0,007. Media pembelajaran interaktif *Lumi Education* dapat meningkatkan hasil belajar peserta didik pada materi sistem pernapasan manusia. Untuk dapat menerapkan Lumi Education diperlukan dukungan kebijakan sekolah untuk fasilitas dan orang tua.

Kata kunci: *Hasil Belajar Kognitif, Multimedia Pembelajaran Interaktif, Lumi Education*

INTRODUCTION

The learning activities in elementary school as a system contain several components that interact with each other to achieve learning objectives, including teachers, students, goals, materials, learning resources, methods, media, and evaluation (Fatmawati et al., 2023; Nurzannah, 2022; Rohmah, 2017). To achieve optimal learning outcomes, it is necessary to optimize each element. Teacher is the actor who carries out all activities in the school, both in management and in teaching. Teachers are a crucial component in the continuity of the student learning process (Kurniadi et al., 2020). Therefore, teachers are required to be creative and innovative in the implementation of the learning process (Ramadhani & Muhroji, 2022). Competencies related to digital technology-based learning need to be possessed by teachers. Teachers have a role and challenges in developing learning media that align with the characteristics of the material and learning objectives (Mahardika et al., 2020).

The indicator of achieving learning objectives can be seen from the cognitive learning outcomes of the students. The levels of students' cognitive learning outcomes according to Bloom's taxonomy range from simple to complex. The categories include remember, understand, apply, analyze, evaluate, and create (Napitupulu et al., 2019). The measurement of students' cognitive learning outcomes reflects the knowledge and intellectual skills that have been acquired and mastered (Wei et al., 2021). According to Piaget's theory of cognitive development, elementary school students have a level of concrete operational thinking (Y. Ismiyanti et al., 2023). Students at this level need learning media facilities since they are thinking to understand (Hidayah et al., 2021). According to (Widodo & Wahyudin, 2018), elementary school children aged 7-11 years should not use formal operations in learning, it will be introduced after the age of 12. Therefore, learning media must be adjusted to the cognitive level of the students.

At the elementary school in Indonesia, which implements the Merdeka Curriculum, there are subjects in natural and social sciences aimed at enhancing students' curiosity about the concepts of natural and social sciences, understanding themselves and their environment, and developing inquiry skills and knowledge (Ernawati & Saputro, 2024; Yáñez De Aldecoa & Gómez-Trigueros, 2022). The subjects of the natural and social sciences have characteristics that include the presence of study objects that are both concrete and abstract. Concrete objects can be observed by students through their senses, while abstract objects are those that are difficult to observe or see in real life and require modeling to be studied in a tangible way (N. Ismiyanti, 2020). Several previous studies have stated that the majority of students experience difficulties in natural and social sciences due to the abstract nature of the material (Aini et al., 2024; Alfatonah et al., 2023; Efendi, 2022; N. Ismiyanti, 2020; Susilowati & Sutama, 2022).

The human respiratory system is covered in both natural and social science courses. Because it incorporates multiple organs, the information is abstract and complex (Han & Kim, 2019; Napitupulu et al., 2019). This is in line with the data from the daily tests of students in the X district on the topic of the human respiratory system, with an average score of 66.3, which is still below the minimum completeness criteria of 70. Additionally, the learning approach is still lecture-based and teacher-centered, with books making up the majority of the learning tools and media. Thus, to address this issue, Anastasya and Erni in (Harahap & Siregar, 2020) and (Y. Ismiyanti et al., 2023) state that interactive learning media must be used. Currently, technological development is very advanced, so teachers must be able to keep up with the technological understanding possessed by students. One of the efforts is through integration into learning media. These can enhance interest, motivation, stimulate learning activities, and even influence the psychological condition of students.

Interactive learning media is a part of the learning methodology through experience that enhances skills to respond to complex situations (Universidad de

Alicante & Satorre Cuerda, 2022). Lumi Education is one of the interactive learning resources that may be used to help students learn about the human respiratory system. With a vast content selection available for free usage, Lumi Education is a desktop-based interactive teaching material development tool that offers a plethora of features, including games, quizzes, course presentations, interactive movies, and more (Ogris, 2022; Widayanti, 2023). Because Lumi Education is practical and visible, it can assist the learning process (Oksaviona et al., 2023; S. Matana et al., 2024).

Previous research by (Oksaviona et al., 2023) on the development of PBL-based sound wave interactive multimedia in physics using Lumi in the form of HTML files (H5P packages) shows that teachers and students are able to use it very practically. Similar research by (S. Matana et al., 2024) also found that the use of Lumi Education for H5P-based learning media is valid for use based on expert assessment. Therefore, Lumi can help students in addressing issues in the learning process of physics and basic atmospheric dynamics.

According to several previous studies, the use of interactive multimedia learning through various innovative applications has an impact and improves students' learning outcomes (Agusti & Aslam, 2022; Amin, 2022). Previous research by (Gregorio & Rabut, 2024) using a quasi-experimental design found that students who received treatment with Strategic Intervention Materials Using Lumi Education (SIMULE) demonstrated better conceptual and procedural outcomes compared to conventional methods. Research by (Depany, 2023) with a quasi-experimental design also found that physics learning media based on the Lumi Education application had an impact on students' critical thinking and communication skills. The utilization of interactive learning media is one of the solution-oriented approaches that can be used to improve student's learning outcomes by the learning objectives.

Currently, research on Lumi Education is still largely in the development stage and has not yet been used and researched at the elementary school level. Studies about Lumi Education such as the development research of Lumi Education for teaching materials on text in the Indonesian language subject for seventh-grade junior high school students using the ADDIE model, resulted in the application being categorized as "very worthy" (Marbun et al., 2024). The development research of Lumi Education based on H5P for atmospheric dynamics materials for students at Senior High School 1 Gorontalo using the ADDIE model found that the application is suitable for the learning process. This study aims to analyze the effect of the application of interactive learning media Lumi Education on students' cognitive learning outcomes regarding the human respiratory system, using a quasi-experimental design. This research aims to provide evidence to all stakeholders that teachers need to possess technological skills in the era of digitalization.

METHOD

This study uses the quasi-experimental design to analyze the differences in the impact of Lumi Education's interactive learning multimedia and conventional methods on students' cognitive learning outcomes. In this experimental design, there are two sample groups: the experimental group and the control group. The research used a non-equivalent control group design. Participants were selected using purposive sampling based on the criteria of A-accredited schools with adequate facilities. Both groups were given a pretest to determine the students' initial abilities. The experimental group received an intervention, which was the application of interactive learning multimedia from Lumi Education, while the control group did not receive any intervention (conventional learning) (Kim & Lee, 2024).

Experimental Group   E   O1 X_1 O2
Control Group   C   O3 X_2 O4
Description:
E   : Experiment Group
C   : Control Group
O1   : Observation of Pretest results for the experimental group
O2   : Observation of Posttest results for the experimental group
X_1 : Intervention of applying interactive learning multimedia from Lumi Education
X_2 : Conventional learning
O3   : Observation of Pretest for the control group
O4   : Observation of Posttest for the control group

This research uses two elementary schools as the experimental group and two elementary schools as the control group. Fifth-grade elementary school students were selected as samples in this study for the subjects of natural science and social studies on the topic of the human respiratory system. The research was conducted in October 2024. The student's willingness to participate in this research is indicated by their signatures on the informed consent form. According to (Munley et al., 2018), informed consent is a document that can be read by prospective respondents before the research is conducted and contains information about the purpose of the study. The 64 students enrolled in the fifth grade of elementary schools in the X District comprise the study's population. The sample size in this study is fifth-grade elementary school students aged 11-12 years, consisting of 32 students (consisting of 14 students in School A and 18 students in School B) in the experimental group and 34 students (consisting of 22 students in School C and 12 students in School D) in the control group. Students in the experimental group are coded as S01-S34 according to their order, and the same applies to the control group.

Interactive multimedia learning from Lumi Education on the topic of the human respiratory system was designed by researchers as an intervention for the experimental group. Lumi education contains learning materials that consist of videos, summaries of learning materials, games, and assessments for cognitive assessment. The research began with students in the experimental group and the control group working on a pretest that had been prepared. Before the implementation of the intervention in learning, the researcher provided training to the fifth-grade teachers in the experimental group on how to operate and utilize Lumi Education. Each student can access Lumi Education through their gadget. Students in the experimental group, after receiving the intervention, then complete the post-test questions. The control group that did not receive the intervention (using conventional methods) also worked on the same post-test questions as the experimental group.

Researchers use test questions to assess students' cognitive learning outcomes in pretests and posttests. It was arranged based on the following blueprint:

Table 1. Learning Outcome Indicators

Indicator	Cognitive Level
Identifying the respiratory organs in humans	C4
Analyzing the respiratory process in humans	C4
Analyzing the function of the organs in the human respiratory system	C4
Identifying various disorders of the human respiratory system	C4
Analyzing various ways to prevent respiratory diseases	C4

The number of right answers multiplied by four is used to assess the learning outcomes of students, with a maximum score of 100 obtained. Descriptive analysis is used to present data in the form of diagrams for learning outcomes and tables for descriptive statistics (Cox-Davenport, 2017). Based on the results of the instrument validity test, 14 items were obtained with a p value > 0.05 and reliability with a p value > 0.06. Inferential statistics using Wilcoxon non-parametric test to analyze the influence of Lumi Education's interactive learning multimedia on students' cognitive learning outcomes. This study also used Mann-Whitney to test hypotheses and find differences between data in two independent groups (Smida et al., 2022).

RESULT AND DISCUSSION

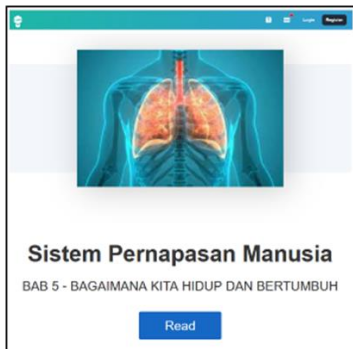Interactive learning multimedia from Lumi Education is managed with the following interface:

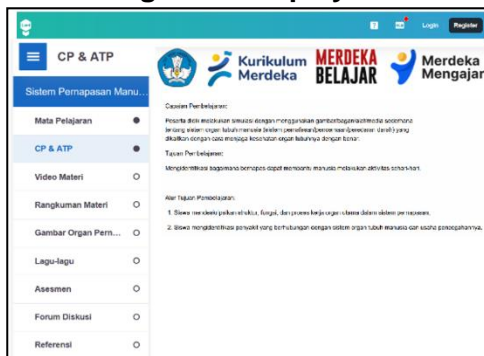

Figure 1. Display

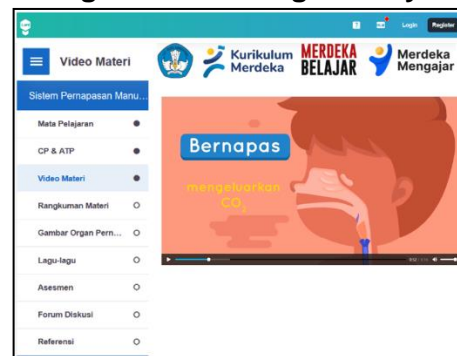**Figure 2. Learning Identity**

Figure 3. CP and ATP

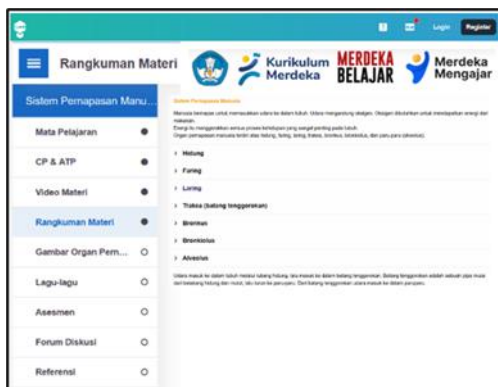**Figure 4. Learning Video**

Figure 5. Summary of Learning Materials

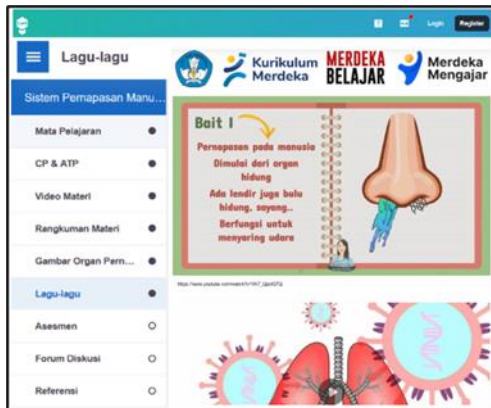**Figure 6. Image of Respiratory Organ**

Figure 7. Music of Human Respiratory
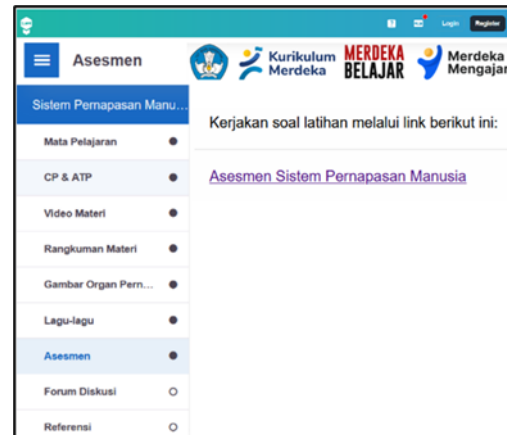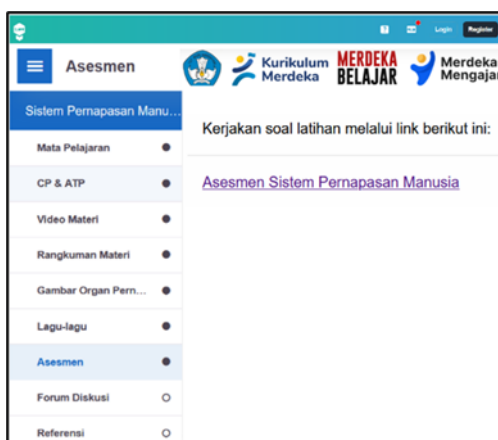

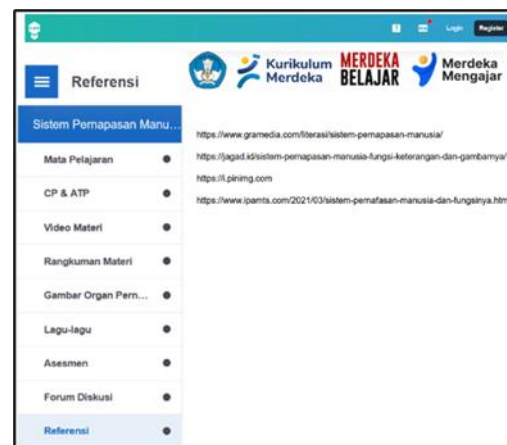**Figure 8. Assessment**

Figure 9. Discussion Room

Figure 10. References

All the menus provided in Lumi Education have been tailored to the learning outcomes and the learning objectives for the human respiratory system material for fifth-grade elementary school students. The menu consists of display, learning identity, CP and ATP, learning video, summary of learning materials, image of respiratory organ, music of human respiratory, assessment, discussion room, and references.

The initial step in creating Lumi Education is for the teacher to design the project (content) on the page https://lumi.education/en/ which consists of the menu mentioned above. The link or barcode that can be accessed by students will be generated after the content is completed. When students have entered Lumi Education, a "display" screen will appear. To enter the learning identity, the student presses the "read" button. Students can choose the left menu according to their needs. Students can also practice solving questions in the assessment menu.

Based on the collection of learning outcome data, the following is the distribution of data for the experimental group:
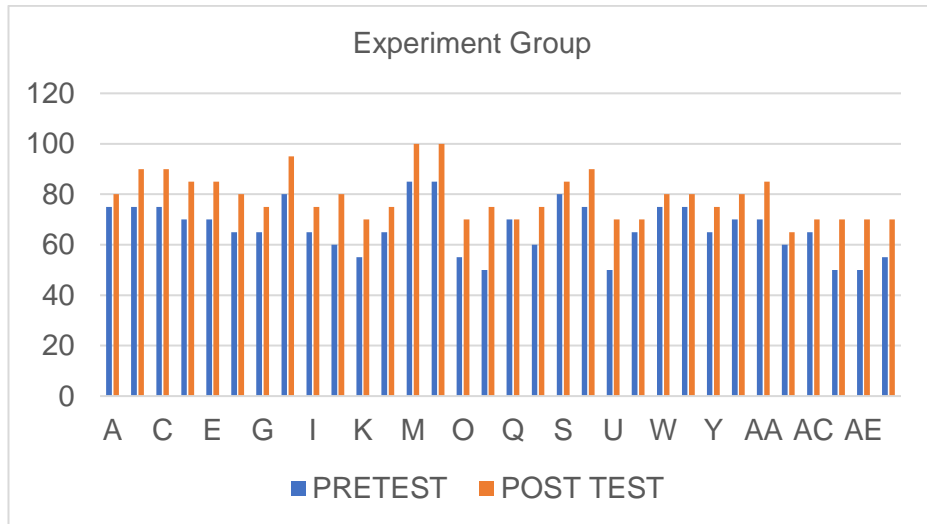
Figure 11. Learning Outcomes of The Experimental Group

Figure 11 above shows that the learning outcomes of the experimental group students in the post-test have improved. The distribution of the learning outcomes of the control group students is as follows:
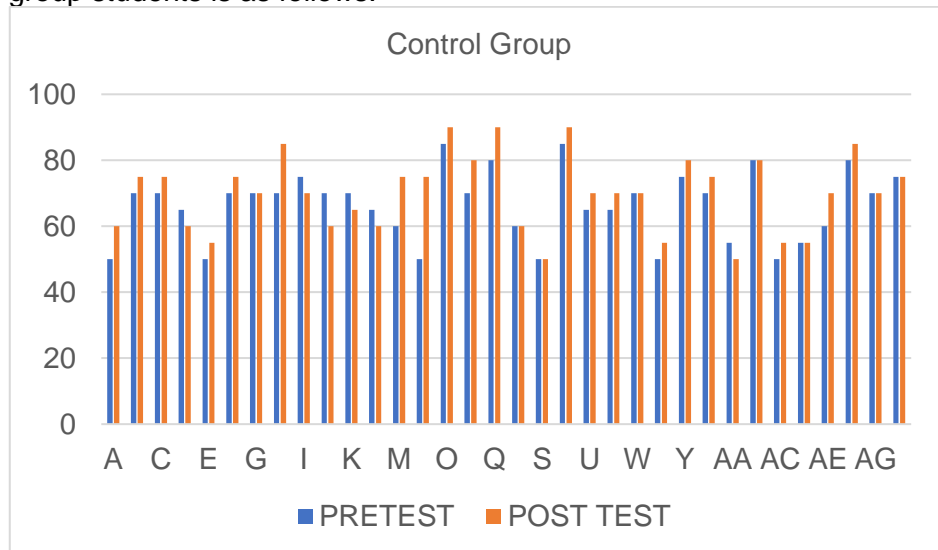

Figure 12. Learning Outcomes of The Control Group

Figure 12 above shows that most of the learning outcomes of the control group students in the post-test increased, although not significantly. Based on the data distribution, the following statistics analysis were obtained:

Table 2. Result of the Wilcoxon and Mann-Whitney Analysis Between the Pretest and Posttest Scores of the Control and Experimental Groups in Student Learning Outcomes

| Group | Pretest | | Postest | | n | Pretest | | Postest | | p | P (Mann | Interpretation |
	Mean	SD	Mean	SD		Min	Max	Min	Max	(Wilcoxon)	Whitnney)	
Control	65,94	10,66	69,84	11,81	34	50	85	50	90	0,005		*Significant*
Experiment	66,56	10,12	79,06	9,28	32	50	85	65	100	0,000	*0,007*	*Significant*

Table 2 above explains that the total sample is 64 students, with 32 students in the experimental group and 34 students in the control group. The minimum and maximum pretest scores in the experimental and control groups are the same, with a minimum value of 50 and a maximum value of 85. The minimum posttest score in the experimental group is higher at 65 compared to the control group at 50. The maximum posttest score in the experimental group is higher at 100 compared to the control group at 90. The standard deviation of the pretest in the experimental group is 10.12 and the control group is 10.66. The standard deviation of the posttest in the experimental group is 9.28 and the control group is 11.81. The standard deviation of the experimental group decreased after the posttest, while the standard deviation of the control group increased after the posttest.

The average score of the experimental group increased by 19% from 66.56 to 79.06, and the control group increased by 6% from 65.94 to 69.84. Non-parametric analysis using Wilcoxon obtained a *p value* = 0.005 for the pretest and posttest of the control group and a *p value* = 0.000 for the pretest and posttest of the experimental group. To determine the difference in learning outcomes between the experimental and control groups, the Mann Whitney test yielded a *p value* = 0.007, indicating a significant difference.

Interactive learning multimedia is one of the options that teachers can utilize for learning media. Electronic-based interactive learning media, which is a combination of images, videos, texts, audio, graphics, and animations packaged in digital files, is used to convey learning materials to students according to the teachers' needs (Masdar Limbong et al., 2022; Munawaroh et al., 2022). Therefore, interactive learning multimedia is suitable when applied to subjects that are complex and abstract, such as the human respiratory system, because it can visualize objects.

Teachers, as important actors in the learning process, need to keep up with the developments in science and technology to improve the quality of education (Wang et al., 2024). According to Fiorella and Mayer, learning with text and images used simultaneously is better than sequentially (Li et al., 2023). This can also be seen from the Cognitive Theory of Multimedia Learning (CTML), which states that multimedia learning has three assumptions: the dual channel assumption, the limited capacity assumption, and the active processing assumption (Mayer, 2002).

Currently, students are accustomed to gadgets and social media that are more varied and interactive in presenting information. This also needs to be applied in the classroom learning process, because technology has a significant impact on the education system that can prepare lifelong learning and support pedagogical goals through the use of learning media (Daryanes et al., 2023; Kassa et al., 2024).

Based on the results above, Lumi Education is suitable as a media for the subject of the human respiratory system. It shows that the use of Lumi Education is more effective in improving students' cognitive learning outcomes compared to conventional methods. This is consistent with previous research, which states that students who receive learning through interactive learning multimedia achieve better learning outcomes compared to conventional methods (Kassa et al., 2024).

Lumi Education is an interactive desktop-based educational material creation application with a complete content selection that can be used for free and is equipped with several features such as quizzes, course presentations, interactive videos, games, and more (Ogris, 2022; Widayanti, 2023). The completeness of its visual and practical features can help students understand the abstract and complex material of the human respiratory system because it involves various organs (Oksaviona et al., 2023; S. Matana et al., 2024). The use of interactive multimedia learning is also in line with the Cognitivism Theory by Robert M. Gagne, in his book The Conditioning of Learning, states that learning is a change that occurs in human abilities after continuous learning, not just

caused by the growth process. Gagne believes that learning is influenced by external and internal factors, and both interact with each other (Basyir et al., 2022).

Before the learning using Lumi Education is conducted, teachers receive training on the menu and how to use it. To be able to manage a class using technology-based media, teachers need to receive training and refreshment to enhance their knowledge and skills. Through the provided training, it is hoped that teachers can continue to improve their skills independently. Based on the results of classroom observations, the students are very enthusiastic about the learning process. The class teacher also stated that learning has become more interactive and has increased student engagement. The use of interactive learning media can create a pleasant learning environment, which is a factor in cognitive development and encourages students to actively participate in all learning processes (Daryanes et al., 2023).

To be able to implement Lumi Education as an interactive learning media, in addition to providing training to teachers, schools need to have adequate facilities such as a stable internet network, supporting gadgets, and support from school and parental policies. Theoretically, improving facilities can help schools enhance learning outcomes (Espinosa Andrade et al., 2024). Menurut (Lohr et al., 2024), school support for technology integration and internet speed plays an important role in teachers' ability to initiate more interactive digital learning activities. According to UNESCO, policies for integrating technology into learning can also enhance the quality of student education (Naik et al., 2020). Parents also play an important role in improving student learning outcomes. Parental involvement in school management is expected to enhance the school's responsiveness to teacher accountability and develop infrastructure to improve student learning outcomes (Jailobaeva et al., 2023).

CONCLUSION

Lumi Education's interactive learning multimedia can improve the cognitive learning outcomes of elementary school students in the subject of the human respiratory system. There is an increase in the average learning outcomes of the experimental group by 19% with a p value = 0.000. The control group using conventional methods also experienced an increase, but it was lower compared to the experimental group, which was 0.005. Based on the results of the difference test between the experimental group and the control group, a p value = 0.007 was obtained. Schools need to provide adequate facilities in the form of gadgets and a stable internet connection to utilize Lumi Education. In addition, it is also necessary to improve teachers' technological competencies and obtain support from school policies and parents. For future researchers, it is expected that they will be able to study the use of Lumi Education in other subjects and materials, following the timeline that aligns with the schedule planned in the semester learning plan.

REFERENCE

Agusti, N. M., & Aslam, A. (2022). Efektivitas Media Pembelajaran Aplikasi Wordwall Terhadap Hasil Belajar IPA Siswa Sekolah Dasar. *Jurnal Basicedu*, *6*(4), 5794–5800. https://doi.org/10.31004/basicedu.v6i4.3053

Aini, I. N., Widyawati, Z. H., Shofiana, A. M., Noviana, F., Nabilah, E. R., & Hilyana, F. S. (2024). Analisis Faktor-Faktor Kesulitan Belajar IPAS pada Peserta Didik Kelas V Sekolah Dasar. *Didaktik*, *10*(1).

Alfatonah, I. N. A., Kisda, Y. V., Septarina, A., Ravika, A., & Jadidah, I. T. (2023). Kesulitan Belajar Peserta Didik pada Mata Pelajaran IPAS Kurikulum Merdeka Kelas IV. *Jurnal Basicedu*, *7*(6), 3397–3405. https://doi.org/10.31004/basicedu.v7i6.6372

Amin, M. (2022). Penerapan Model Pembelajaran Penjasorkes Inovatif Untuk Meningkatkan Hasil belajar Penjasorkes Pada Matero Kebugaran Jasmani Siswa

Kelas V Semester Genap SD Negeri 25 Mataram. *Jurnal Realita Bimbingan dan Konseling*, *7*(1).

Basyir, M. S., Aqimi Dinana, & Diana Devi, A. (2022). Kontribusi Teori Belajar Kognitivisme David P. Ausubel dan Robert M. Gagne dalam Proses Pembelajaran. *Jurnal Pendidikan Madrasah*, *7*(1), 89–100. https://doi.org/10.14421/jpm.2022.71.12

Cox-Davenport, R. A. (2017). "The Five-Minute Check-In" Intervention To Ease The Transition Into Professional Education: A Descriptive Analysis. *Nurse Education Today*, *50*, 25–28. https://doi.org/10.1016/j.nedt.2016.12.014

Daryanes, F., Darmadi, D., Fikri, K., Sayuti, I., Rusandi, M. A., & Situmorang, D. D. B. (2023). The Development Of Articulate Storyline Interactive Learning Media Based On Case Methods To Train Student's Problem-Solving Ability. *Heliyon*, *9*(4), e15082. https://doi.org/10.1016/j.heliyon.2023.e15082

Depany, P. D. (2023). Penerapan Media Pembelajaran Fisika Lumi Education Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Komunikasi. *Jurnal Pendidikan Fisika*, *10*(1).

Efendi, N. (2022). Studi Literature Kesulitan Siswa Pada Pembelajaran IPA Sekolah Dasar. *Jurnal Pendidikan dan Konseling*, *4*(6).

Ernawati, L., & Saputro, B. A. (2024). Analisis Penerapan Model Project Based Learning Mata Pelajaran IPAS Kelas V Sekolah Dasar. *Jurnal Pendidikan Tambusai*, *8*(1).

Espinosa Andrade, A., Padilla, L., & Carrington, S. J. (2024). Educational Spaces: The Relation Between School Infrastructure And Learning Outcomes. *Heliyon*, *10*(19), e38361. https://doi.org/10.1016/j.heliyon.2024.e38361

Fatmawati, L. W., Suryanti, H. H. S., & Widyaningrum, R. (2023). Analisis Hasil Belajar Peserta Didik Pada Pembelajaran Tematik. *Jurnal Sinektik*, *4*(1), 71–79. https://doi.org/10.33061/js.v4i1.4067

Gregorio, J. M., & Rabut, J. (2024). Strategic Intervention Materials Using Lumi Education (SIMULE) and Students' Conceptual Understanding and Procedural Fluency. *Psychology And Education: A Multidisciplinary Journal*, *20*(9). https://doi.org/10.5281/ZENODO.11651941

Han, M., & Kim, H. (2019). Elementary Students' Modeling Using Analogy Models to Reveal the Hidden Mechanism of the Human Respiratory System. *International Journal of Science and Mathematics Education*, *17*(5), 923–942. https://doi.org/10.1007/s10763-018-9895-x

Harahap, L. K., & Siregar, A. D. (2020). Pengembangan Media Pembelajaran Interaktif Berbasis Adobe Flash CS6 Untuk Meningkatkan Motivasi Dan Hasil Belajar Pada Materi Kesetimbangan Kimia. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *10*(1), 1910. https://doi.org/10.26740/jpps.v10n1.p1910-1924

Hidayah, N., Nasir, N., Afriana, S., & Nur Shawmi, A. (2021). Development Of Environment-Based Islamic Comic Learning Media At Class Iv In Elementary School. *JIP Jurnal Ilmiah PGMI*, *7*(1), 41–51. https://doi.org/10.19109/jip.v7i1.8276

Ismiyanti, N. (2020). Perancangan Pembelajaran IPA Menggunakan Software Videoscribe. *VEKTOR: Jurnal Pendidikan IPA*, *1*(2), 50–58. https://doi.org/10.35719/vektor.v1i2.11

Ismiyanti, Y., Permatasari, D., Mayasari, N., & Qoni'ah, M. (2023). The Impact of Video-Based Learning to Cognitive Learning Outcome of Student in Elementary School. *JIP Jurnal Ilmiah PGMI*, *9*(1), 51–60. https://doi.org/10.19109/jip.v9i1.17270

Jailobaeva, K., Jailobaev, T., Baialieva, G., Ismanbaeva, R., Kirbasheva, D., & Adam, M.-A. (2023). Empowering Parents And Promoting School And Teacher Accountability And Responsiveness: Case Of Kyrgyzstan. *International Journal of Educational Development*, *103*, 102899. https://doi.org/10.1016/j.ijedudev.2023.102899

Kassa, M. M., Azene, M. K., Mengstie, S. M., & Ferede, M. W. (2024). Effect Of Using Multimedia And Dynamic Classroom Integrated Instruction On Grade 11 Students' Biology Academic Achievement. *Heliyon, 10*(18), e37315. https://doi.org/10.1016/j.heliyon.2024.e37315

Kim, D., & Lee, M. K. (2024). Effectiveness of Postoperative Dietary Intervention in Patients with Gastric Cancer who Underwent Gastrectomy: Quasi-Experimental Study Design. *Seminars in Oncology Nursing, 151797*, 1–9. https://doi.org/10.1016/j.soncn.2024.151797

Kurniadi, A., Popoi, I., & Mahmud, M. (2020). Pengaruh Kompetensi Profesional Guru Terhadap Motivasi Belajar Siswa. *Jambura Economic Education Journal, 2*(1). https://doi.org/10.37479/jeej.v2i1.4425

Li, H., Zhang, T., Woolley, J. D., An, J., & Wang, F. (2023). Exploring Factors Influencing Young Children's Learning From Storybooks: Interactive And Multimedia Features. *Journal of Experimental Child Psychology, 233,* 105680. https://doi.org/10.1016/j.jecp.2023.105680

Lohr, A., Sailer, M., Stadler, M., & Fischer, F. (2024). Digital Learning In Schools: Which Skills Do Teachers Need, And Who Should Bring Their Own Devices? *Teaching and Teacher Education, 152*, 104788. https://doi.org/10.1016/j.tate.2024.104788

Mahardika, I. K., Rudiansyah, M. I. M. Y., Yushardi, Rasagama, I. G., & Doyan, A. (2020). Characteristics Of Textbooks Based On The Sets (Science, Environment, Technology, And Society) Of The Respiratory System To Improve The Ability Of Junior High School Students To Multi-Representations. *Journal of Physics: Conference Series, 1465*(1), 012069. https://doi.org/10.1088/1742-6596/1465/1/012069

Marbun, F., Ritonga, M. U., & Hadi, W. (2024). Feasibility Analysis Of Description Text Teaching Materials Helped By Lumi Education In Class VII SMP. *Journal Of Teaching And Learning*.

Masdar Limbong, Firmansyah, Fauzi Fahmi, & Rabiatul Khairiah. (2022). Sumber Belajar Berbasis Media Pembelajaran Interaktif di Sekolah: Learning Resources Based on Interactive Learning Media in School. *Decode: Jurnal Pendidikan Teknologi Informasi, 2*(1), 27–35. https://doi.org/10.51454/decode.v2i1.27

Mayer, R. E. (2002). *Psychology of Learning and Motivation* (Vol. 1).

Munawaroh, I., Sulthoni, S., & Susilaningsih, S. (2022). Pengembangan Multimedia Interaktif Materi Sistem Peredaran Darah Manusia Untuk Kelas V Sekolah Dasar. *JKTP: Jurnal Kajian Teknologi Pendidikan, 5*(2), 190–199. https://doi.org/10.17977/um038v5i22022p190

Munley, B., Buser, A. T., Gaudreau, S., Breault, J. L., & Bazzano, L. A. (2018). An Analysis of Informed Consent Form Readability of Oncology Research Protocols. *Journal of Empirical Research on Human Research Ethics, 13*(4), 363–367. https://doi.org/10.1177/1556264618795057

Naik, G., Chitre, C., Bhalla, M., & Rajan, J. (2020). Impact Of Use Of Technology On Student Learning Outcomes: Evidence From A Large-Scale Experiment In India. *World Development, 127,* 104736. https://doi.org/10.1016/j.worlddev.2019.104736

Napitupulu, O. R., Restuati, M., & Hasruddin. (2019). An Analysis of Students High Order Thinking Skills in Respiratory System Through a Scientific Approach. *Proceedings of the 4th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2019)*. Proceedings of the 4th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2019), Medan City, Indonesia. https://doi.org/10.2991/aisteel-19.2019.20

Nurzannah, S. (2022). *Peran Guru dalam Pembelajaran. 2*(3).

Ogris, A. (2022). *Improving Distance Learning In An Object Oriented Modeling Lecture By Enhancing Digital Media With H5P*. Technische Universität Wien.

Oksaviona, V., Islami, N., & Nasir, M. (2023). Development of PBL-Based Sound Wave Interactive Multimedia Using Lumi for Class XI High School Students. *Jurnal Penelitian Pendidikan IPA*, *9*(10), 8008–8015. https://doi.org/10.29303/jppipa.v9i10.4426

Ramadhani, D. A., & Muhroji, M. (2022). Peran Guru dalam Meningkatkan Motivasi Belajar pada Peserta Didik di Sekolah Dasar. *Jurnal Basicedu*, *6*(3), 4855–4861. https://doi.org/10.31004/basicedu.v6i3.2960

Rohmah, A. N. (2017). *BELAJAR DAN PEMBELAJARAN (PENDIDIKAN DASAR). 9*(2).

S. Matana, M. D., Maryati, S., & Koem, S. (2024). Development of Lumi Education Learning Media Based on H5P for Atmospheric Dynamics Subject at Senior High School 1 Gorontalo. *JPG (Jurnal Pendidikan Geografi)*, *11*(1). https://doi.org/10.20527/jpg.v10i2.16278

Smida, Z., Cucala, L., Gannoun, A., & Durif, G. (2022). A Wilcoxon-Mann-Whitney spatial scan statistic for functional data. *Computational Statistics & Data Analysis*, *167*(107378), 1–16. https://doi.org/10.1016/j.csda.2021.107378

Susilowati, A., & Sutama. (2022). Kesulitan Belajar IPS pada Siswa Sekolah Dasar: Studi pada SD Muhammadiyah Kota Bangun, Kutai Kartanegara. *JIPSINDO (Jurnal Pendidikan Ilmu Pengetahuan Sosial Indonesia)*, *9*(1).

Universidad de Alicante, & Satorre Cuerda, R. (Eds.). (2022). *El Profesorado, Eje Fundamental De La Transformación De La Docencia Universitaria* (1st ed.). Editorial Octaedro. https://doi.org/10.36006/16394-1

Wang, J., Zhou, H., Chen, S., Tong, H., & Yang, Y. (2024). How Teachers Support Secondary School Students To Become Self-Regulated Learners In Technology-Enhanced Language Learning. *System*, *123*, 103313. https://doi.org/10.1016/j.system.2024.103313

Wei, X., Saab, N., & Admiraal, W. (2021). Assessment Of Cognitive, Behavioral, And Affective Learning Outcomes In Massive Open Online Courses: A Systematic Literature Review. *Computers & Education*, *163*, 104097. https://doi.org/10.1016/j.compedu.2020.104097

Widayanti, Y. (2023). Penerapan Video Interaktif Berbasis "Lumi Education" Untuk Meningkatkan Minat Belajar Kimia Peserta Didik. *Proceedings Series of Educational Studies*.

Widodo, S. A., & Wahyudin. (2018). Selection of Learning Media Mathematics for Junior School Students. *The Turkish Online Journal of Educational Technology*, *17*(1).

Yáñez De Aldecoa, C., & Gómez-Trigueros, I. M. (2022). Challenges with Complex Situations in The Teaching and Learning of Social Sciences in Initial Teacher Education. *Social Sciences*, *11*(7), 295. https://doi.org/10.3390/socsci11070295