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Development of Integrated Science Microlearning Learning Media with Lontara Bugis Local Wisdom Based on Responsive Website Design (RWD)

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Abstract: The research carried out has the aim of developing science microlearning learning media integrated with regional letters that is feasible, practical and effective. The development research (R&D) method was designed using the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model. The small-scale experiment was tested on 9 grade 8 students at SMPN 2 Marioriwawo and the large-scale experiment was implemented in the experimental group (8.2) of SMPN 2 Marioriwawo with 27 students. The research results in this study prove that the science microlearning learning media integrated with Lontara Bugis local wisdom based on Responsive Website Design (RWD) is very suitable for use in science learning. The practicality test based on teacher and student responses has very practical criteria. The effectiveness of the product was tested through an experimental method through a post-test only control group design research design. Hypothesis testing uses an independent sample t-test with significance results (2-tailed) = 0.01 < 0.05, which means that the learning outcomes of experimental class students are higher than the scores of control class students. The resulting responses from experimental class students were in the positive category. So the conclusion of this research is that the learning media products developed are feasible, practical and effective for use as media in the teaching and learning process (PBM).

Keywords: Instructional media; Local wisdom; Microlearning; Responsive web

Introduction

In the 21st Century, the explosion of innovation and use of information and communication technology (ICT) has increased the use of digital devices for various purposes in the world of work and in formal and non-formal education. Now we are facing the Industrial Revolution 4.0 or what is usually called a disruptive era, where information and communication technology innovation is developing very rapidly. The Industrial Revolution 4.0 also introduced us to the "Education Era 4.0". Education 4.0 is a response that arises to the needs of the current industrial revolution by adapting a new curriculum to be implemented in an era like today. The development of ICT has greatly influenced the field of education, such as the digitalized teaching and learning process (PBM). This digitalization has introduced the world of education to the concepts of electronic learning (e-learning), mobile learning (m-learning) and digital learning (d-learning).

According to Kumar Basak et al. (2018), the terms e-learning, m-learning and d-learning are used indifferently or in a complementary way to define technological learning. Jamun (2018) said that the development of ICT has resulted in the wider understanding of e-learning, namely learning processes that are supported by technology such as the internet, computers, audio-video and smartphones. Frolova et al.

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(2020) stated that the basis of digitalization is the widespread introduction of electronic resources and digital technologies in pedagogical practice, which opens up wide opportunities for the formation of students' competencies. In particular, digital education is closely related to the possible use of electronic content, electronic educational environments, social media, virtual reality technologies and open information systems.

The Covid-19 pandemic has resulted in learning loss in various countries, not only in Indonesia. This was caused by the closure of schools and the transfer of PBM from face-to-face learning to virtual learning during the pandemic. Evaluation of the 2013 Curriculum (K13) carried out by the ministry of education and culture in several regions in the country found that the learning load that students had to bear was too much. Most teachers still think that (mastery learning) is how students complete all lesson material and instead ignore students' understanding. Therefore, systemic change is needed, not just school or regional interventions. Students are expected to study essential materials to catch up caused by school closures and online learning. The quality of learning must be prioritized over quantity in pursuing learning loss (Anggraena et al., 2022).

Distribution of data from the Central Statistics Agency (BPS) regarding education statistics for 2021 shows that students (aged 5-24 years) at all levels of education use cell phones more than computers. The use of cell phones by students has continued to increase over the last 4 years, namely cell phones with data distribution for 2018 (67.36%), 2019 (71.48%), 2020 (77.12%), and 2021 (86.83%). Meanwhile, students who use computers have continued to decrease over the last 4 years with data distribution for 2018 (32.04%), 2019 (24.52%), 2020 (24.11%), and 2021 (17.30%). A survey conducted by the Ministry of Education and Culture (2020) shows that the higher the level of education, the more use of cell phones and computers increases.

The development of ICT in the education sector raises challenges that teachers must overcome, namely having to have qualifications in the field of ICT. Based on data from BPS regarding the use and utilization of information and communication technology (P2TIK) in the 2018 education sector, teachers who have qualifications in the field of ICT, for all levels of education, are 10.10%. Based on educational level, the highest education level is SMA and equivalent (14.43%), followed by SMP and equivalent (11.33%), then elementary school and equivalent (6.90%).

ICT developments also have a disruptive impact. Such as the erosion of existing values in society due to the rapid pace of ICT development. One element of local wisdom that has been sidelined in this era is local language. Indonesia is a country rich in linguistic diversity. On the one hand, Indonesia's linguistic diversity is very valuable. However, on the other hand, the existence of these regional languages will one day be eroded by increasingly sophisticated digitalization of information (Purba, 2021). One of the regional languages in Indonesia is the Bugis regional language in South Sulawesi using the Lontara Bugis script. According to Hadrawi et al. (2017), the level of ability of students at Putri Mangkoso Middle School, Barru district in reading Lontara texts is generally below average. According to him, the symptoms of students' weakness in learning Lontara and speaking Bugis are common things experienced by today's young generation, especially in schools.

Even further, Fitrawahyudi et al. (2019) concluded that the Bugis-Makassar regional language is in danger of extinction (endangered languages) because the majority of respondents aged 17-22 in Maros district, South Sulawesi are no longer able to use the regional language correctly in the listening aspect, speaking, reading and writing. Microlearning is a learning method that can be used to catch learning loss. Micro learning and content is a method for conveying quantities of knowledge and information in a structured manner in the form of content with small and interconnected segments. Micro content refers to information whose length is determined by one topic, content that covers one idea or concept and can be accessed via a uniform resource locator (URL), mobile devices, e-mail and websites. Thus, micro content is an integrated part of micro learning (Giurgiu, 2017). To achieve Learning Outcomes (CP) effectively and efficiently, you can utilize technology-based learning using the microlearning method. With this micro learning method, teachers can create content that suits students' characters in various forms ranging from text, multimedia and so on which can be designed briefly (Rafli & Adri, 2022).

One solution that can be implemented in developing e-learning is to use website media (e-learning website) because it can be accessed from both cell phones and computers. However, in its development it is necessary to implement responsive web design (RWD) or known as responsive web, namely e-learning websites that are responsive (Putra et al., 2020). Responsive design in general is a way to create websites that can be viewed and used easily on all types of devices and screen sizes, from the smallest mobile phones to the largest desktop monitors (Peterson, 2014). According to researchers, responsive web can be used effectively to overcome differences in devices used by students in learning.

Preserving regional languages is a way to maintain local culture. One way to maintain the existence of the Bugis language is to apply it to the PBM. This can be done by integrating local content (Lontara Bugis) with

the subjects. The Merdeka Curriculum applies the principle of flexibility in applying local content in learning. In the 2013 Curriculum, local content is one subject. This policy was changed to the Merdeka Curriculum, where local content can be taught in three ways that educational units can choose, namely integrating local content into existing subjects, integrating local content into a project to strengthen the Pancasila student profile, or developing subjects specifically local content as is the case in the 2013 Curriculum (Anggraena et al., 2022). This research aims to determine the feasibility, practicality and effectiveness of science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD). The benefit of this research is that students can overcome learning loss that occurs due to the pandemic and as a means of conserving local wisdom in the form of the Lontara Bugis script which is threatened with extinction due to modern developments.

Method

Research Design and Procedures

The type of research used is research and development or better known as Research & Development (R&D) research. The media developed is Integrated Science Microlearning Learning Media with Lontara Bugis Local Wisdom Based on Responsive Website Design (RWD) on the subject matter of vibrations, waves and sound for class VIII SMP. This research produces a product in the form of science microlearning media which is integrated with Lontara Bugis script on the basis of a website that is responsive to students' devices, which is then tested on the product. Development in this research was carried out using the ADDIE development design developed by Dick & Carry (1996) (Figure 1). This model consists of five steps, namely Analysis, Design, Development, Implementation and Evaluation. This development model provides the opportunity to carry out evaluations at each stage of development. This can have a positive impact on the learning media being developed. The design stage of ADDIE development can be seen in Figure 1.

Figure 1. ADDIE model development stage

Population and Sample

The population in this study was class VIII students at SMPN 2 Marioriwawo, totaling 81 people. A small-scale trial sample was carried out on 9 students in class VIII of SMP 2 Marioriwawo for the 2022/2023 academic year. The students consisted of 3 students with high abilities, 3 students with medium abilities, and 3 students with low abilities. Sampling was carried out using purposive random sampling technique. This is because sampling is carried out by determining the characteristics of the sample first, namely students must have a smartphone, then the sample is selected randomly from a homogeneous population based on the teacher's opinion. The large scale trial sample for the experimental class is class VIII.2, totaling 27 students and for the control class, namely class VIII.3, totaling 26 students.

Data Analysis Technique

Data collection techniques use validation questionnaires from media experts, material experts, language experts, and teacher and student practicality questionnaires. By using a questionnaire, quantitative data was obtained in the form of suggestions and comments on the learning media being developed. The results of validation questionnaire analysis by media, language and material experts are used to determine the suitability of learning media. The results of the questionnaire analysis in the form of quantitative data will be interpreted using a Likert scale with a rating scale of 1-4. The score is assessed based on a percentage range and the qualitative criteria for the media suitability test based on Akbar (2017) can be determined in Table 1.

Teacher and student response questionnaires were used to determine the practicality of the learning media being developed. The score is assessed based on a percentage range and the qualitative criteria for the media suitability test based on Akbar (2017) can be determined in Table 2.

Table 1. Percentage Range and Qualitative Criteria for Learning Media Feasibility Test

Eligibility criteria (%)	Qualitative Criteria
85.01 – 100.00	Very worthy
70.01 – 85.00	Decent enough
50.01 – 70.00	Not worth it
01.00 – 50.00	Not feasible

Table 2. Percentage Range and Qualitative Criteria for Testing the Practicality of Learning Media

Eligibility criteria (%)	Qualitative Criteria
85.01 – 100.00	Very practical
70.01 – 85.00	Quite practical
50.01 – 70.00	Not practical
01.00 – 50.00	Not practical

Stage of Research Based on the Development of The ADDIE Model

The analysis stage is carried out in several stages, such as performance analysis to identify student problems during the learning process and needs analysis to identify material characteristics, student characteristics and the learning environment. This analysis is carried out to identify and measure the level of gaps that occur in learning. The Design Stage is carried out by formulating learning objectives on vibration, wave and sound material while still referring to the school curriculum, selecting appropriate learning media, namely microlearning media using a responsive web platform. Software selection is carried out to make product design more efficient while still producing quality products and designing instruments that will be used to create learning media. The Development Stage is carried out by creating products and instruments to be measured by media, material and language experts, each consisting of one expert, to obtain suggestions and comments on media improvements. A small scale test was carried out to see the practicality of the learning media developed involving 2 science teachers and 9 students with high, medium and low cognitive qualifications.

The implementation stage was carried out by conducting wide-scale tests using experimental and control classes selected using purposive random sampling techniques. Students take a post-test and fill out a positive response questionnaire after the learning process using the media developed. The evaluation stage is carried out at each stage of the research. Evaluation at the analysis stage is used to check whether the analysis is feasible until the media developed meets learning needs. Evaluation at the planning stage is carried out by selecting game characters, images, content and music. Evaluation at the development stage is carried out based on expert validation. The procedures for this research can be seen in Table 3.

Table 3. Research Procedures

Stage	Description
Analysis	Observations, interviews, literature studies related to student needs, materials and learning media used
Design	Develop learning tools, create research instruments, validate instruments, create learning media product wireframes, and carry out revisions
Development	Developing microlearning, integrating elements of local wisdom, creating a website using the RWD method, expert validation, collecting product feasibility data, limited trials (practicality data), and carrying out revisions
Implementation	Wide Scale Trials (product effectiveness data)
Evaluation	Evaluation at each stage of development and conducting data analysis

Result and Discussion

The discussion in this research discusses the results of the development of learning media that have been carried out to answer various questions related to the results of research in the development of science microlearning learning media integrated with Lontara Bugis local wisdom based on Responsive Website Design (RWD) on the subject matter of vibrations, waves and sounds for class VIII Marioriwawo 2nd Middle School. In general, there are 3 problem formulations that must be answered in this development research, namely how is the feasibility of the responsive web-based Lontara Bugis integrated science microlearning media for local wisdom for students at SMPN 2 Marioriwawo, how practical is the responsive web-based Lontara Bugis integrated local wisdom science microlearning media for students? students of SMPN 2 Marioriwawo, and how effective the responsive web-based Lontara Bugis local wisdom integrated science microlearning learning media is for students of SMPN 2 Marioriwawo. Based on the results obtained, the following matters can be discussed.

The Analyze stage aims to determine various problems and needs in the science learning process within the scope of SMPN 2 Marioriwawo. This stage is very important so that the product developed is in accordance with the teacher's performance, characteristics and needs of students. The process of understanding the characteristics and needs of students is very necessary, so that if it is ignored, the learning process will not run optimally (Janawi, 2019). Then further, Fauth et al. (2019) said that the quality of teaching is influenced by several aspects such as cognitive activities, a supportive environment and classroom management. So it can be concluded that understanding the characteristics and needs of students is very important. Based on the results of the analysis that has been carried out, science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) can be an alternative that can support the learning process at SMPN 2 Marioriwawo to make it more optimal. The development of science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) focuses on helping

students learn independently, focused and structured and students can develop awareness of the Lontara Bugis script.

Integrating elements of local wisdom in the form of Lontara Bugis script into learning materials is a form of researchers' concern for ancestral culture which has been eroded by developments over time and is a form of cultural conservation carried out by researchers in the field of education. Conservation of regional languages is very important so that the extinction of mother tongues in Indonesia does not increase. The Bugis language in the South Sulawesi region is one of the objects of regional language revitalization carried out by the Ministry of Education and Culture (Kemendikbud) together with 11 other provinces, namely North Sumatra, West Java, Central Java, Bali, West Nusa Tenggara, East Nusa Tenggara, East Kalimantan, Central Kalimantan, Maluku, North Maluku and Papua (Ministry of Education and Culture Web Management, 2022). According to researchers, integrating elements of local wisdom in learning is very appropriate as stated by Uge et al. (2019) that local wisdom is one of the nation's unique cultural heritages and is very important to be explored, maintained and studied by students through the learning process.

The second stage is design in the form of adjusting KI and KD to produce competency achievement indicators (GPA) and learning objectives that are integrated with elements of local wisdom. Examples of local wisdom that are integrated into the material in the learning media being developed are the Bugis harp (kEcpi aogi) which is a stringed musical instrument of the Bugis community, Mattojang (mtoj) is a community swing tradition during the harvest festival (Pagga, 2019; Tenri & Pananrangi, 2021) . Then proceed to design the website wireframe using Axure RP 9. Axure RP is a program that is usually used to build a prototype of a website. Axure RP provides an effective solution for front-end web developers (Robinson & Kelley, 2020; Hongyan, 2019). A front-end developer is someone who is tasked with developing the graphical user interface of a website, through the use of HTML, CSS, and JavaScript, so that users can access and interact with the website (Prasetiyo et al., 2022).

Development stage, at this stage the collection of teaching materials is carried out in accordance with the GPA and learning objectives that have been formulated. The development of science microlearning learning media products integrated with Lontara Bugis local wisdom based on responsive website design (RWD) was carried out in two development stages, namely creating micro content (microlearning) and creating a responsive web. Micro content in the form of images is designed using Photoshop C6, CorelDraw 2019 and Adobe Illustrator 2019 applications. Digital design development should not only be limited to one particular application. However, a combination of several applications is needed to produce maximum variations in shape and artistic effect (Sugiarto et al., 2021).

Photoshop is a popular application in the field of graphic design because it is practical to use, simple to operate so that user creativity can be developed. Then CorelDraw and Adobe Illustrator are professional vector-based applications that allow users to design objects freely by adjusting the resolution to avoid output with broken images. Adobe Illustrator has the ability to manage SVG (Scalable Vector Graphics) files which are suitable for websites (Wu, 2020; Ma et al., 2020; Lubis et al., 2022). Micro content in the form of video and sound is designed using the Camtasia 2022 application. Camtasia is software developed by TechSmith Corporation. Camtasia has various advantages, such as being easy to use for video and sound editing and having a screen recording feature that can record the user's laptop screen activity (Widada et al., 2020).

Responsive web is built using the Visual Studio Code (VS Code) application in its development. VS Code is a text editor application that can be used to develop an application in native code (machine language) developed by Microsoft and has several advantages. VS Code is free for personal or commercial use. The core feature of VS Code is its extension support, users can add languages, debuggers, and various extensions to the user's installation to carry out development better (Tan et al., 2023). Website design that uses responsive techniques aims to make it easier for users to interact with the learning media products being developed. This is because by using responsive website design techniques, designers can design websites that can be accessed at various types of resolution, density and aspect ratio on various types of devices (Lestari et al., 2020; Megawaty & Putra, 2020). So according to researchers, by using a responsive web base, students can maximize the independent learning process. In line with Ramadhan (2019) in his research, responsive web-based learning media can facilitate and be suitable for students to use in overcoming the lack of face-to-face learning hours in class through independent learning.

The novelty element of the learning media developed by researchers is the integration of local wisdom in the form of case examples and Lontara Bugis script on the subject matter of vibrations, waves and sound. The main feature of the learning media product being developed is the language switching feature, namely the ability for users to change the language of the subject matter from Indonesian to Bugis (using Lontara Bugis script) and vice versa. With this feature, researchers hope that users can understand the essential material presented and can develop users' abilities to use

the Bugis language in everyday life as an effort to conserve culture in the field of education.

This research involved three expert validators, namely material experts, media experts and language experts. A good development product to use is a product that has good category validity (Pribowo, 2018). The results of the feasibility test in this research must be at least valid criteria for feasibility testing and at least practical criteria for practicality testing of the product being developed. Practicality test data was taken at the small scale trial stage with a sample of 9 students in class VIII of SMPN 2 Marioriwawo consisting of 3 students with high ability, 3 students with medium ability and 3 students with low ability based on the perception of science subject teachers.

The small-scale trial consists of 2 stages, namely the distribution of learning media product links (http://kuliah.unnes.ac.id/~teguh_s2ipa) on the researcher's Facebook page on Wednesday 8 March 2023 and the distribution of practicality questionnaires to students on Saturday 11 March 2023. After that, researchers carried out a process of revising learning media products based on teacher and student responses at the small-scale trial stage. The final results of the science microlearning media product integrated with Lontara Bugis local wisdom based on responsive website design (RWD) with Indonesian language content can be seen in Figure 2 to Figure 6.

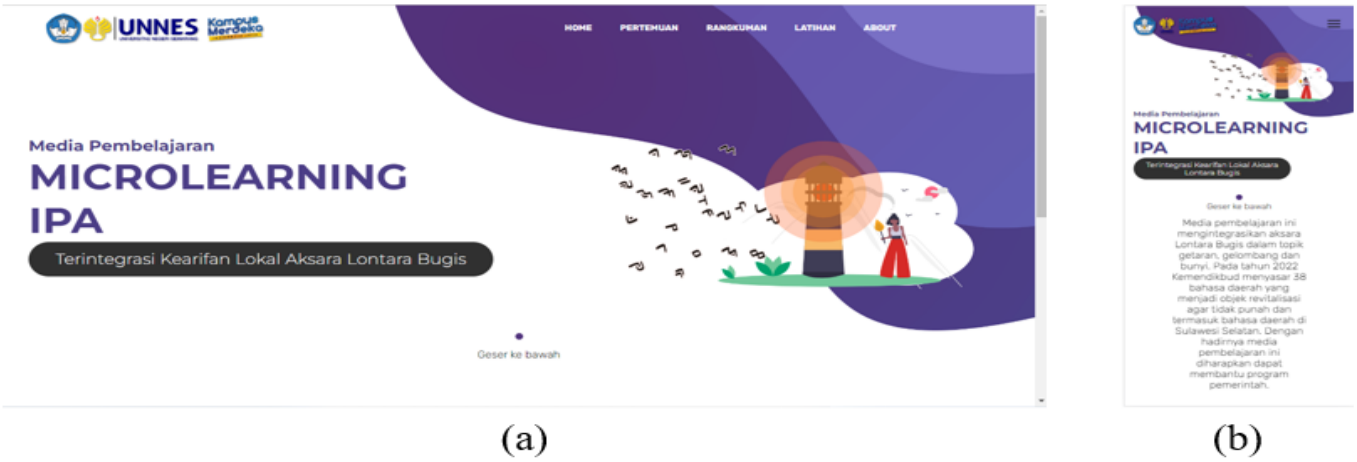

Figure 2. Home page (a) PC, (b) Mobile

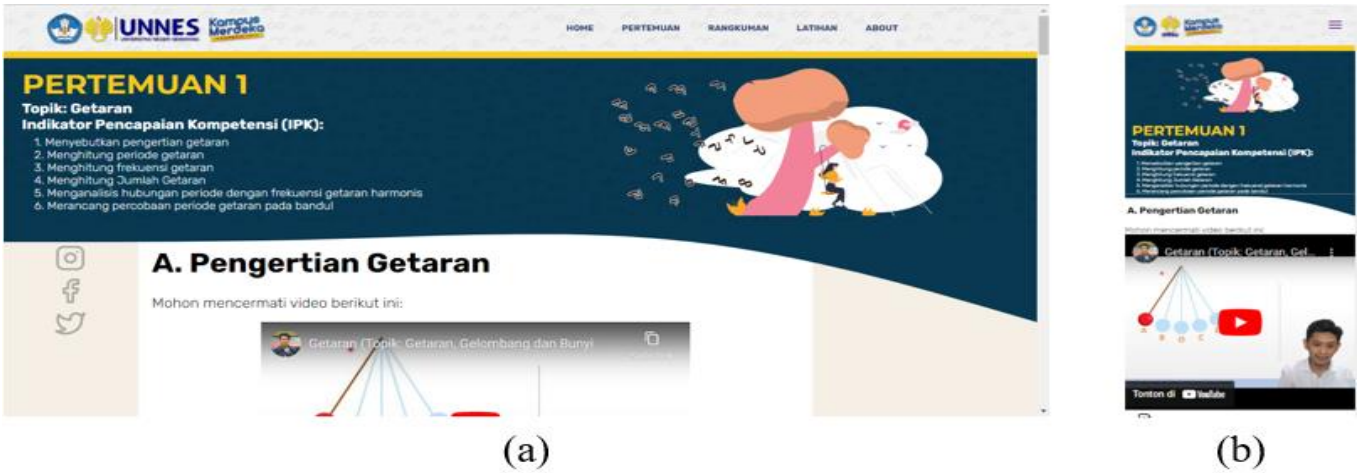

Figure 3. Meeting Page 1 (a) PC, (b) Mobile

The final product result shown in Figure 2 is the home page interface of the learning media product when accessed on a PC with a screen resolution of 1366x768 pixels and Figure 2 is the display of the learning media product when accessed on a mobile phone with a screen resolution of 1080x2220 pixels.

The final product result shown in Figure 3 is the first page interface (discussing the concept of vibration) of the learning media product when accessed on a PC with a screen resolution of 1366x768 pixels and Figure 3 is the display of the learning media product when

accessed on a mobile phone with a screen resolution of 1080x2220 pixels.

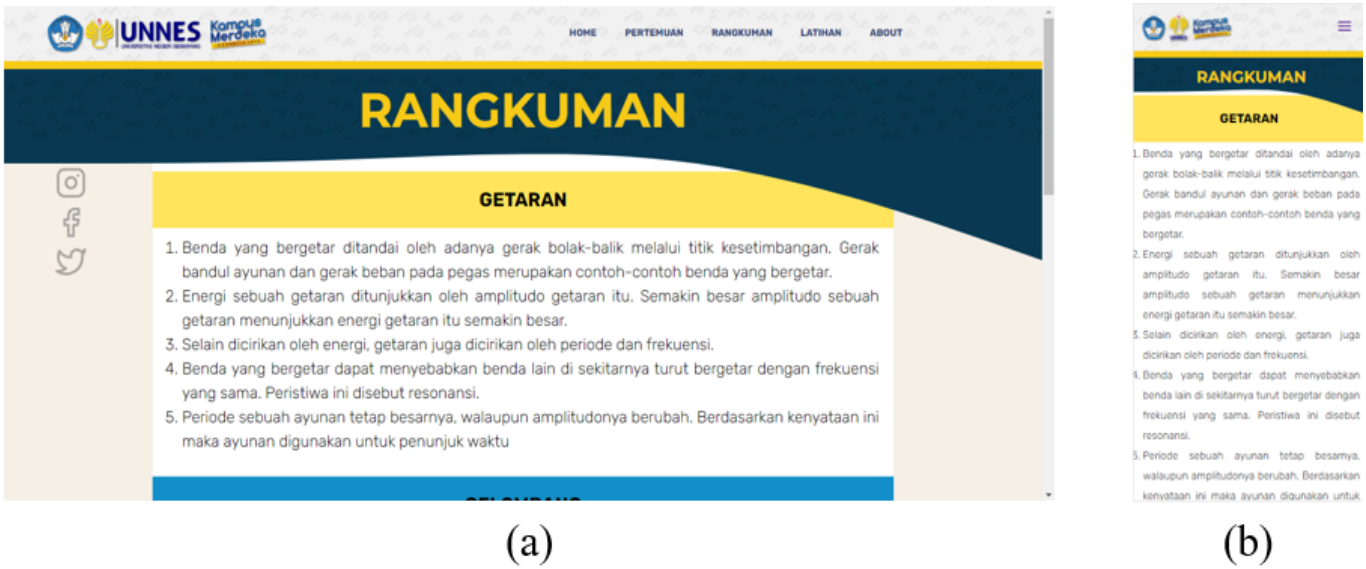

Figure 4. Summary page (a) PC, (b) Mobile

The final product result shown in Figure 4 is an interface page summarizing vibration, wave and sound material in learning media products when accessed on a PC with a screen resolution of 1366x768 pixels and Figure 4 is a display of learning media products when accessed on a mobile phone with a screen resolution of 1080x2220 pixels.

Figure 5. Practice page (a) PC, (b) Mobile

The final product shown in Figure 5 is a practice page interface for questions on vibrations, waves and sound which consists of multiple choice tests and essays. These results show the learning media product when accessed on a PC with a screen resolution of 1366x768 pixels and Figure 5 shows the display of the learning media product when accessed on a mobile phone with a screen resolution of 1080x2220 pixel.

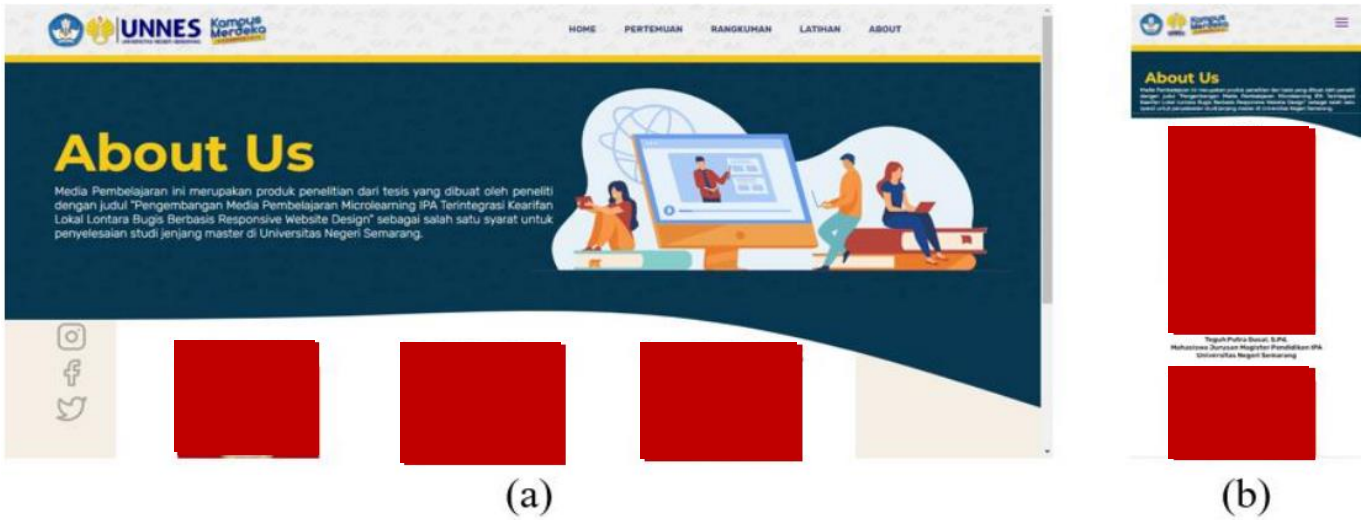

Figure 6. About page (a) PC, (b) Mobile

The final product result shown in Figure 6 is the about page interface which contains information about researchers and supervisors in producing development products. These results show the learning media product when accessed on a PC with a screen resolution of 1366x768 pixels and Figure 6 shows the display of the learning media product when accessed on a mobile phone with a screen resolution of 1080x2220 pixels. What makes this learning media product different from others is the language translation feature which can change Indonesian to Bugis (Lontara script) and vice versa. The final results of the science microlearning media product integrated with Lontara Bugis local wisdom based on responsive website design (RWD) with Bugis language content can be seen in Figures 7 to Figure 10.

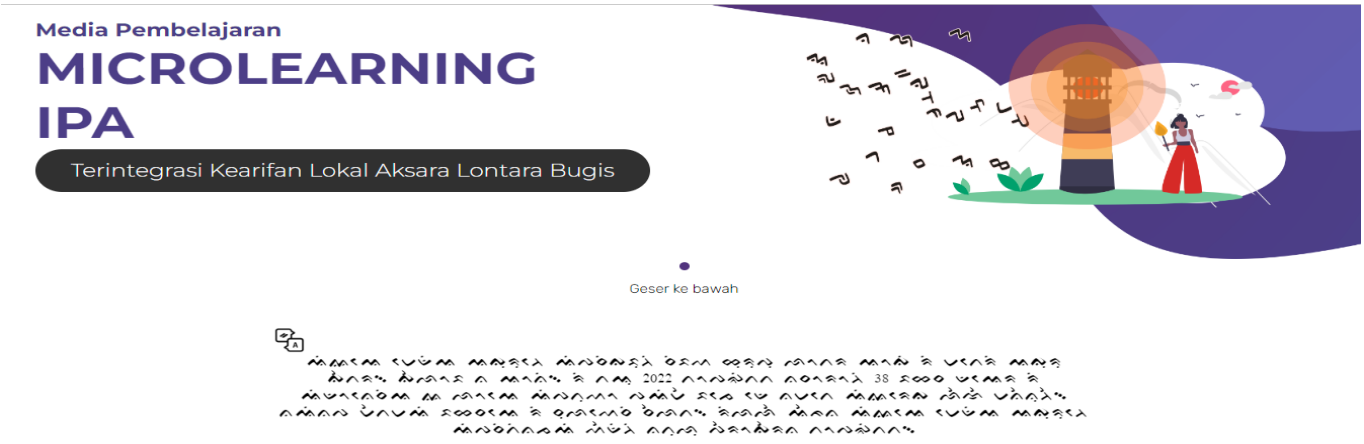

Figure 7. Home page using lontara bugis script

The final product result shown in Figure 7 is the home page interface of the learning media product when accessed on a PC with a screen resolution of 1366x768 pixels. The language used is Bugis using the Lontara Bugis script. This change in language and characters can occur by using the language switch button.

The final product shown in Figure 8 is microlearning content in the form of infographics showing examples of local wisdom of the Bugis community that applies the concept of vibration. 8learning media products when accessed on a PC with a screen resolution of 1366x768 pixels. The language used is Bugis using the Lontara Bugis script.

The final product shown in Figure 8 is microlearning content in the form of an infographic that displays the parts of the human ear. These results show that the 8learning media product is accessed on a PC with a screen resolution of 1366x768 pixels. The language used is Bugis using the Lontara Bugis script. Apart from being able to facilitate students to overcome learning loss that occurs, this learning media product can also help the government in its efforts to revitalize

regional languages that are almost extinct or in other words as a form of cultural conservation in the education sector. The learning media developed must be suitable before use. Therefore, an evaluation is needed to see the feasibility of the product.

Figure 8. Content at meeting 1 using lontara bugis script

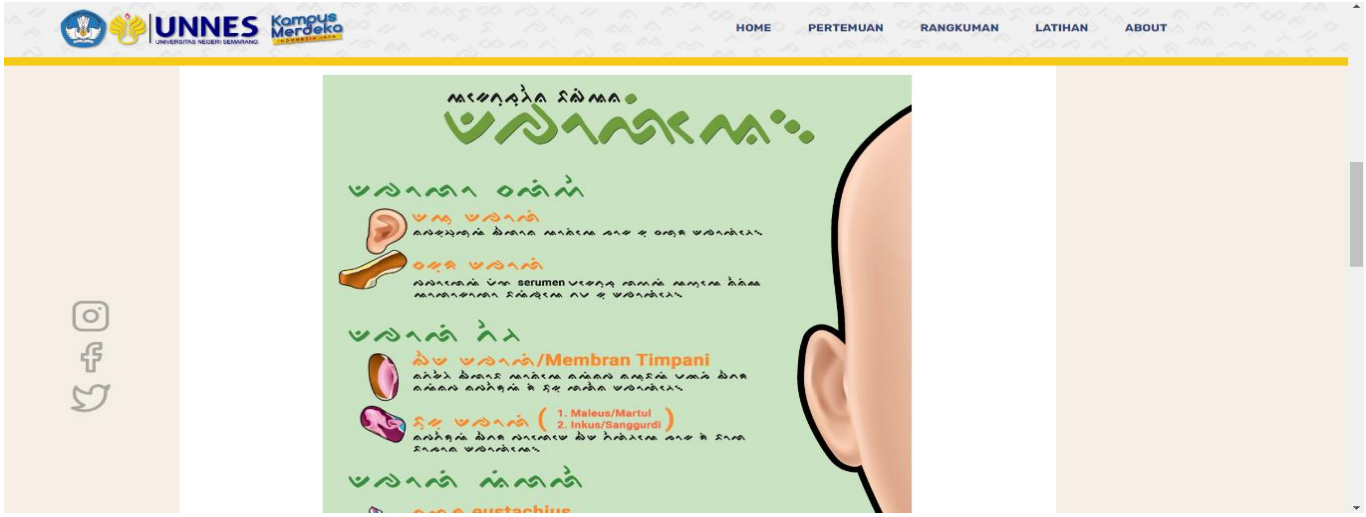

Figure 8. Content at meeting 4 using lontara bugis script

The feasibility of the learning media product being developed was validated by 3 experts consisting of a science education lecturer at Makassar State University as a material expert, a physics education lecturer at Makassar State University as a media expert and a regional language teacher at SMPN 2 Marioriwawo as a language expert. The validation results of the science microlearning media product integrated with local knowledge of Bugis Lontara based on responsive website design (RWD) can be seen in Table 4.

Based on Table 4, the percentage of material expert validation results obtained was 96.43% with very appropriate criteria. The media expert validation results obtained a percentage of 91.00% with very feasible criteria. The validation results from language experts obtained a percentage of 92.86% with very appropriate criteria. Validation results for the products developed had an average feasibility percentage of 93.43% with very feasible criteria. So it can be concluded that the science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) is very suitable for use.

Table 4. Learning Media Feasibility Results

Validator	Percentage (%)	Criteria
Materials Expert	96.43	Very Worth It
Media Expert	91.00	Very Worth It
Linguist	92.86	Very Worth It
Average	93.43	Very Worth It

Learning media has an important role in the learning process as a tool to stimulate students in acquiring knowledge (Novaliendry et al., 2020). Therefore, in its application appropriate learning media is needed. The eligibility criteria for the learning media developed are that each aspect of the learning media (material, media and language) reaches the minimum category of validity (Hasibuan et al., 2019). Validity testing in this research was carried out by 3 experts, namely media experts by lecturers at the Physics Education Study Program, FMIPA UNM, whose assessments included aspects of visual communication: 95.83%, website appearance: 92.86%, navigation: 79.17% and robustness: 95, 83%. Material expert by a lecturer at the FMIPA UNM Science Education Study Program whose assessment includes content aspects: 96.43%, website appearance: 100% and navigation: 93.75%. Linguist expert by regional language teacher SMPN 2 Marioriwawo whose assessment includes aspects of straightforwardness: 75%, communicativeness: 91.67%, conformity with Indonesian language rules: 100%, conformity with Bugis language rules: 100% and use of terms, symbols or formulas: 91.67%.

The average percentage validation scores of material experts, media experts and language experts are 96.43%, 90.92% and 91.57% respectively. The minimum validity category in this research is in the score percentage range of 70.01%–85.00% (valid criteria) in Table 1. Based on Table 3, the average percentage score for the suitability of the media being developed is 93.43% so it can be concluded that The science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) developed by researchers is classified as very valid. Small-scale trials were carried out to assess the practicality of the product being developed. This is seen from the aspect of content/material, presentation of learning content, readability and Robustness aspects. The small-scale trial was carried out on Saturday, March 11 2023 with a sample of 9 class VIII students at SMP 2 Marioriwawo for the Even 2022/2023 academic year. The students consisted of 3 students with high abilities, 3 students with medium abilities, and 3 students with low abilities. The results of small-scale trials are shown in Table 5 and Table 6.

The results of the practicality data in this research were obtained from obtaining practicality questionnaire scores filled in by 2 subject teachers and 9 class VIII students at SMPN 2 Marioriwawo at the small-scale trial stage.

Based on Table 5, the practicality score assessed by the teacher includes aspects of content/material: 95.83%, presentation of microlearning content: 95.31%, readability: 97.92% and robustness: 97.92% and has an average percentage score amounting to 96.74% is included in the very practical criteria. Based on Table 6, the practicality score assessed by students includes aspects of content/material: 89.35%, presentation of microlearning content: 84.92%, readability: 92.13% and robustness: 87.50% and has an average percentage of The average score of 88.48% is included in the very practical criteria. So it can be concluded that the learning media products developed are very practical to use in the teaching and learning process (PBM).

Table 5. Results of Practicality of Learning Media Products by Teachers

Aspect	Percentage (%)	Criteria
Content	95.83	Very Practical
Presentation of Microlearning Content	95.31	Very Practical
Legibility		Very Practical
Robustness	97.92	Very Practical
Average	97.92	Very Practical

Table 6. Results of Practicality of Learning Media Products by Students

Aspect	Percentage (%)	Criteria
Content	89.35	Very Practical
Presentation of Microlearning Content	84.92	Practical
Legibility	92.13	Very Practical
Robustness	87.50	Very Practical
Average	88.48	Very Practical

Based on researchers' observations, the existence of science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) makes it easier for students in class because some of them have studied independently the material that will be taught in the previous days. This is because the learning media products developed can be accessed anywhere and at any time. In accordance with Setuju et al. (2020) that the rapid development of science and technology in the world of education has caused many developments to occur, such as producing learning media in the form of websites, so that students can access teaching materials anywhere and anytime. Furthermore, Roro et al. (2021) say that the presence of e-learning in the world of education is not a substitute for face-to-face learning in the classroom but as a complement. According to researchers, a combination of science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) with face-to-face learning in the classroom can maximize PBM.

This research uses the Shapiro-Wilk test as a prerequisite test to see whether the sample learning outcome data is normally distributed or not normally distributed. Data is said to be normally distributed if the significance of the Test of Normality is greater than 0.05.

The normality test used in this study was Shapiro-Wilk because the sample size was less than 50 (Tapia & Cevallos, 2021). The results of the normality test in this study can be seen in Table 7.

Table 7. Normality Test Results of Student Learning Outcome Values

Class	Shapiro-Wilk			Information
	Statistics	dk	Sig.	
Experiment	0.95	27	0.18	Normal
Control	0.94	26	0.15	Normal

Based on the normality test (Shapiro-Wilk) in Table 7, it can be seen that the significance of the experimental class is 0.178 > 0.05 and the significance of the control class is 0.151 > 0.05. So it can be concluded that each sample data in this study is normally distributed. The hypothesis used in this research is a comparative hypothesis so that to test the comparative hypothesis where the samples are unrelated (in different classes) an independent t-test is used whose data comes from the students' post-test. The homogeneity test used in this research is the F-test (Fisher) as a requirement for carrying out independent t-test data analysis. Post-test data on student learning outcomes was taken at the wide-scale trial stage. The results of the F-test and t-test can be seen in Table 8.

Table 8. Independent Sample T-test of Student Learning Results

	F-test		T-test		
	F	Sig.	t	dk	Sig. 2-tailed
Equal variances assumed	6.43	0.01	2.57	51	0.01
Equal variances not assumed			2.60	46.23	0.01

Based on Table 8, it can be seen that the significance of the F-Test (Fisher) is 0.014 < 0.05, so it can be concluded that the data is not homogeneous. Because the amount of data is not the same and is not homogeneous, significance (2-tailed) is seen in equal variances not assumed of 0.01 < 0.05. Based on the hypothesis testing criteria, if the sig. < 0.05 then H0 is rejected and H1 is accepted. So it can be concluded that the learning outcomes of experimental class students are higher than those in the control class after being taught using science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD).

Students' positive responses are a questionnaire containing several positive statements. This response aims to determine students' attitudes towards the learning media developed and students' attitudes towards aspects of local wisdom that have been integrated into Lontara Bugis local wisdom integrated science microlearning learning media based on responsive website design (RWD). The results of students' positive/negative responses can be seen in Table 9.

Table 9. Positive Student Responses to Learning Media Products

Aspect	Percentage (%)	Criteria
Students' Attitudes towards Microlearning Learning Media	76.30	Positif
Students' Attitudes towards Aspects of Local Wisdom	79.35	Positif
Average	77.82	Positif

Research into the development of learning media for science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) was carried out to develop a learning media product that was feasible, practical and effective. Development research (R&D) is a systematic effort to develop an effective new product by referring to a concept or hypothesis (Hanafi, 2017; Cividino et al., 2019). R&D methodology in educational research is required to produce effective and efficient products or services related to pedagogical or educational practices (Gustiani, 2019). The learning media product developed in this research is said to be effective if the learning outcome scores of experimental class students are higher after being taught using science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) compared to the learning outcome scores of control class students who were taught using conventional method.

Microlearning as a method in education has shown positive effects in its implementation. Based on how the brain stores and retrieves information, microlearning can facilitate and maximize student learning (Gagne et al., 2019). The amount of information that can be stored in short-term memory is relatively small, so to overcome this there is a method called chunking as a method of storing information in long-term memory humans (Bhinnety, 2015). Chunking is the act of breaking down the components of a large topic into smaller units so that they are easier for students to digest (Bhadri & Patil, 2022). Providing material using the chunking method in online learning provides effective and efficient results and is suitable for various current technology platforms. Learning with micro content can increase students' attention and help time management in completing teaching material and greatly contribute to improving students' learning outcomes and self-efficacy (Humphries & Clark, 2021; Şahin & Kirmizigül, 2023; Zarshenas et al., 2022).

Integrating elements of local wisdom in learning media aims to enable students to develop awareness of ancestral culture, especially the Lontara Bugis script, through conservation efforts in the education sector. Local culture in an indigenous community can be used and utilized for learning and education. This learning media is a source of learning scientific knowledge that can be used as a vehicle for developing soft skills in the form of cultural conservation and student learning outcomes (Pamungkas et al., 2017; Sudarmin et al., 2017; Sudarmin et al., 2017). Students are expected to have social awareness and control in society as owners of language, literature and culture. Students are also expected to have good socio-cultural knowledge and an understanding of the local wisdom of the Bugis community so that good and upright character emerges like the message of the ancestors of the Bugis community (pappaseng). Pappaseng is a guide regarding how to live a good, straight and correct life and can also be used as a medium for moral education to build a person's personal qualities in creating an ideal societal system. Students are expected to become intelligent and wise individuals, "aiyro tEpj aisp tomc n wlEPu" meaning that the person who is always sought is someone who is intelligent and honest (Sari et al., 2022; Rasna & Tantra, 2017; Susmihara et al., 2022).

Learning media products developed using a responsive web base. This aims to make students feel comfortable accessing the website because it uses the responsive website design (RWD) method which can be responsive to all types of device screen resolutions and can be accessed anywhere and at any time. Students are more comfortable using responsive websites than unresponsive websites (Paiva & Pinheiro, 2020). This research also utilizes the YouTube platform by linking micro content in the form of videos that have been uploaded to the website pages that have been designed. This can save users' time and will provide convenience in accessing learning videos (Lookman et al., 2019). According to researchers, responsive web is very effective to use as a complement to face-to-face learning in the classroom because it can be accessed by students anywhere and at any time and is dynamic on every device. Furthermore, Yousaf et al. (2019) say that conventional website design is not enough to meet the growing needs of web usage. Therefore, RWD design is very important to meet the technological advances of the World Wide Web (WWW). Then confirmed by Bhanarkar et al. (2023) that responsive design always offers a better and more dynamic user experience compared to designs that have a fixed size. So responsive web design is a practical solution for various types of websites.

Based on several relevant research results that support the results of this research, it can be seen that the science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) which has been developed based on the characteristics and needs of students is very effective and easy to use, can improve results. learning and getting a positive response from students so that it can be concluded that the learning media developed is feasible, practical and effective for use in learning. The implementation of this research was not free from obstacles that arose, although in general this research was carried out well and smoothly. The obstacles encountered by the researchers were adjusting to the students' conditions, some of the practicum equipment being incomplete, the existence of activities at school which resulted in increased research time, and the condition of the students' networks which sometimes became poor. The limitation of the learning media product being developed is that the topics provided are still limited to vibration, wave and sound material and there are still several bugs that occur during the language translation process. These limitations can be used as evaluation material for improvement and reference for further research.

Conclusion

Science microlearning learning media integrated with Lontara Bugis local wisdom based on responsive website design (RWD) is included in the criteria of being very feasible, very practical for use in the teaching and learning process of class 8 students at SMPN 2 Marioriwawo. The learning media products developed are also effective for students to use compared to using conventional learning media.

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Author Contribution
Conceptualization, T.P.G., S., B.S.; methodology, T.P.G., S., B.S.; software, T.P.G.; validation, S., B.S.; formal analysis, T.P.G.; investigation, S., B.S.; resources, T.P.G.; data curation, S., B.S.; writing-original draft preparation, T.P.G., S., B.S.; writing-review and editing, S. and B.S.

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Conflicts of Interest
The authors declare no conflict of interest. This research was conducted to overcome students' learning loss and as a means of conserving local wisdom in the form of Lontara Bugis script which is threatened with extinction as time goes by.

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