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DEVELOPMENT OF ELECTRONIC TEACHING MATERIALS BASED ON ENRICHED VIRTUAL MODEL ON HUMAN RESPIRATORY SYSTEM MATERIALS TO IMPROVE STUDENT'S COGNITIVE ABILITY

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ABSTRACT

This study aims to produce electronic teaching materials based on blended learning enriched virtual models that are valid, practical, and effective in improving students' cognitive abilities. This type of research is Research and Development (R&D). The subjects in this study were 15 students of class VIII junior high school. Two expert validators and one practitioner carry out validation to assess the product from the aspects of presentation, content, and language. Practicality is assessed based on the implementation of learning, student activities, and student responses to electronic teaching materials. Effectiveness is assessed based on THB. The study results obtained: (1) The design of electronic teaching material products discusses the structure and function of the organs of the human respiratory system equipped with images, audio, and video. (2) The validation of these electronic teaching materials obtained an average score of 93% (very valid). (3) The practicality test score from the learning implementation results obtained 100% (very good), the student activity score was 89.5% (very good), and the student response results obtained 95% (very good). (4) The effectiveness test results based on N-Gain analysis obtained an average score of 0.7 medium criteria. Thus, the electronic teaching materials developed are suitable for learning support to improve students' cognitive abilities in the human respiratory system material. The research implies that it can be of information for broader research.

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INTRODUCTION

As information and communication technology develops, the learning process also develops. E-learning is learning by utilizing technology (Ambrose & Laura, 2013). Innovations in education today require that learning occurs not only in the classroom or face-to-face but is carried out in a blended or combined manner. According to Husamah (2014), blended learning is a combination of online and face-to-face meetings in a learning activity. This learning model combines conventional learning with technology. Therefore, the process needs to be supported by the availability of learning support in the form of teaching materials so that the delivery of concepts can be better.

During the implementation of the Introduction to Schooling Environment II (PLP II) at SMP Negeri 5 Gorontalo, it was found that most of these junior high school students already had smartphones. However, the learning process had not used these smartphones properly to support their learning needs. In addition, the teacher stated that the availability of existing learning resources was only based on the content summary book and practice questions. One of the crucial components in learning activities is teaching materials. The quality of classroom learning will increase if the teaching materials used in the learning process are developed according to the needs of educators and used correctly (Sadjati, 2021). Arsyad (2014) argues that the development of teaching materials is expected to improve learning outcomes and student learning activities using learning whose stages are combined with the rules of a scientific approach.

The preliminary study conducted in this study was an interview with a science subject teacher, and information was obtained that the average value of the formative test for the respiratory system material in humans is still below the KKM standard (Minimum Completeness Criteria), which is 50-60 while the standard KKM value is 70. Other information obtained is that students' lack of interest in online learning is one of the causes of the low formative scores. It is indicated that smartphones should be used to access information on learning materials but have not been used optimally.

Based on the problems found, it shows that the school does not yet have teaching materials that utilize technology to support online (virtual) and offline (face-to-face) learning, which is the cause of the lack of student interest and not achieving the predetermined KKM value standards. So that an effort is needed to improve students' cognitive abilities and interests, namely by developing teaching materials that utilize current technological advances. Developing these electronic teaching materials can increase students' interest in learning. The presentation of these teaching materials is not only in the form of writing but also pictures, audio, and video that will help students get efficient learning resources in online and offline learning. The learning process using electronic teaching materials is recommended in learning to attract students' interest in learning (Yunita & Hamdi, 2019).

The current learning system is done online (E-Learning). Electronic teaching materials based on the Blended Learning Enriched Virtual model follow the learning characteristics that are currently applied. This virtual model is an online learning and face-to-face meetings with teachers as support for enriching virtual knowledge (Gusmawan & Priatna, 2020). In line with Halimah (2019), The use of technology in learning is a form of learning technology innovation that seeks to integrate information and communication technology with learning content. This development research is expected to be one of the learning innovations that help teachers in the current learning process.

The results of previous research by Gusmawan & Priatna (2020), the development of teaching materials for blended learning models can facilitate the achievement of students' mathematical critical thinking skills on derivative application topics and attract students' interest in learning independently with the help of the GeoGebra application. Other studies were also conducted by Sriwahuni et al. (2019) regarding developing electronic teaching materials using Flip PDF professional on optical instrument materials produced validly. However, whether these electronic teaching materials can improve students' cognitive abilities has not been studied. Therefore, it is necessary to conduct new research to overcome the problems found in schools, namely increasing students' cognitive

abilities on the material of the human respiratory system. The difference between this study and previous research is that it facilitates the concept of online and offline learning by utilizing applications in the presentation of teaching materials, namely electronic teaching materials based on blended learning enriched virtual models that take advantage of technological advances by using the Flip PDF professional application. This enriched virtual model is carried out online and offline (face to face) (Dewi et al., 2019). This professional Flip PDF application has advantages, namely electronic teaching materials developed using this application, it looks more attractive, there are learning videos, and interactive quizzes (Sriwahyuni et al., 2019).

The purpose of this research is to produce electronic teaching materials that are valid, practical, and effective in improving students' cognitive abilities on the material of the human respiratory system.

RESEARCH METHOD

This research was conducted from January 2022 to February 2022 at SMPN 5 Gorontalo. This type of research is a research development or Research and Development (R&D), while the stages of the R&D method consist of several activities, namely starting from a preliminary study, electronic teaching material design, electronic teaching material validation, electronic teaching material revision, trial limited scale and produce valid, practical and effective electronic teaching materials. This research targets the students of SMP Negeri 5 Gorontalo class VIII, totaling 15 people for a limited trial. The instruments used are validation sheets, learning implementation sheets, student activity sheets, student response sheets to electronic teaching materials, and learning outcomes test sheets.

The process of developing these teaching materials is carried out by preliminary studies and collecting information using initial observations, designing products, then validating instruments to expert validators and practitioners, making grids and statements in response questionnaires, and making learning outcomes test questions (pretest and posttests) consisting of 15 questions with categories C1-C6.

Data analysis was carried out to obtain valid, practical, and effective results by calculating the percentage of scores obtained using the formula which is a reference from Yazid (2016), Ayuningtiyas and Ipah (2021), Mustofah et al. (2021). Scoring validation of electronic teaching materials using a Likert scale with a range of 1-5. The results of the percentage of validity can be seen in Table 1.

Table 1. questionnaire score criteria

Penilaian	Nilai/Skor
Sangat Valid	86-100
Valid	71-85
Cukup Valid	56-70
Kurang Valid	41-55
Tidak Valid	40-0

The practicality of electronic teaching materials is assessed based on the implementation of learning, student activities, and student responses. The calculation of the implementation of learning is interpreted in Table 2.

Table 2. Category of Learning Implementation

Answer	Score
0%-20%	Very less
21%-40%	Less
41%-60%	Fair
61%-80%	Good
81%-100%	Very good

Student activities can be seen from observers' observations of the overall students according to the number of students determined. The assessment of student activities is in the form of a checklist, while the scoring of student activities is assessed using a score scale of 1 to 4 with less-very good criteria. The results of the calculation of the percentage of student activities are interpreted in Table 3.

Table 3. Category of Student Activities

Answer	Score
0-20	Very less
21-40	Less
41-60	Fair
61-80	Good
81-100	Very good

Student response scoring was analyzed using the Guttman scale with YES or NO ratings. The results

of the calculation of the percentage of students' responses to the limited-scale trial were interpreted in Table 4.

Table 4. Interpretation of Student Response Questionnaire Scores

Average	Respon criteria
0-20%	Not practical
21-40%	Less practical
41-60%	Fair
61-80%	practical
81-100%	Very practical

After the data was analyzed using the t-test, and there was a significant effect on the pretest and post-test questions, it was analyzed using the N-Gain test. The results of the N-Gain calculation are then categorized into three categories which can be seen in table 5.

Table 5. Criteria of N-Gain score

Score	Criteria
0.70 < N-Gain	High
0.3 < N-Gain < 0.70	Moderate
N-Gain < 0.30	Low

RESULT AND DISCUSSION

The results of the recapitulation of the validation of the developed electronic teaching materials obtained a score in aspects of 1) the quality of the presentation of the material and content obtained a value of 95% with very valid criteria. Aspect 2) the truth and breadth of the concept get a score of 87% with valid criteria, and aspect 3) Language feasibility gets a score of 97% with very valid criteria. The validity of electronic teaching materials is obtained from the results of the validation carried out at the development stage. Validation analysis has been assessed through predetermined aspects that become benchmarks in determining validation criteria. Electronic teaching materials that have been revised have the advantage that they are easy for students to use and can be used anywhere. In line with Haris (2011), electronic teaching materials have been proven to be much more concise and easier for students to access using smartphones anytime and anywhere. The total number of the three aspects assessed reached an average of 93% with very valid criteria, as shown in Figure 1.

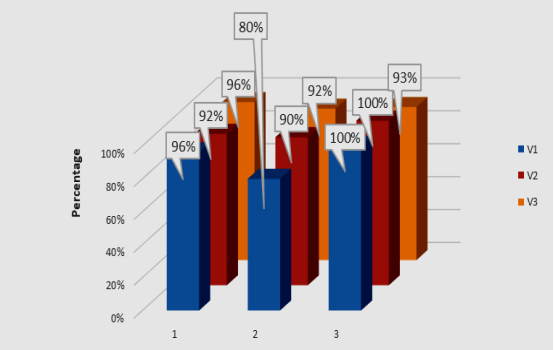

Figure 1. Graph of Validator Assessment Results, (1) aspects of the quality of presentation of material and content, (2) truth and breadth of concepts, and (3) appropriateness of language. V1 & V2: Expert Validators, V3: Practitioner Validators.

Seperti yang dikemukakan oleh Prasetiyo *et al.* (2017) hasil dari validasi yang diperoleh rata-rata presentase hasil penilaian sebesar 91,6%-100% dengan kriteria penilaian sangat valid. Berdasarkan hasil uji validasi maka bahan ajar elektronik telah dapat diimplementasikan dalam proses pembelajaran di SMP Negeri 5 Gorontalo.

Hasil kepraktisan bahan ajar elektronik dilihat berdasakan hasil keterlakasanaan pembelajaran, aktivitas siswa dan respon siswa. Hasil pengamatan keterlaksanaan pembelajaran yang dilaksanakan pada dua pertemuan yaitu *online (virtual)* dan *offline* (tatap muka) memperoleh hasil yang baik, yakni pada pertemuan I *online (virtual*) memperoleh skor 100% dan pertemuan II *offline* (tatap muka) memperoleh skor 100% dengan kriteria sangat baik (Gambar 2). Hal ini sesuai yang dikemukakan oleh Rahayu *et al.* (2017) hasil penilaian keterlaksanaan pembelajaran sebesar 92%-100% termasuk dalam ketegori sangat baik.

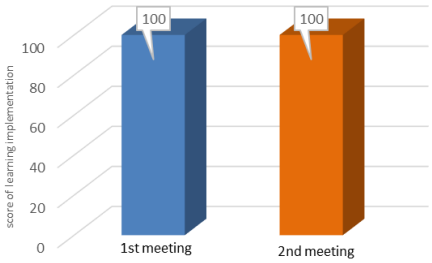

Figure 2. Graph of Learning Implementation

Pada pertemuan *online (virtual*) yang di laksanakan melalui *Google Meet* guru dituntut untuk dapat melaksanakan seluruh aspek dalam keterlakasanaan pembelajaran melalui aktivitas

guru, dengan keterlaksanaan aktivitas guru dapat memberikan dampak besar terhadap hasil belajar siswa. Syaifudin, *et al.* (2017) menuliskan bahwa tenaga pendidik atau guru merupakan salah satu komponen pendidikan yang penting untuk ditingkatkan kompetensinya karena melalui perantara gurulah awal perbaikan mutu perbaikan.

Hasil pengamatan aktivitas siswa pada pertemuan I *online (virtual)* diperoleh skor 89% dengan kriteria sangat baik. Pada uji coba terbatas pertemuan I aspek memberikan tanggapan atas apersepsi yang disampaikan guru memperoleh skor 3 dengan kriteria baik yakni siswa memperhatikan penjelasan guru, tampak fokus mengarahkan pandangan ke guru. Aspek siswa menanyakan hal yang tidak dipahami dalam materi memperoleh skor 3 dengan kriteria baik yakni siswa berani memberikan pertanyaan terkait hal-hal yang tidak dipahami tatapi tidak menggunakan bahasa yang sopan. Menurut Adriana (2018) perkembangan bahasa anak dipengaruhi oleh perkembangan neurologis dan perkembangan biologisnya. Seorang anak tidak dapat dipaksa atau dipacu untuk mengucapkan sesuatu, bila kemampuan biologisnya belum memungkinkan karena ada keterkaitan antara perkembangan biologi dengan kemampuan berbahasanya.

Pengamatan aktivitas siswa pada pertemuan II *offline* (tatap muka) dieproleh skor 90% dengan kriteria sangat baik. Pada pertemuan II aspek melakukan diskusi dengan 1 kelompok diperoleh skor 3 dengan presentase baik yakni siswa berdiskusi dengan teman 1 kelompok tetapi hanya memberikan pendapat ketika ditanya, sehingga saat proses belajar mengajar siswa lebih banyak diam. Haryadi (2014) juga menuliskan bahwa terdapat beberapa faktor yang menyebabkan siswa takut bertanya dan mengemukakan pendapat diantaranya adalah takut dianggap bodoh oleh temannya dan takut menyampaikan pendapat karena bingung cara meyampaikannya.

Hasil respon siswa diperoleh dari memberikan angket kepada siswa setelah pembelajaran selesai. Berdasarkan hasil uji respon siswa, pertanyaan 1,2,3,4,5,6,7,8,9, dan 10 memperoleh nilai 86% dan 100% dengan kategori sangat baik pada rentang 81%-100%. Pada pertanyaan 11 memperoleh nilai 80% dengan kategori baik pada rentang 61%-80%. Total keseluruhan hasil uji respon memperoleh 95,15% dengan kriteria sangat baik yaitu pada rentang 81%-100% dapat dilihat pada gambar 3.

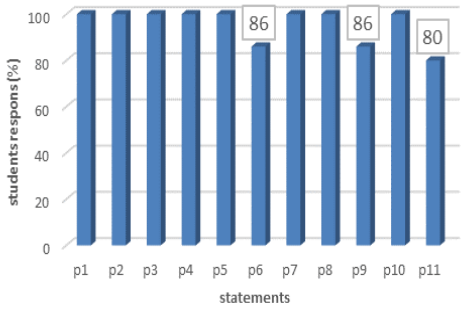

Figure 3. Student Response, P1-P3: Presentation of Electronic Teaching Materials, P4-P9: Material Concepts, P10-P11: Benefits

The results of student responses obtained are 95% with very good percentage criteria because two students answered no to question 6: the material provided in this electronic teaching material is easy to understand and question 11: electronic teaching material makes me interested in learning, so the results This limited test student response questionnaire gave a positive response to electronic teaching materials for the human respiratory system and can be said to be effective during the learning process. According to Kadir (2018), student responses to products used in learning are said to be effective if at least 75% of students give positive responses to products used in the learning process.

The effectiveness of electronic teaching materials is seen from the limited test student learning outcomes consisting of 10 multiple choice questions and five essay questions with question levels containing categories C1-C6. The pretest and post-test learning results show that students' cognitive abilities are 100% incomplete, the highest score obtained by students is 45, and the lowest is 15. Students do not know the learning material to be studied. In the post-test learning outcomes, the highest score reached 89, while the lowest score obtained by students was 65, and there were still students who did not meet the Minimum Completeness Criteria (KKM) that the school, namely 70, had set. According to Ayuningtyas and Minarti (2021), student learning outcomes were declared complete. Suppose students can

consciously increase their independence during the learning process. In line with Atmojo (2013), students who study thoroughly are primarily students who are active in learning activities. measured by giving tests to students. Helpful in getting the information needed in the learning process. To determine students' cognitive abilities, the government applies a cognitive domain that is not only at a low level of thinking but also at a high level of thinking. Agree with Agustina and Mulyani (2016) that the value of knowledge is obtained from the results of tests given to students in class. Therefore, the pretest and posttest learning outcomes have met met a significant value of $p<0.05$ through the t-table test with a significant value of 0.00. Analysis of the N-Gain value showed that 15 students obtained an average N-Gain score of 0.7 in the medium category, which can be seen in table 4. This value has achieved the objectives of this study, meaning that most students can achieve a high score. The school has determined that the minimum score to pass is 70.

Table 6. Analysis of N-Gain in Product Trials

Average			N-gain category
Pre-test	***Post-test***	**N-*gain***	
29,13	79,53	0,7	Moderate

CONCLUSION

Based on the results of research and discussion, it can be concluded that this study produces electronic teaching materials for the human respiratory system material for class VIII Junior School to improve students' cognitive abilities. The electronic teaching materials developed were declared to be very valid based on the validator's assessment with an average score of 93%, practicality seen from the observation of 100% learning implementation, very good student activity with an average acquisition of 89.5%, and positive responses given by students 95 %. Effectiveness can be seen by increasing student learning outcomes, as seen from the results of the N-Gain analysis obtaining moderate criteria with an average score of 0.7. Thus the electronic teaching materials in the limited test of 15 students can be used in the learning process at SMP Negeri 5 Gorontalo.

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