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Development of Chemical Literacy Book on Local Wisdom of Madura Culture Based on Augmented Reality (AR)

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Abstract: This study provides a detailed description of the development of a chemical literacy book on Madurese local cultural wisdom based on augmented reality (AR). The research aims to identify the characteristics of chemical literacy books, then evaluate their suitability based on teacher usability tests and student readability tests. This research used an exploratory mixed methods design. The instruments used were a needs analysis questionnaire, expert validation sheet chemistry learning, teacher usability questionnaire sheet, and student readability questionnaire sheet. Feasibility assessments include content and scientific literacy, language, presentation, graphics, usefulness and attractiveness. The output of this research is a chemical literacy book on Madurese local cultural wisdom based on Augmented Reality (AR) in printed form consisting of 7 (seven) cultural themes and 7 (seven) Basic Competencies in the 2013 Curriculum referring to the Minister of Education and Culture Regulation and Culture Regulation Number 37 of 2018. The book This was declared suitable for use as a learning resource based on chemistry teachers' usability test responses with Very Good (SB) criteria in all aspects with an ideal percentage of 91.50% and based on student readability test responses with Very Good (SB) criteria in all aspects with an ideal percentage amounting to 87.91%.

Keywords: Augmented reality (AR); Chemistry learning; Chemical literacy; Madura culture

Introduction

The 21st century is an era where competition between individuals is increasingly intense. In this century, several skills are needed that individuals must have, one of which is mastery of technology. To face this competition, quality human resources are needed. Education plays a strategic role in preparing human resources. This human resource potential will be realized if education is able to foster critical, creative and adaptive thinking skills to current developments (Ngertini et al., 2013). Education is very important to improve the quality of human resources and is one of the aspects that determines the progress of a society's life (Bahriah, 2013).

One of the problems with education in Indonesia, especially in the science sector, is the low level of scientific literacy. The low level of scientific literacy and the quality of science education is most likely caused by a lack of attention to aspects related to the socio-cultural environment as a learning resource (Imansari et al., 2018).

Chemistry learning is one type of learning that plays an important role in instilling students' understanding of the development of science and technology because through this learning students will be able to develop curiosity and motivation to learn about science and technology. Apart from that, through learning chemistry students will have an understanding of the chemical elements that play a role in their daily lives (Jamaluddin et al., 2019).

The ability to understand particle matter, reactions, rules, theories and applications of chemistry in everyday life is one component of chemical literacy. A person with good chemical literacy is able to describe daily

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experiences using chemical principles, solve problems, then understand and apply chemistry in everyday life (Fahmina et al., 2019).

The different abilities possessed by students with explanations of abstract chemical material influence students in the learning process, especially their ability to understand the material, creativity and literacy (Susilawati et al., 2023). The application of ethnoscience in learning is important because of the importance of having cultural knowledge, beliefs and practices in forming an individual's understanding of the world. Therefore, by incorporating ethnoscience into learning, students will be encouraged to explore and appreciate their own culture and the cultural diversity around them (Rahmawati et al., 2023).

According to Rusilowati et al. (2016), there are which indicates a lack of literacy skills science students, especially in Indonesia, among others teachers often teach comparative formulas with concept; students do not understand the concept the basics taught by the teacher; students do not have knowledge of facts, terminology and sufficient scientific concepts; participant skills educate in critical thinking, deductive reasoning inductive, analyzing causality and analyzing insufficient scientific data; students are rare carry out practical activities; learners spend more time with knowledge that promotes rote memorization and lack of knowledge of students in science knowledge and technology.

The importance of chemical literacy is related to students' ability to appreciate nature by applying science and technology (Nisa et al., 2015). To develop scientific literacy, improving the quality of learning can be done by including elements of local wisdom (Sudarmin, 2014). Literacy plays an important role in the educational process, especially learning. This also depends on the literacy abilities and awareness of each individual. The existence of literacy values instilled in students will influence their success in life both at school and in society (Hamidah, 2018).

Low scientific literacy skills of participants education is also caused by students only memorizing concepts and less able to think more in to connect what they have learn by applying it to new situations (Nopriadi et al., 2022). Utilizing local and cultural wisdom in learning will enable students to integrate scientific concepts into everyday life because they may have encountered this culture in everyday life (Nuroso et al., 2018).

Integrating local wisdom can be used as a science learning object that can increase student motivation and interest. In Indonesia, curriculum development must pay attention to the integration of local cultural knowledge into chemistry learning. This application is specifically applied to the chemistry curriculum for high schools (SMA) and educational institutions (LPTK) so that education in schools can become a medium for cultural transmission (Sudarmin et al., 2013).

Local wisdom is a person's way of behaving and acting in the face of environmental changes, both physical and cultural. Conceptually, in a society that continues to grow and develop based on self-awareness related to life from the sacred to the ordinary parts of life (Istiawati, 2016). Madura Island is an island that has a lot of local wisdom. Madura Island, also known as Salt Island, is located to the east of Java Island and is separated by the Madura Strait. Each location on Madura Island offers a variety of its own culture, customs and traditions. Apart from that, Madura Island is also famous for its unique culture in everyday life. This can be seen from the Madurese people who always try to maintain good brotherhood between people (Syamsuddin, 2019).

Local wisdom is an accumulation of the results of activities in addressing and treating the environment, which describes how society behaves and acts to respond to specific changes in the scope of the physical or cultural environment. This local wisdom results from human thought in the form of behaviour, knowledge, beliefs, and customs believed to be true in life (Chotimah et al., 2018). Meanwhile, Rusilowati et al. (2015) states that local wisdom is the values that apply in society which are believed to be accurate and become a reference in everyday behaviour. It can be concluded that local wisdom is the nature, beliefs, customs, and values of an area or community group.

Local wisdom-based education is an educational process that teaches students to always be attached to the concrete situations they face. Several steps that can be taken to implement learning based on local wisdom by equipping students to face problems outside of school are by inventorying potential aspects of local excellence, analyzing the internal conditions of the school, analyzing the external conditions of the school, and determining the type of local excellence by implementing local wisdom-based implementation strategies (Pingge, 2017).

As for the role of local wisdom as a basis for building a reality that puts forward matters related to culture and scientific knowledge (Abonyi et al., 2018). This can be developed so that learning is not only oriented to cognitive aspects, but students can understand nature and apply what they have learned to solve real-life problems (Novia et al., 2015). In addition, education based on local wisdom is proven to increase awareness of preserving the environment and local wisdom (Ardan, 2016).

Teachers must employ local wisdom-based learning to enhance students' knowledge and comprehension of the subject matter to foster respect for local wisdom in the communities. Cultivating positive personalities is consistent with the virtuous values of indigenous wisdom and equips students to deal with life's challenges (Pingge, 2017).

The ethnoscience approach needs to be carried out and implemented with a learning model that is in accordance with the 2013 curriculum, namely student-centered (Susbiyanto et al., 2019). Using an ethnoscience approach is a learning strategy in the process of creating an environment and designing experiences that integrate culture into the learning process (Sudarmin et al., 2018). According to Sumarni (2018), ethnoscience learning can improve students' chemical literacy skills in the aspects of content, context and competency.

Submission of local wisdom as an effort to increase scientific literacy can be conducted using appropriate teaching materials. However, teaching materials linking local wisdom in Madura still need to be expanded in number. If there are teaching materials related to local wisdom, they are still based on manuals and have not been integrated with AR technology. The application of AR will provide new and innovative ways to visualize abstract concepts in 2D and 3D forms. AR is a type of media development that overlays virtual objects on top of actual images. It has exceptional value for chemistry students because it facilitates the visualization of material that cannot be understood intuitively (Wu et al., 2013). The application of AR in chemistry learning can be used to support learning activities, including conceptual understanding, which consists of representational aspects, namely macroscopic, submicroscopic, and symbolic, which can be fully comprehended to reduce misconceptions in abstract chemical concepts (Chusna et al., 2021).

Augmented Reality (AR) is an applicable technology to visualization. AR integrates the real world with the virtual world through virtual objects overlayed on the real world 21 (Sugiana et al., 2019). It has particular value for chemistry students because it facilitates the visualization of unintelligible material (Wu et al., 2013). Simulation and visualization with AR are highly effective (Nechypurenko et al., 2020). Consequently, AR will offer advantages for 3D object modeling, a more interactive and effective use, and the ability to be implemented and operated on various media types (Chusna et al., 2021). This technology will make learning more enjoyable and engaging.

Previous research that is relevant to the development research conducted, namely research conducted by Suparman (2017) entitled "Development of Problem-Based Chemistry Learning Media Integrating Local Papuan Cultures" showed that problem-based chemistry learning media combined with Papuan culture showed good or significant results because of the learning outcomes of 25 students who took the test yielded 40% for the high category and 48% for the very high category, and the results of the reliability analysis obtained were 0.780. The results of Ardan's research (2016) show that students show significantly more concern in preserving the environment and the local wisdom of the Timor area. There is also research conducted by Martilia et al. (2017) entitled "Development of Local Wisdom-Based Chemical Teaching Aids as Class XI Chemistry Learning Media" and found that there were 4 teaching aids based on local wisdom, namely limestone kiln mock-ups, natural pH paper, hard water softening tools, and electrocoagulation tools, all of which were equipped with manuals for making and using chemical teaching aids. The results of the assessment show that it has a very good quality category (SB) and can increase students' learning motivation. Furthermore, research conducted by (Pratiwi, 2018) entitled "Development of a Chemical Enrichment Book Based on Local Wisdom of Bogor Regency" also showed that the overall assessment by the teacher's response obtained an overall score of 94% and 85.38% of the students' responses in the very good category. This enrichment book is suitable for use as an additional book to support the chemistry learning process in schools.

From the several studies mentioned above, the results are relevant in the process of developing literacy books on local wisdom of Madurese culture based on AR, including also relevant to assessing the quality of books seen from the aspects of material feasibility, presentation aspects, language aspects, picture aspects, content aspects, and approach aspects related to the local wisdom of a region. In addition, this research will have advantages in the technological aspect because it is integrated using AR technology which can display 2D or 3D shapes of chemical materials such as the molecular shapes of chemical compounds related to local cultural wisdom in Madura so that it has innovation compared to previous research previously referred to.

With AR we found that both technologies can be used to promote exploratory behavior and perceived usefulness and develop a positive attitude. It is believed that exposing students to computer-simulated environments may make science learning effective (Chen et al., 2019). This is can combining actual and virtual environmental would result in mixed reality, which would provide learners with a wide variety of exploration options (Correia et al., 2016).

This study aimed to: identify the characteristics of chemical literacy books, then evaluate their suitability

based on teacher usability tests and student readability tests.

Chemical literacy book on local wisdom of Madura culture based on AR have benefits as a learning reference for students, increase students' interest in learning chemistry, add insight and knowledge, and foster creative, innovative attitudes, and as an effort to preserve local wisdom, can assist teachers in the learning process which can develop students' thinking that chemistry is relevant to existing contexts in everyday life, and can be used as reference material for conducting similar research as well as learning support books and add insight about preserving Indonesian culture.

Method

This study used an exploratory mixed method development model to demonstrate quantitative data that can support qualitative data. Exploratory mixed method is a sequential exploratory (sequence of discovery) mixed method model; the first stage employs a qualitative method followed by a quantitative method (Cresswel et al., 2007). The stages are:

Qualitative Data Collection

In this stage, an exploration of qualitative data collection was conducted on several topics, including the level of needs analysis by distributing needs analysis questionnaires to 5 chemistry teachers and 40 students, as well as conducting interviews with expert sources to collect Madura cultural data in the contents of chemical literacy book, references on Core Competencies (KI) and Basic Competencies (KD) for high school chemistry subjects that must be achieved by students in the 2013 curriculum based on Permendikbud number 37 of 2018 as a reference material to be used in the preparation of the book, the scope of material on Madura local wisdom culture related to chemistry material, and references for developing chemical literacy books consists of literature books, national and international research journals and other scientific articles.

Qualitative Data Analysis

At this stage, data analysis was carried out through a qualitative descriptive method as a reference for developing a chemical literacy book on local wisdom of Madura culture based on AR. Data analysis was carried out by analyzing Madura culture which has more to do with chemistry material in schools so that it can be more easily recognized and understood by students.

Qualitative Data Result

The results were based on the qualitative data analysis that has been carried out, specifically in the form of a table of results of the identification of local wisdom of Madura in chemistry learning, which is then used to compile chemical literacy books on local wisdom of Madura culture based on AR.

Develop Product

At this stage it is carried out by going through five stages which are carried out sequentially to develop a chemical literacy book, the stages that are passed are as follows:

Preparation of Chemical Literacy Book

The step included creating an outline of the content in each chapter of the book selecting local wisdom to be associated with chemistry learning, collecting material related to the local wisdom of Madura, preparing for making AR media and preparing assessment instruments as product quality criteria in book development.

Writing the Chemical Literacy Book

The compiling of the book utilized applications consisting of Canva Pro, Assemblr Studio, Blender, Sketchfab, Me-QR Code Generator, and Microsoft Word 2010, makes layout designs and book covers, arranges materials and examples of learning devices according to the content framework in each chapter, and developing material with AR. AR can be assessed via a smartphone by downloading the Assemblr Studio application and scanning the barcode contained in the contents of the book.

Validation Stage of the Chemical Literacy Book

The validation stage of the chemical literacy book involved product validation by two lecturers as chemistry learning experts. Comment, suggestions and input were used as a reference for product improvement.

Quantitative Data Collection

This stage included collecting data on usability test results by 6 chemistry teachers and readability test by 30 students. Then perform data analysis by converting the qualitative values in the questionnaire using a scale of five into quantitative values.

Quantitative Data Analysis

This stage analyzed the data collected at the Quatitative Data Collection stage. The data analysis stages aimed to draw conclusions from the test results to enhance product development.

Quantitative Data Result

This stage presented the analysis results from the Quatitative Data Analysis stage. The results of the data

collected during the teacher usability test and student readability test are used as a basis for making product improvements.

First Interpretation

At this stage, a product was produced in the form of a chemical literacy book that is feasible based on the results of qualitative and quantitative data.

Data Collection Techniques and Research Instruments

Data collection techniques in this study were literature study and questionnaires. The instruments used were developed through adaptation by adding usefulness and product attractiveness aspects. All instruments were validated logically by experts. Student needs questionnaires are used to analyze educational problems faced by students, where the questionnaire results serve as a basis for consideration in the development of chemical literacy book. Several data collection instruments were used: literature study, needs analysis questionnaire sheets, expert validation sheets, teacher usability sheets, and student readability sheets.

Data Analysis

Qualitative Data

Qualitative data were obtained from comments and suggestions from chemistry learning experts, chemistry teachers, and students. The collected, tabulated, and selected comments and suggestions were then used to improve the book product in accordance with the concept of book development.

Quantitative data

The results of teacher and student questionnaires were used as quantitative data. Data analysis began with changing the assessment given by the teacher and students from a qualitative value to a quantitative value with a scale of five which is converted according to a Likert scale.

Table 1. Ideal Score Conversion

Category	Score
Very good	5
Good	4
Acceptable	3
Poor	2
Very poor	1

Next, add up the overall l scores and calculate the average score for each aspect of the assessment using the following formula:

$$X = \frac{\Sigma X}{n} \quad (1)$$

Information:

X = Average score of each aspect

ΣX = Total score for each aspect

n = Number of respondents

Then change the average score for each indicator and criteria aspect in the form of quantitative data into qualitative data by coparing the average score with the ideal assessment criteria, as in the following table.

Table 2. Ideal Assessment Criteria

Interval (i)	Category
$X > \bar{X}i + 1.5\ Sbi$	Very good
$\bar{X}i + 0.5\ Sbi < X \leq \bar{X}i + 1.5\ Sbi$	Good
$\bar{X}i - 0.5\ Sbi < X \leq \bar{X}i + 0.5\ Sbi$	Pretty good
$\bar{X}i - 1.5\ Sbi < X \leq \bar{X}i - 0.5\ Sbi$	Less good
$X \leq \bar{X}i - 1.5\ Sbi$	Not good

Information:

Ideal maximum score = highest score

Ideal minimum score = lowest score

X= Total actual score

$\bar{X}i$ = Ideal average score

$\bar{X}i$ = ½ (Ideal maximum score + Ideal minimum score)

Sb*i* = Ideal standard deviation

Sb*i* = $\frac{1}{2}\frac{1}{3}$ (Ideal maximum score – Ideal minimum score)

where:

Highest score = Σ criteria items x 5

Lowest score = Σ criteria items x 1

The chemical literacy book developed in this study can be considered feasible if the average score is at least "Good". Calculate the percentage of ideal products subsequently using the formula below.

$$Ideal\ percentage\ (\%) = \frac{\Sigma\ average\ score}{\Sigma\ maximal\ score}\ x\ 100\% \quad (2)$$

Result and Discussion

Qualitative data collection was conducted to obtain information on problems that occur in chemistry lessons faced by high school chemistry teachers. In addition, literature reviews were carried out regarding Core Competencies (KI), Basic Competencies (KD), Competency Achievement Objectives (IPK) and coverage of material through the curriculum published by the Ministry of Education and Culture. The goal is to acquire the materials used in the preparation of chemical literacy books. The purpose of carrying out a needs analysis is to find out the supporting learning resources needed in chemistry learning.

The following are the results of the identification of KI and KD on the selection of cultural themes that have been adapted to the scope of chemistry and KD material in chemistry lessons.

Based on Table 3, it is known that the selected chemical and local wisdom materials have material discussions that have visualizations that are easy to see and understand by students, but some materials also have material limitations that cannot be reached by the senses. This is related to microscopic material such as the shape of atoms and molecules. In accordance with the opinion expressed by Sukmawati (2019), that macroscopic material in chemistry is the part that can be observed through phenomena and can be felt by the human senses, while microscopic material is chemical material that is abstract and explains more at the particle level such as atoms, molecules., and ions, for symbolic material, are representations of chemical material such as writing chemical formulas, chemical equations and chemical calculations.

Table 3. Identify Local Wisdom Madura and Chemistry Concept

Local wisdom	Chemistry concept
Madura salt ponds	changes in matter separation of mixtures properties of salt solutions
Pottery crafts	combustion products of hydrocarbon
Batik madura	thermochemistry acids and bases
Madura traditional herbal medicine	benzene and its derivatives
Karapan sapi madura	benzene and its derivatives
Wisata api tak kunjung padam	period 3 elements transition groups
Bukit kapur arosbaya	abudance of main group elements

Discussion

Characteristics of Chemical Literacy Book

The research began with conducting a literature review on the 2013 curriculum in accordance with Permendikbud no 37 of 2018. The literature study aims to determine the scope of objectives and materials, which will be linked to local wisdom in Madura. The selection of local knowledge serves as the foundation for education to express and communicate an idea and to advance science (Parmin et al., 2017). This is consistent with the findings of Istiawati's research, which indicates that the content of local wisdom values in learning can increase motivation because it feels more natural (Istiawati, 2016). According to this explanation, the use of additional books based on local wisdom is essential for preserving local wisdom and increasing student motivation to learn.

The product development process began with the preparation of media content, the contents of each chapter, and the identification of the local wisdom context. The product layout was created using the Canva application with an A4-sized literacy book (21 x 29.7 cm). There are seven cultural themes: Madura salt ponds, earthenware crafts, Madura batik, Madura traditional herbs, cow races, the never-ending fire tour, and Arosbaya Limestone Hill. The selection of cultural material is adapted to the popular Madurese local wisdom.

Local wisdom-based teaching materials are a set of materials that will be arranged in a coherent manner that will be used by teachers and students to create an effective and efficient learning environment. Apart from that, integrating local wisdom-based values can increase students' understanding and increase their knowledge to recognize local wisdom in their environment and as a medium for cultivating a sense of love for local wisdom in their area. By providing experience and introducing local wisdom, it is hoped that it can create changes in behavior for the better (Isra et al., 2023).

Students are required to be able to apply science concepts, communicate discussion findings, and make connections between diverse science materials and science found in society as part of chemistry instruction that is focused on local wisdom (Suastra, 2013). Local knowledge enables students to learn from the culture that emerges around them. Using local knowledge has been shown to improve students' scientific literacy (Martawijaya et al., 2019). This is confirmed by students' assessments on the readability of content aspects and scientific literacy content, namely the Very Good category (VG), which demonstrates how the presentation of literacy content and content can help students improve literacy in relation to chemistry in Madura. In order to facilitate the goals to be achieved in each area and increase student interest in learning chemistry, the delivery of chemistry content begins with the mapping of several indicators of scientific literacy. Students will be more motivated to learn chemistry because it is connected to the role of chemistry that they frequently encounter in daily life.

Students with scientific literacy are expected to possess the skills necessary for involvement in modern society, including awareness of scientific knowledge and concepts and digital citizenship. The capacity to ask and research questions that arise from curiosity about the real world, assess the validity of scientific knowledge, explain and predict phenomena, and derive conclusions and arguments from these, as well as the ability to assess these arguments using relevant data (Kristyowati et al., 2019).

The following seven cultural themes were included: the Madura salt ponds, earthenware crafts, Madura batik, Madurese traditional herbal medicine, cow races, Unremitting Fire Tourism, and the Arosbaya Limestone Hills. The choice of cultural content is adjusted to reflect common Madurese local wisdom. Eight Basic Competencies make up the chosen chemistry concepts.

Previous study described that chemistry is a science that entails comprehending and implementing ideas of submicroscopic representations, such as molecular structures, and macroscopic, symbolic ones, such as chemical formulas and equations. The selection of this material is determined so that it can be visualized with AR. A 3-dimensional explanation of the shape of chemical molecules is given to ensure students do not experience difficulties when understanding chemical material (Prasetiyo et al., 2020).

Figure 1. Cover layout

This chemical literacy book is integrated with AR technology to help visualize abstract chemical material such as molecular shape material, so that students can easily comprehend some examples of the molecular shapes of chemical compounds presented. A total of 23 3D shapes of chemical molecules are presented using AR technology developed with the Blender application to create molecular shapes. Additionally, the created 3D shapes are converted into markers, specifically a QR Code that has been linked to the Assemblr Studio application. This QR Code will be scanned utilizing the camera on a smartphone or Google Lens. The application Assemblr Studio requires an internet connection in order to display its AR form.

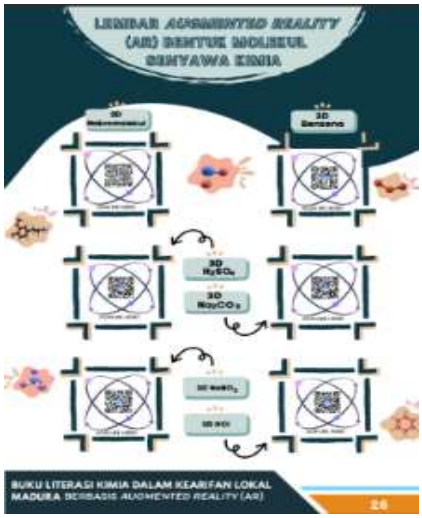

Figure 2. AR is presented using barcode

This chemical literacy book is completed with evaluation questions related to the material that has been presented. The preparation of evaluation questions is based on indicators of scientific literacy derived from the OECD mapping, which consists of four aspects, namely knowledge, context, competence, and attitude (OECD, 2015). Evaluation questions are in the form of essays in order to be able to stimulate students' critical thinking. In addition, the chemical literacy book contains a self-reflection sheet that describes personal benchmarks, making it easier for students to assess their understanding or emotions following self-study.

Figure 3. Evaluation sheets to assess scientific literacy

Figure 4. Page view shapes of chemical molecules

The integration of AR was intended to represent the submicroscopic level of a substance. This is intended to accommodate chemistry as a science that requiring comprehension and application of concepts consisting of macroscopic, symbolic representations, such as chemical formulas and equations, and submicroscopic representations, such as molecular shapes (Talanquer, 2011). The selection of this material is determined so that it can be visualized with AR. A 3-dimensional explanation of the shape of chemical molecules is given so that students can easily understand chemical subtances (Prasetiyo et al., 2020).

It can be concluded that the use of visualization of objects in 2D or 3D form and it is intended that AR media will be able to display and visualize abstract chemical objects more authentically, such as the molecular shape of chemical compounds and help increase students' chemical literacy and make chemistry learning more relevant.

Product Usability Test Results by Chemistry Teachers

Based on the results of the product feasibility test on six chemistry teachers, it was concluded that the chemical literacy book that had been developed was very good, with revisions in several parts. The six chemistry teachers came from 3 schools: SMAN 1 Sampang with three teachers, SMAN 2 Sampang with one teacher, and SMAN 1 Torjun with two teachers. Based on the usability test by the chemistry teacher, the results are shown in Figure 4.

The teacher usability questionnaire consists of six aspects, namely scientific literacy and content aspects, presentation aspects, language aspects, graphic aspects, usefulness aspects, and attractiveness aspects. The student readability questionnaire consists of six aspects, namely scientific literacy and content aspects, presentation aspects, language aspects, graphic aspects, usefulness aspects, and attractiveness aspects. Based on these aspects, it was then developed into several indicators that were used to determine the suitability of the product. The selection of this assessment aspect is based on the provisions of BSNP (2014).

The teacher's usability test was conducted before the student's readability test, where the testing or testing stage is divided into two stages, namely Alpha Testing and Beta Testing (Sutopo, 2003). The Alpha Testing stage is the initial stage of testing, which aims to identify and eliminate as many errors as possible before the product reaches the user. The comments and suggestions serve as a foundation for enhancing the product to make it better. The second stage, Beta Testing, consists of testing delivered directly to students to determine which products are suitable for use as learning media.

The purpose of the initial assessment by the teacher first aims to make layered improvements if there are errors in the product. By completing a product usability questionnaire, teachers will evaluate and provide feedback on the product's assessment. After revising the teacher's suggestions and input, an evaluation of the students' responses to the book under development is conducted.

The results of testing the developed literacy book are said to be effective if the score obtained is >80% of a l aspects fulfilling the minimum requirements (Kirana et al., 2018).

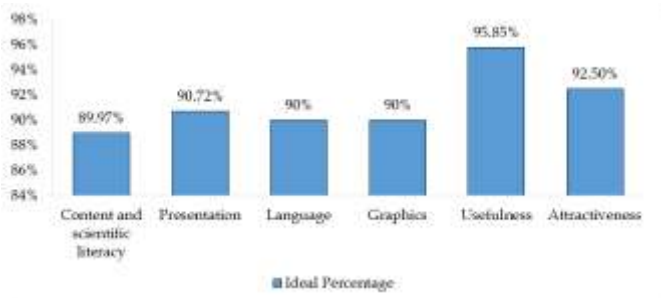

Figure 5. Percentage of ideality of product usability test by chemistry teacher

The highest percentage of ideality in the usability test results by chemistry teachers was in the aspect of usefulness, with a percentage of 95.85%. This demonstrated that the chemical literacy book developed was appropriate for supporting students' active learning, can increase interest and motivation in learning chemistry, can facilitate the delivery of chemistry material in Madura culture because it is directly related to daily life, and can assist teachers in developing understanding chemical concepts related to local wisdom in Madura. This is consistent with previous research that students with low learning

motivation will understand more easily because it is associated with the local wisdom that they typically encounter. Furthermore, students with high learning motivation will find more challenges in learning (Azis, 2021).

In terms of presentation, language, graphics, and attractiveness, the percentages were 90.72%, 90%, 90%, and 92.50%, respectively, in the Very Good category. This demonstrated that the presentation of the book, the language presented, the graphics on the cover display, the size and type of letters, the placement of writing and pictures, the quality of the images, and the whole book were engaging and enjoyable for the readers.

The lowest percentage of ideals was in the aspect of content and scientific literacy, with a percentage of 89.97% in the Very Good category. In addition to a quantitative assessment, this book also obtained a qualitative assessment in terms of material aspects which, in general, stated that the material in the chemical literacy book was Very Good and intriguing for further development in order to add more chemistry material and local wisdom content, as well as disseminate chemical literacy book to the wider public. The suggestions and comments given by the chemistry teacher were used as material to enhance the chemical literacy book, so in the material aspect, there was the addition of salt hydrolysis material in the Madura salt ponds and pottery crafts chapters, but the addition of this chemical material did not contribute to local wisdom content in the chapters in the book.

In general, the material in the book focused on something other than certain class levels because the development of this book aimed to provide knowledge related to chemistry that all students from each level represented to be able to find out their responses to the development of this book. Likewise, suggestions regarding books with practicum instructions were not followed up because the book did not discuss practicum in class; based on the research title, this book is a literacy book with some reading content related to chemistry and culture, evaluation questions, and presented reflections. However, this suggestion can be presented as a consideration for further research by including simple practicum material that can be implemented in the learning process related to the local wisdom selected.

Supported by research results conducted by Lukluah (2016) that teaching materials based on local wisdom can overcome the problems of teaching materials used by teachers. Therefore, hopefully, this chemical literacy book can be used as a reference and a supporting book to facilitate learning processes that are interesting and relevant to everyday life thereby enriching chemistry lesson. Chemistry learning can be relevant when learning has a positive impact on everyday life, such as helping students solve problems that are being experienced that are related to one's interests in order to understand the role of chemistry in everyday life and be able to anticipate and prepare various alternatives for problems that arise in their lives both now and in the future (Eilks et al., 2015).

In accordance with the results of research conducted by Septiayuni et al. (2019) that the teacher's assessment as a facilitator will help the teacher to guide students to understand lesson material independently, generate interest in learning, and facilitate students to discover concepts in the learning process.

Product Readability Test Results by Students

After testing the chemistry teacher's usability and the second revision stage, thirty students were given a readability test. The selection of students includes grades X, XI, and XII because the material of supplementary books should have been provided for readers across levels and grade classes (Pratiwi, 2018). Students will be able to apply the knowledge they have to relevant situations in everyday life which can be seen from their outstanding achievements in all aspects assessed (Permatasari et al., 2019). The data obtained is qualitative data converted into quantitative data to be analyzed and determined product feasibility categories as a reference in product improvement at the final stage. The ideal percentage of students' readability tests can be seen in Figure 6.

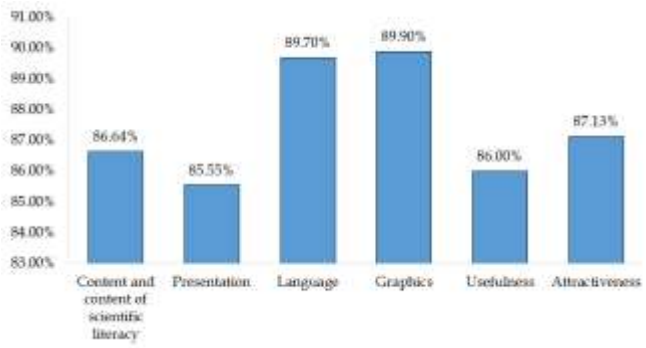

Figure 6. Percentage of ideality product readability test by students

Graphics, language, usefulness, attractiveness, content and scientific literacy, and presentation received respective scores of 89.90%, 89.70%, 86.00%, 87.13%, 86.64%, and 85.55% based on the data analysis that was conducted. The graphic aspect received the highest score of 89.90% in the Very Good category. The colors, layout, type and size of letters, illustrations and pictures presented can attract the attention and interest of the readers. This typeface used a font size of 12 and only in some parts used a different size to distinguish between content and reading titles. This is supported by prior

research indicating that the presence of illustrations in teaching materials facilitates students' comprehension of the material in depth (Putra et al., 2012).

Regarding content and scientific literacy, it has an ideal percentage of 86.64% in the Very Good category. In general, this book contains local wisdom in Madura, which is aimed at readers. Hence, they familiar with the applications of chemistry in everyday life, particularly the daily occurrences of local wisdom. This indicated that the material is coherent, simple to comprehend, and capable of fostering respect for the motherland, care for the environment, social responsibility, and concern for others (Puskurbuk, 2014).

Students have chemical literacy skills in context aspects in the good to very good category (Siami et al., 2023). The developed ethnoscience learning resources can increase motivation, foster curiosity and enthusiasm among students in learning and improve learning outcomes (Widiastuti et al., 2022). Learning based on local wisdom will help students learn knowledge that is in line with students' beliefs without being separated from applicable standard concepts (Ariningtyas et al., 2017). Students will have abilities that provide and make it easier for them to understand chemistry contextually (Jumalia et al., 2022). This is in accordance with PISA 2006 which stipulates that there are three aspects of competency or process to increase scientific literacy in students who use an ethnoscience approach (Pertiwi et al., 2019).

In terms of language, it scores an ideal 89.70% in the category of Very Good. There are two items with the highest scores in this aspect that contain the statement "sentences that are used clearly and effectively so that I can easily comprehend them." This value indicates that the language used is Very Good because every chemical and cultural material content was easy to understand and did not overwhelm the reader; if there was a difficult-to-understand scientific term in the material content, the glossary provided definitions. According to the research of Pangastuti et al. (2016) educational materials possess decency and elegance. However, several words or sentences are missing from the glossary, resulting in a language score of only 83% (Pangastuti et al., 2016).

It has an ideal proportion of 87.13% for attractiveness, and 86.00% in terms of usefulness, placing it in the Very Good category. This value indicates that the book has engaging qualities, a colorful appearance, is simple to comprehend, and provides additional information about Madura. According to the Puskurbuk standard, when compiling instructional materials, one must first select images that complement the reading text's content (Puskurbuk, 2014).

Moreover, the presentation aspect has the lowest ideal percentage of 85.55 percent in the very good category. This value indicates that the book was able to provide the reader with new understanding and insight. However, the lowest score is possible because some of the incoherence of the book's content is supported by a qualitative evaluation stating that it would be preferable to make it easier to read; the table of contents is located after the preface. Based on Prasetio and Perwiraningtya's suggestion that a coherent presentation of the material encourages readers to seek additional information on the ability to think creatively, innovatively, and effectively Prasetio et al. (2017)the author proposes that the presentation of the material should be more organized.

Overall, the final results of the assessment given by the chemistry teacher and students me*et al*l Very Good (VG) eligibility criteria. Based on the results of data analysis, it is feasible to use the chemical literacy book as a learning resource for teachers and students both at school and outside of school.

The final results of the assessment given by the chemistry teacher have an appropriateness category with very good criteria (SB) in the appropriateness aspect of scientific literacy content, presentation appropriateness aspect, language appropriateness aspect, graphic appropriateness aspect, usefulness aspect, and product attractiveness aspect. The final results of the assessment given by students as users of chemical literacy books have a feasibility category with very good criteria (SB) aspects of appropriateness of content and scientific literacy content, aspects of appropriateness of presentation, aspects of appropriateness of language, aspects of appropriateness of graphics, aspects of usefulness, and aspects of product attractiveness. Based on feasibility theory, a book can be considered appropriate if the average score obtained is at least "Good". Therefore, based on the results of the data analysis the chemistry literacy book that has been prepared can be declared suitable for use as a learning resource for teachers and students at school and outside school.

This chemical literacy book has a number of benefits, including integration of AR technology to aid in the visualization of abstract chemical material, such as molecular shape material, so that students can easily understand some examples of the molecular shapes of chemical compounds presented; completed with evaluation questions related to the material that has been presented to measure the scientific literacy of students; and could provide new insights for teachers in utilizing cutting-edge technological advancements as an engaging learning media.

The use of textbooks is a norm for the teachers, who rely on textbooks for teaching because the government provides science textbooks every year. That textbooks contain the syllabus to be covered (Alalwan et al., 2020). It is hoped that this chemical literacy book based on the local wisdom of Madura culture based on AR will be an engaging learning resource that will make students enjoy learning chemistry along with how it relates to Madura Island culture, add insight and knowledge about chemical applications in Madura Island culture, and foster creative attitudes of students. For further development, research can create the 3D object in Virtual Reality (VR).

Conclusion

Based on the research, it can be concluded that the chemistry literacy book, which was developed based on local Madurese wisdom using Augmented Reality (AR) technology, is a printed book that contains 7 (seven) cultural themes and 8 (eight) Basic Competencies which are aligned with the curriculum guidelines specified in the Minister of Education and Culture Regulation Number 37 of 2018. This book contains 2D or 3D representations of chemical molecules, can be accessed via Assemblr Studio, and contains scientific literacy including knowledge, context, competence and attitudes. The usability test for chemistry teachers shows that the chemistry literacy book received a Very Good (VG) rating in all aspects, with an overall ideal percentage of 91.50%. This shows the high level of usefulness and effectiveness of books in supporting active learning, increasing students' interest and motivation in learning chemistry, facilitating the integration of Madurese culture into chemistry education, and assisting teachers in conveying chemistry concepts related to local wisdom. Based on student readability tests, the chemistry literacy book also received a Very Good (VG) rating in all aspects with an ideal percentage of 87.91%. This shows that this book has succeeded in attracting students through its graphics, language, usability, attractiveness, content and scientific literacy, as well as its presentation.

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Author Contributions
For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, Yuendita, D. and Dina, D, D.; methodology, Yuendita, D. and Dina, D, D.; software, Yuendita, D.; validation, Dina, D., Handayani, S., and Pranjoto, M.; formal analysis, Yuendita, D.; investigation, Yuendita, D.; resources, Yuendita, D.; data curation, Yuendita, D. and Dina, D.; writing—original draft preparation, Yuendita, D.; writing—review and editing, Yuendita, D.; visualization, Yuendita, D.; supervision, Dina.; project administration, Yuendita, D.

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The authors declare no conflict of interest.

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