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# Developing CTL-Based Digital Media E-Worksheet for Second Language Learning

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## ABSTRACT

Currently, technology has influenced human life, including the world of education. Teachers also have to design how the exercises and materials can be used by using a cellphone. One way is CTL-based interactive e-worksheets which is an alternative learning media for popular scientific article text material that can visualize images, audio and video to make it easier for junior high school students to understand Indonesian language learning. This e-worksheet will later be designed using the CTL learning model. The CTL learning model will make students learn to connect everyday life with the material being studied. This research aims to develop CTL-based interactive e-worksheet as a digital medium for studying the text of popular scientific articles. This research uses mixed methods or mixed research. The research model used is 4-D. Data were collected using questionnaires, interviews, and scientific article text reading skill tests. The research results show that (1) the manufacture of CTL-based interactive e-worksheets follows the 4D research model until the deployment stage; (2) the results of e-worksheet validation are included in the very valid category in terms of content suitability, presentation

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language, and graphics; and (3) product dissemination shows an increase in popular scientific article text reading skills in experimental and control classes. Therefore, CTL-based interactive e-worksheet is suitable for use as a digital learning medium for popular scientific article text material.

***Keywords:*** E-Worksheet; Contextual Teaching and Learning; Liveworksheet

# 1. Introduction

The ease of human survival today is influenced by advances in technology. The field of education is also facilitated by technological advances if utilized optimally. According to Permendikbudristek Number 16 of 2022 explains that the use of technology and communication is needed to achieve learning objectives. Along with the advancement of science and technology that moves dynamically, of course, balanced education and knowledge are needed to follow this dynamic movement[1]. Referring to the statement of Permendikbudristek, technology in learning should be used optimally to achieve learning objectives, especially in Indonesian language learning. However, the fact is that according to a survey conducted by New Jersey Minority Educational Development shows that the quality of Indonesian education is ranked 67th out of 203 countries in the world in 2023[2]. This is very concerning because based on Newzoo's Global Mobile Market data in 2022 Indonesia is ranked fourth as the country with the most smartphone users in the world after China, India and the United States with 192.15 million users. Being ranked fourth as the country with the most smartphone users requires us as Indonesians to maximize the use of technology as best as possible to advance human resources.

Advancing human resources certainly begins in the realm of education. Educators have a duty to be able to optimize technology in learning, for example creating electronic-based teaching materials. Changing traditional printed worksheets to electronic worksheets or e-worksheet is one way to improve the appearance and quality of worksheets learning and encourage student innovation and creativity[3]. E-worksheet also has advantages for teachers because it is flexible by directing students to find concepts through experiments and investigations with interactive e-worksheet[4]. Students' interest in learning will also be stimulated because the material and practice questions are made interesting and fun[5]. Besides e-worksheet, e-books are also interactive learning media in delivering information because they can display multimedia illustrations and make more animations so that students are not easily bored[6]. In addition to improving students' reading skills, interactive e-worksheet can also reduce the use of worksheets that require students to pay more. Students are required to pay more because the worksheets that has been made is required to be printed first before use. Worksheet is printed because it does not include interactive elements in it so that students cannot directly use it with cellphones but it must first be printed in paper form. The use of printed worksheets that use costs from students is certainly inefficient. Worksheets in printed form are still not effective in their use[7]. Therefore, in order to increase the effectiveness and efficiency of learning, it is necessary to have an electronic-based and interactive worksheets in learning.

Liveworksheet as interactive e-worksheet is one type of learning media that can be used to increase student learning motivation. Liveworksheet interactive e-worksheet can assist students in learning independently, is interesting, clear, easy to understand, and can be used without space and time constraints with learning videos equipped with automatic assessment features[8]. The use of the Liveworksheet interactive e-worksheet itself can be used directly by students by directly visiting the site via Google Chrome so that students do not need to download or register on Liveworksheet[9]. Popular scientific article text is one of the texts in Indonesian language learning for junior high school students. The text of popular scientific articles is important to learn for students because the text is close to students in everyday life. The text of popular scientific articles requires students to have good reading skills to be able to understand the entire content of the text. Reading skills can help students more quickly understand the material because reading skills are a process carried out by students to get messages conveyed by writers through written language[10]. However, 71% of students' reading comprehension skills are in the low category, and some are even not fluent readers[11]. This can be caused by

the learning process that is carried out only listening and doing assignments, causing boredom for students and teachers in the learning process [12].

One way to attract students to be more motivated in participating in learning is to use interactive applications. Interactive e-worksheet can be used as an alternative digital learning media in learning the text of popular scientific articles. The interactive form of e-worksheet is by visualizing e-worksheet using a website called Liveworksheet. Liveworksheet is a digital platform that makes it easy for teachers to create e-worksheet because it can be directly shared by students using the internet [13]. The Liveworksheet platform can increase student motivation because it is proven that liveworksheet is most often used compared to other platforms, such as youtube, quiz, Kahoot, and so on [14]. In addition, teachers must also pay attention to learning models that can present popular scientific article texts related to students' daily lives so that students can easily understand popular scientific article texts. One of the most appropriate ways is to choose a learning approach that is in accordance with the characteristics of students, materials, facilities, and school infrastructure [15]. Therefore, the learning model that fits the situation is the Contextual Teaching and Learning model [16]. The learning model links the learning process with the real daily experiences experienced by students. Thus, the role of students in the CTL learning model is as a learner who discovers and builds their own concepts [17]. The combination of the CTL model with technology-based interactive e-worksheet learning media can make students more critical in understanding the text of popular scientific articles. Interactive e-worksheet based on CTL learning model will also make learning more interesting and innovative because it can well visualize the text of popular scientific articles for students. Therefore, students will be more motivated to follow the learning process at school.

Traditional teaching methods often rely on printed worksheets, which present several limitations. They lack interactivity, hindering student engagement and potentially increasing costs due to printing requirements. Furthermore, they do not fully capitalize on the potential of digital media to present varied stimuli (visual, audio, video) which can cater to diverse learning styles and enhance comprehension. This is particularly relevant in Indonesian language learning, where texts like popular scientific articles require strong reading comprehension skills, yet students often struggle with low reading comprehension. To address these gaps, this research proposes the development and validation of Contextual Teaching and Learning (CTL)-based interactive e-worksheet. CTL is a pedagogical approach that emphasizes connecting learning to students' real-life experiences, fostering deeper understanding and engagement. E-worksheet, delivered through platforms like Liveworksheet, offer interactive exercises, multimedia integration, and immediate feedback, potentially overcoming the limitations of traditional worksheets and enhancing learning outcomes. Therefore, this study aims to develop and validate a CTL-based interactive e-worksheet for learning popular scientific article texts in Indonesian language for junior high school students. Although the core of this research centers on the development of the CTL-based interactive e-worksheet, a hypothesis is established to guide the validation phase. Specifically, it is hypothesized (H1) that experts will evaluate the resulting e-worksheet as valid. This validation will encompass assessments of its content suitability, the clarity and correctness of its language, the effectiveness of its presentation, and the quality of its graphics.

# 2. Literature Review

## 2.1. Interactive Liveworksheet

E-worksheet are teaching materials that make it easier for students to understand learning through electronic media that can be accessed using a computer, laptop, or smartphone [18]. Through the use of E-worksheet, students' desire to learn and interest in learning can be increased [19]. E-worksheet need to be made creatively and interactively so as to develop a more enjoyable learning process. Interactive E-worksheet can be made independently by teachers according to the subjects they teach [20]. Interactive E-worksheet are made using information and communication technology that provides feedback on the learning process of students so that there is two-way communication with students. Some tools that can be used to create E-worksheet include 3D Pageflip, Kvisof Flipbook Maker, and Liveworksheet [21].

Liveworksheet is an education platform founded by Victor Gay in 2016 to integrate technology into classroom learning [13]. Liveworksheet transforms learners' worksheets from printed to interactive digital forms that can be accessed

by learners from various devices. The interactive element in this E-worksheet is in the form of automatic assessment of learners' work so that teachers do not need to spend a lot of time checking students' answers one by one. Learners can immediately know the results of their work after completing the exercise. Liveworksheet also provides features for students according to their respective classes so that communication between teachers and students can occur intensively and interactively [22]. In addition, Liveworksheet interactive E-worksheet can be added to various media in the form of images, videos, audio, and several types of interactive question exercises so that the learning process feels more fun in the classroom [23]. Liveworksheet transforms learners' worksheets that were originally printed into an interactive digital form and can be accessed by learners from various devices. The interactive element in this E-worksheet is in the form of automatic assessment of learners' work so that teachers do not need to spend a lot of time checking students' answers one by one. Learners can immediately know the results of their work after completing the exercise. Liveworksheet also provides features for students according to their respective classes so that communication between teachers and students can occur intensively and interactively [24]. In addition, Liveworksheet interactive E-worksheet can be added to various media in the form of images, videos, audio, and several types of interactive question exercises so that the learning process feels more fun.

## 2.2. Contextual Teaching and Learning (CTL)

Contextual Teaching and Learning (CTL) is a learning model that requires teachers to bring real life into the classroom and encourage students to connect their knowledge with their daily lives [25]. Learning with the CTL model is more concerned with learning strategies, not learning outcomes so that students' understanding of the material is deeper and more meaningful [26]. CTL emphasises student involvement in learning and connects the material learned with what students find in real life so that students are encouraged to apply knowledge and skills in their daily lives as family and community members [27]. As a learning model, CTL has 7 principles that underlie the implementation of the learning process. These CTL principles are often referred to as CTL components. The seven principles are constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment [28].

## 2.3. Popular Scientific Article Texts

In general, the definition of popular scientific article text is a text in which structured information is presented with the aim of explaining something to the reader. The text of a popular scientific article is a scientific essay that contains science and is written in a light language style so that it is easy for readers to understand [29]. A popular scientific article, also known as a popular article, is a medium in the form of a written work to express an idea and is published in mass media, either newspapers, magazines, or internet media [30]. Another expert explained that the text of popular scientific articles is writing that contains views and observations and is packaged in popular language so that people can easily understand it [31]. Popular scientific articles can also be about reviews, opinions, and criticisms about problems that are being discussed by the community [32]. The text of popular scientific articles is a work of writing that contains opinions in the style of fact analysis and is not news presented in newspapers or magazines [33]. Popular scientific articles directly discuss hot topics and are indeed the center of public attention and are not bound to certain scientific structures or various descriptions of basic theories.

The text of popular scientific articles aims to provide information about a factual problem that is useful to communicate to readers. Popular scientific essays can be presented in the form of papers that contain opinions and are actual and sometimes controversial for the purpose of convincing, influencing, and entertaining readers by providing information [34]. Popular scientific article text is a type of text that aims to provide information about a problem in a systematic and structured manner. Popular scientific article text uses formal and objective language by including valid facts, and is packaged in a form of writing that is easily understood by the public.

## 2.4. Digital Learning Media and Interactive E-Worksheet Platforms

The rapid development of educational technology has transformed the way instructional materials are delivered, shifting from static print formats to dynamic, interactive digital platforms. One such innovation is the interactive e-

worksheet, a form of digital learning material that promotes learner autonomy, immediate feedback, and engagement [35]. When designed effectively, e-worksheet can increase student motivation and support independent learning by providing multimedia elements such as videos, audio, and interactive tasks [36].

Among the widely used platforms, Liveworksheet stands out due to its ease of use, support for multimedia integration, and automatic assessment features. Developed by Victor Gay in 2016, Liveworksheet enables teachers to convert traditional worksheets into interactive formats accessible via various devices. It supports differentiated instruction by allowing teachers to assign specific tasks based on student profiles and to track learning progress in real-time [37]. However, while Liveworksheet has gained popularity, research on its pedagogical integration—particularly in language learning contexts—is still limited. This study seeks to address this gap by embedding CTL principles into the worksheet structure to enhance its educational impact.

## 2.5. Contextual Teaching and Learning (CTL) and Its Instructional Design Integration

Contextual Teaching and Learning (CTL) is a constructivist-based instructional model that emphasizes the connection between academic content and real-world experiences. Rather than focusing solely on knowledge acquisition, CTL prioritizes meaningful learning through active engagement, inquiry, reflection, and authentic application [38]. CTL comprises seven core components—constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment—that guide how instruction should be structured to promote deeper understanding [39].

While CTL has been widely applied in classroom settings, its theoretical application in the design of digital instructional media remains underexplored. Existing studies often describe CTL conceptually but lack clear operationalization within media design frameworks [40]. This research responds to that gap by embedding each CTL component into the development of an interactive e-worksheet, ensuring that every activity is aligned with a pedagogical function:

- Constructivism: Tasks scaffold learners' prior knowledge and encourage sense-making through contextual analysis.
- Inquiry and Questioning: Open-ended prompts guide students to explore issues, collect data, and synthesize arguments.
- Learning Community: Activities encourage collaboration through peer review and classroom discussion.
- Modeling: Annotated examples of popular scientific texts demonstrate structural conventions and linguistic features.
- Reflection: Learners are prompted to self-assess and evaluate their learning process after each section.
- Authentic Assessment: Final tasks involve producing publishable-level texts that reflect real-world communicative purposes.

By integrating CTL not just in content but also in design, this study builds a pedagogically coherent media product that addresses not only curriculum demands but also students' sociocultural learning needs. In line with the Merdeka Curriculum, which emphasizes autonomy, relevance, and local context, the e-worksheet includes culturally responsive themes such as environmental issues in West Sumatra and indigenous wisdom practices This is reflected in the modeling presented in the e-worksheet, which is derived from Minangkabau culture. CTL principles are systematically accommodated in the e-worksheet design. Among these principles, constructivism is prioritized because it positions students as active participants in constructing knowledge through contextual learning experiences [41]. Emphasizing constructivism enables students to independently develop understanding, enhance critical and creative thinking skills, and strengthen concept retention [42]. Thus, the interactive e-worksheet reinforces a learning process that is not only outcome-oriented but also focused on the process and meaning of learning itself.

## 2.6. Characteristics and Pedagogical Potential of Popular Scientific Article Texts

The popular scientific article is a genre that bridges academic discourse and public communication, often used in education to develop critical thinking, argumentation, and scientific literacy. It presents factual information in an accessible and engaging style, aiming to inform or persuade lay audiences [43]. Unlike academic articles, popular scientific texts are less rigid in structure, allowing for more creative expression while still demanding logical coherence, evidence use, and clarity.

In Indonesian junior secondary schools, the popular scientific article is part of the curriculum under the text-based genre approach. However, many teachers report challenges in guiding students to write such texts, due to limited instructional models and a lack of engaging teaching materials [44]. Existing worksheets often fail to emphasize the functional communicative goals of the genre and instead focus narrowly on text structure. Therefore, integrating this genre into a CTL-based digital media offers an opportunity to make the writing process more meaningful, authentic, and student-centered.

### 2.7. Identified Gaps and Contribution of This Study

While prior studies have addressed the role of e-worksheet and CTL in education separately, few have systematically integrated CTL principles into the design of interactive e-worksheets, especially for genre-based language instruction. Furthermore, there is limited empirical evidence on the effectiveness of such media in enhancing students' engagement and writing performance in the context of popular scientific articles. This study contributes to the existing literature by offering a theoretically grounded and practically tested CTL-based interactive e-worksheet, specifically tailored to support students' learning of popular scientific article texts. By combining genre pedagogy, contextual learning, and digital media design, the study addresses the need for instructional tools that are not only technologically innovative but also pedagogically principled and culturally situated.

## 3. Materials and Methods

### 3.1. Research Design

E-worksheetThe methodology employed in this research is a mixed-methods approach. Mixed methods, as defined by Creswell involve the integration of both qualitative and quantitative research. The research model utilized in this study is the 4D model, developed in 1974 by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel. The 4D model comprises four primary stages: (1) define, (2) design, (3) develop, and (4) disseminate [45]. This research implemented these 4D stages to achieve specific objectives.

The define stage involved three key activities: (1) an analysis of teacher and student needs, (2) an analysis of the curriculum to be implemented, specifically the Kurikulum Merdeka, and (3) a concept analysis. Subsequently, during the design stage, an e-worksheet model was created prior to its implementation. The development stage, entailed assessing the validation, practicality, and effectiveness of the e-worksheet that was developed. Finally, the disseminate stage involved a limited trial with eighth-grade students at SMP Negeri 1 Padang to determine (1) student learning outcomes after utilizing the interactive e-worksheet and (2) the level of significant difference in reading skill outcomes between students using the e-worksheet compared to those using conventional worksheets.

### 3.2. Data Sources and Data Collection

This research method uses the survey method. The survey method was used to collect data from teachers, students, and validators regarding the making of CTL-based interactive e-worksheet. Teacher data was collected through structured interviews with an Indonesian language subject teacher at SMP Negeri 1 Padang. Student data was collected by giving questionnaires to 34 eighth-grade students of SMP Negeri 1 Padang. This questionnaire contains 16 questions related to students' learning styles, learning needs, social and cultural backgrounds, and learning materials that are difficult for students. The questionnaire contains open statements regarding student needs in making CTL-based interactive e-worksheet for popular scientific article text material. Product validation questionnaires consisting of content suitability, language, presentation, and graphics were distributed to experts in their fields to assess the quality of the e-worksheet that had been made. So, there are three lecturers who are validators for the media that was developed. After the assessment by experts, researchers then analyzed the data and revised the e-worksheets based on the input and suggestions given by the experts. This was done before the CTL-based interactive e-worksheet was used in Bahasa Indonesia learning. This research uses mixed data which is a combination of qualitative and quantitative data. Qualitative data is obtained from input and suggestions from experts as validators of CTL-based interactive e-worksheet. Quantitative data was obtained from the results of validation questionnaires filled out by experts as validators in assessing the resulting CTL-based interactive e-worksheet.

Research data was collected using several instruments

in the form of questionnaires (appropriateness of presentation, content, language, and graphics) and an objective test of reading skills of popular scientific article texts. The questionnaire is in the form of questions and respondents choose one of the alternative answers available. This questionnaire is in the form of the validity of the CTL-based Liveworksheet interactive e-worksheet model. The assessment aspects determined are (1) appropriateness of presentation, (2) content, (3) language, and (4) graphics. Each aspect will be developed into several statements to facilitate the process of analyzing the validity of the CTL-based Liveworksheet interactive e-worksheet learning media being developed. To measure the level of effectiveness of this e-worksheet media, a test was conducted in the form of a reading comprehension skills test with the help of the developed e-worksheet media. This data collection used a posttest only control group design with a control class and an experimental class. Students' understanding of the text was tested with an instrument in the form of a reading skills test containing 30 objective questions related to modeling that were displayed to measure students' level of understanding of the contents of the reading. This test contains four alternative answers that students can choose after understanding the contents of the reading.

### 3.3. Data Analysis

The questionnaire data obtained in the study used a Likert scale of 0-100 to determine its validity. The product validity analysis consists of five categories, namely invalid, less valid, quite valid, valid, and very valid. The validity category of the CTL-based interactive e-worksheets can be described in **Table 1** and the results of the validity value calculation are obtained using the following formula.

$$Validity\ Value = \frac{Score\ obtained}{Maximum\ Score} \times 100\% \quad (1)$$

**Table 1.** E-worksheets Validity Category.

| Interval (%) | Class |
|---|---|
| 81–100 | Very Valid |
| 61–80 | Valid |
| 41–60 | Quite Valid |
| 21–40 | Less Valid |
| 0–20 | Invalid |

In addition to using questionnaires, this study also conducted a dissemination phase employing a multiple-choice objective test for data collection. The students' test scores were subjected to prerequisite analyses, including tests of normality, homogeneity, and hypothesis testing using the t-test. To analyze the data obtained from the test results, the researcher employed a multi-step analytical technique (1) converting student test scores into grades, (2) converting reading skill scores into a standardized scale out of 10, and (3) describing the distribution of students' test scores using frequency distribution and performance qualifications, namely perfect, very good, good, more than enough, enough, almost enough, lacking, very lacking, bad, very bad. **Table 2** presents the conversion scale used.

**Table 2.** Scale Conversion Guidelines.

| No | Mastery Level (%) | Scale Change Value 10 | Qualification |
|---|---|---|---|
| 1 | 96–100 | 10 | Perfect |
| 2 | 86–95 | 9 | Very good |
| 3 | 76–85 | 8 | Good |
| 4 | 66–75 | 7 | More than enough |
| 5 | 56–65 | 6 | Enough |
| 6 | 46–55 | 5 | Almost enough |
| 7 | 36–45 | 4 | Lacking |
| 8 | 26–35 | 3 | Very lacking |
| 9 | 16–25 | 2 | Bad |
| 10 | 0–15 | 1 | Very bad |

## 4. Results and Discussion

The rapid development of technology and science has changed the field of education. To be able to keep up with this development, the education is required to adapt to existing innovations so that the learning process remains interesting and relevant. One innovation that utilises technology is the use of technology-based teaching materials such as e-worksheet. Liveworksheet-based e-worksheet enable more dynamic interactions between teachers and students, facilitate access to materials, and provide immediate feedback through automatic assessment that can increase efficiency in the learning process. With these features, Liveworksheet-based e-worksheet not only increase student engagement but also make it easier for teachers to monitor student learning progress in real-time. The automated assessment provided by this platform allows teachers to identify student difficulties quickly and provide timely interventions, thus supporting a more responsive and adaptive learning process.

In this study, researchers will focus on the utilisation of Liveworksheet as a medium to create an interactive e-worksheet. The development of this e-worksheet refers to

the 4D development model, which includes four main stages, namely definition, design, development, and dissemination. Researchers have completed the design, validation, and dissemination of the CTL-based interactive e-worksheet, which will then be used to improve the quality and effectiveness of learning. Thus, it is expected that the use of Liveworksheet-based e-worksheet can significantly contribute to a more interactive and technology-based learning process, as well as assist teachers in managing and delivering learning materials.

## 4.1. Define Stage of CTL-Based Interactive E-worksheet

The initial stage of the 4D research model is the definition stage. This stage is carried out to create a CTL-based interactive e-worksheets that meets the needs. At this stage, all information is collected regarding the extent of development that needs to be done based on Merdeka Curriculum at the junior high school level. The definition stage is carried out in three steps, namely needs analysis, curriculum analysis, and concept analysis. Needs analysis was conducted on Indonesian language subject teachers and grade 8 junior high school students. Teacher needs analysis was carried out by observing and interviewing grade 8 Indonesian language subject teachers at SMP Negeri 1 Padang. The interview results showed that the teacher had used electronic teaching media in the form of powerpoint and online e-books. However, in face-to-face learning, teachers often give exercises using conventional learning media such as worksheet books made by the subject teacher meeting or Indonesian Language MGMP for junior high school in Padang City. The learning media used today cannot be maximised to build students' knowledge, so the creation of CTL-based interactive e-worksheets is expected to improve the shortcomings that exist in the current learning media.

In addition, student needs analysis was conducted by distributing questionnaires to 34 grade 8 students of SMP Negeri 1 Padang. The analysis of students' needs aims to determine the right learning media so that it can support interest and cognitive learning outcomes on popular scientific article text for grade 8 students of SMP Negeri 1 Padang. The questionnaire contained 15 statements with categories of strongly disagree, disagree, agree, and strongly agree. The results of the questionnaire distributed to the students are presented in **Table 3**.

**Table 3.** The Results of the Questionnaire.

| No | Statements | Category (%) | | | |
|---|---|---|---|---|---|
| | | **Strongly Disagree** | **Disagree** | **Agree** | **Strongly Agree** |
| 1 | I like Indonesian Language Lessons. | 3.3 | 3.3 | 70 | 23.3 |
| 2 | Learning Indonesian is easier to learn independently. | 3.3 | 46.6 | 43.3 | 6.6 |
| 3 | Learning Indonesian is difficult to understand. | 16.6 | 66.6 | 10 | 6.6 |
| 4 | I always ask questions regarding the material the teacher shares. | 0 | 20 | 63.3 | 16.6 |
| 5 | By learning Indonesian, I can increase my knowledge through reading activities. | 0 | 0 | 76.6 | 23.3 |
| 6 | Indonesian language teachers more often use the lecture method in learning Indonesian | 3.3 | 33.3 | 50 | 13.3 |
| 7 | I like learning Indonesian which is interactive and interesting. | 0 | 0 | 60 | 40 |
| 8 | Indonesian language teachers rarely use varied teaching media in Indonesia language learning | 13.3 | 53.3 | 30 | 3.3 |
| 9 | Indonesian language teachers rarely use digital technology-based learning media. | 23.3 | 50 | 23.3 | 3.3 |
| 10 | I prefer learning Indonesian using digital technology. | 0 | 6.6 | 56.6 | 36.6 |
| 11 | I need interactive and interesting Indonesian language learning media, especially popular scientific article text material. | 0 | 0 | 66.6 | 33.3 |
| 12 | I need interactive and interesting Indonesian language learning media, especially popular scientific article text material. | 0 | 6.6 | 56.6 | 36.6 |
| 13 | I need Indonesian language learning media, especially popular scientific article text material. | 0 | 6.6 | 63.3 | 30 |
| 14 | It is easier for me to understand texts in Indonesian language learning with the help of interactive visual and audio object images. | 0 | 3.3 | 53.3 | 43.3 |
| 15 | After learning Indonesian, I would prefer to immediately work on evaluation questions. | 0 | 16.6 | 66.6 | 16.6 |

Based on the data presented in **Table 3**, it was found that 93.2% of students prefer to learn Indonesian using digital technology, 93.2% of students find it easier to understand Indonesian learning using digital technology, 96.6% of students

find it easier to understand text in Indonesian learning with the help of visual objects and interactive audio, and 83.2% of students prefer to do evaluation questions directly after learning Indonesian. So, it can be concluded that students need learning media in the form of interactive e-worksheet in learning popular scientific article text.

Based on the questionnaire results, most students agreed strongly that interactive and technology-based learning media can increase their interest in learning popular scientific article texts. Students also revealed that they understand the material more easily when it is presented interactively and visually compared to conventional methods that tend to be monotonous. In addition, students mentioned that they need more varied exercises to deepen their understanding of the material taught. Thus, the development of CTL-based interactive e-worksheet is expected to not only fulfil the needs of teachers, but also be able to answer students' needs for more dynamic and challenging learning media. This media is expected to be a solution in creating a more enjoyable learning experience, as well as supporting the achievement of more optimal learning outcomes in accordance with the demands of the Merdeka Curriculum.

Curriculum analysis is carried out by reading and understanding the learning objectives and their suitability for the applicable Merdeka Curriculum. The learning objectives for the text of popular scientific articles are formulated independently by the teacher based on the Learning Outcomes listed in the Merdeka Curriculum. At SMP Negeri 1 Padang, the text of popular scientific articles is taught to grade 8 students. The learning objectives listed in the e-worksheet are to explore and evaluate various information from the text of popular scientific articles listened to, interpret and provide examples of facts and opinions from the text of popular scientific articles read, present interview results as data for writing popular scientific article texts, and create creativity in the form of opinions and facts in popular scientific article texts.

In addition, this curriculum analysis also considers how e-worksheet can accommodate students' needs to achieve these learning objectives. In the teaching process, teachers are expected to utilise e-worksheet as a medium that helps students in understanding the important concepts of popular scientific article texts in a more interesting and interactive way. The use of e-worksheet also aims to provide a more contextual and relevant learning experience, so that students are not only able to master the material theoretically, but also can apply it in real-life situations.

Concept analysis was conducted to review the accuracy of the concepts contained in the Indonesian language print book published by the Ministry of Education and Culture, as well as its suitability for the Merdeka Curriculum. From the results of the analysis, several important things were found that need attention. First, the main concept in the learning material for popular scientific article texts is in accordance with the formulation of the Merdeka Curriculum, which emphasises the relevance of the material to students' needs to understand the text in depth. However, in the details of the learning concept, there are still some shortcomings. One of them is the lack of a comprehensive application of the CTL learning model in delivering the material. This shows that the contextual approach that should help students relate the material to real life has not been well integrated in the learning of popular scientific article texts.

Furthermore, the curriculum demands that learning resources can provide a comprehensive explanation of the material concept, so that students not only understand the theory, but can also apply the knowledge through various activities. Unfortunately, this analysis also revealed a significant lack of material, namely the absence of a clear discussion of the difference between scientific articles and popular scientific articles. The absence of this material may hinder students' understanding of the specific characteristics of the two types of articles. In addition, it was also found that some concepts in the learning materials tend to be conveyed theoretically without being balanced with concrete examples that can facilitate students in understanding the material. Therefore, this analysis emphasises the importance of improving and enriching the material in the e-worksheet to make it more comprehensive and in line with the demands of Merdeka Curriculum, as well as ensuring that all required concepts are well covered before proceeding to the e-worksheet design stage, which can be seen in **Figure 1**.

**Cuplikan Konsep Pembelajaran yang Akan Diuraikan dalam E-LKPD Teks Artikel Ilmiah Populer**
**(Preview of Learning Concepts for the E-LKPD on Popular Scientific Articles)**

HALAMAN SAMPUL (COVER PAGE)
IDENTITAS E-LKPD (E-LKPD IDENTITY)
PANDUAN PENGGUNAAN E-LKPD (E-LKPD USER GUIDE)
URAIAN CAPAIAN PEMBELAJARAN (DESCRIPTION OF LEARNING OUTCOMES)
TUJUAN PEMBELAJARAN (LEARNING OBJECTIVES)
PROFIL PELAJAR PANCASILA (PANCASILA STUDENT PROFILE)
INDIKATOR PEMBELAJARAN BERBASIS CTL (INDICATORS OF CTL-BASED LEARNING)
Kegiatan 1 (Activity 1)
Mengekspolasi dan Mengevaluasi Berbagai Informasi Teks Artikel Ilmiah Populer yang Disimak. (Exploring and Evaluating Diverse Information from Popular Science Articles)

Kegiatan 2 (Activity 2)
Menginterpretasi dan Memberi Contoh Fakta dan Opini dari Teks Artikel Ilmiah Populer yang Dibaca.
(Interpretation and Exemplification of Factual and Opinion-Based Content within Read Popular Science Articles)

Kegiatan 3 (Activity 3)
Mempresentasikan Hasil Wawancara Sebagai Data untuk Menulis Teks Artikel Ilmiah Populer. (Presenting Interview Findings as Data for Writing Popular Science Articles)

Kegiatan 4 (Activity 4)
Menciptakan Kreatifitas dalam Bentuk Opini dan Fakta pada Teks Artikel Ilmiah Populer. (Cultivating Creativity through Opinions and Facts in Popular Scientific Articles)

**Figure 1.** Snippets of Learning Concepts from Scientific Articles.

The results of this concept analysis contain a structure that will be used as a whole e-worksheet format. This structure is designed by taking into account the theoretical elements that should be in the worksheet, such as learning objectives, materials, tasks, and evaluation. In addition, this concept analysis also includes the addition of subject matter that will be learned by students, accompanied by relevant exercises. The materials and exercises are designed to support the achievement of learning objectives and ensure that all important aspects of the curriculum are covered in the e-worksheet. It aims to provide a comprehensive and structured guide for students, so that they can learn effectively and gain a deep understanding of the topics studied.

## 4.2. Design Stage of CTL-Based Interactive E-worksheet

The design stage is an important phase in making CTL-based interactive e-worksheet learning media for learning popular scientific article texts. At this stage, the e-worksheets design is adjusted to the results of the needs analysis and curriculum analysis that have been carried out previously. The main focus at the design stage is to develop a framework, not directly create animations or other multimedia elements. This framework includes important parts such as the cover, instructions for use, learning materials, tasks, and final assessment. The designed e-worksheets is in digital format, consisting of text, images, videos, and presentations in Powerpoint format, which can be accessed through computers or other electronic devices. By providing interactive and accessible materials, the e-worksheets are expected to increase learning productivity and support a more effective learning experience.

After developing the framework, the next step is to develop the supporting elements of the CTL-based interactive e-worksheets model. This includes designing an attractive e-worksheets cover as well as compiling other supporting elements, such as page layout and visual design. The cover design and other elements should make use of contrasting colours and relevant designs in order to attract students' attention and create a pleasant visual experience. These design elements are important to ensure that the e-worksheets is not only informative but also interesting and motivates students to engage in the learning process.

Furthermore, drafting the Liveworksheet interactive e-worksheet model involves designing each page by considering effective visual design principles. The pages of the e-worksheet should be designed to be more attractive by selecting contrasting colours and designs related to the learning materials. The researcher developed a CTL-based e-worksheet framework by formulating key elements that will facilitate optimal interaction between students and learning materials. With an attractive and functional design, the e-worksheet is expected to increase student engagement and facilitate understanding of the material, thus supporting more innovative and enjoyable learning.

The researchers developed a CTL-based interactive e-worksheet framework with systematic steps that include formulating learning objectives, identifying teaching materials based on indicators, organising materials systematically and logically, and designing e-worksheet in accordance with the CTL learning model. All of these designs were carried out using Microsoft Word 2013, which allows the structured arrangement and organisation of materials. By using this software, researchers can ensure that all elements required in the e-worksheets are well integrated and in accordance with CTL learning principles.

In addition, researchers also included supporting elements of the e-worksheets which include learning outcomes, learning objectives, indicators, teaching materials, work steps, and evaluation. These supporting elements were designed following the graphic elements of the e-worksheets that had been designed using Adobe Illustrator CC 2020. The results of this graphic design are then saved in PDF format, which ensures that all visual elements, such as page layout and design, remain consistent and professional when accessed by users.

The CTL-based interactive e-worksheet that has been designed as learning media is then saved in PDF format and uploaded as a project on the website www.liveworksheets.com. On this platform, interactive media in the form of video and audio, as well as assessment settings for questions, are arranged in such a way that the assessment can appear automatically when students complete the task. The use of Liveworksheets facilitates the presentation of interactive media that can be accessed online, so that students can interact directly with learning materials.

The arrangement of the pages in the CTL-based interactive e-worksheets that have been uploaded on the Liveworksheets site is arranged by paying attention to aesthetic aspects and functionality. Each page is designed to be attractive and easy to navigate, with graphic elements that support material understanding and increase student engagement. A good design will help students to follow the learning process more efficiently, as well as provide a more enjoyable and interactive learning experience.

The e-worksheet that has been designed by the researcher is now ready for the validation stage. This validation will ensure that all elements in the e-worksheets function in accordance with the learning objectives and meet the expected quality standards. The page layout of the CTL-based interactive e-worksheets uploaded on the Liveworksheets website can be seen in **Figure 2**.

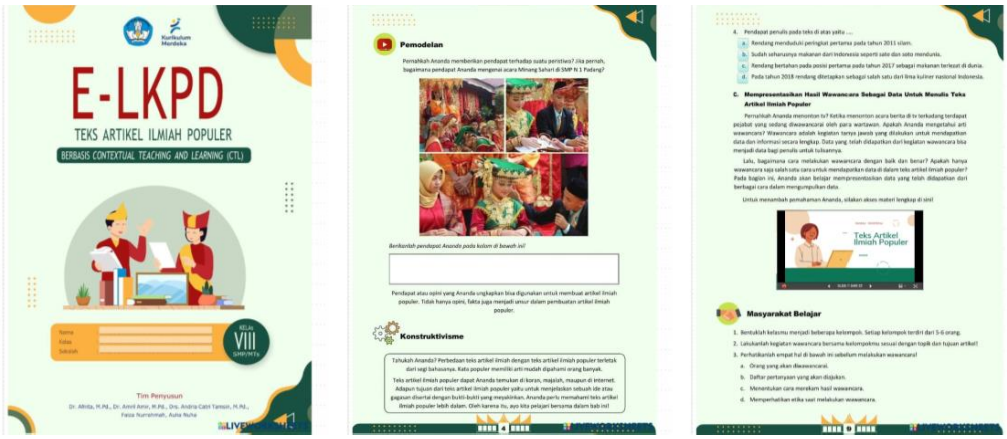


**Figure 2.** E-worksheets Page Layout Based on CTL on Liveworksheet Website.

Based on **Figure 2**, it can be seen that the layout design of this interactive e-worksheet is designed with an approach that incorporates elements of Minangkabau culture visually and functionally. For example, on the cover page, the name of the learning media, "E-LKPD Teks Artikel Ilmiah Populer Berbasis Contextual Teaching and Learning," is written in capital letters to emphasize a formal and professional impression. The main visual element on the cover is a picture of two people wearing Minangkabau traditional clothing, which functions not only as a decoration, but also as an attempt to bring West Sumatra's local wisdom into the context of modern education. Minangkabau traditional clothing, known for its beauty and distinctiveness of design, becomes a symbol of a rich and colorful culture, while strengthening the identity of this e-worksheet as a learning media rooted in local values.

For the overall layout, a mix of contrasting colors is chosen. These colors not only serve to beautify the appearance, but also to ensure the readability of the text remains optimal, by considering the contrast between the text and the background. The design is designed so that every visual element, from images to layout, has a role in increasing user engagement without compromising functionality or reading comfort.

Each page in this e-worksheet is organized consistently by maintaining visual harmony and the established Minangkabau cultural theme. Minangkabau carving motifs or cultural icons such as Rumah Gadang can be used as decorative elements that tie all pages into a cohesive whole. Readability remains a top priority in determining font size and typeface, ensuring that the information presented can be received clearly and effectively by users. Thus, this e-worksheet is not only an informative and interactive learning tool, but also acts as a medium to introduce and preserve Minangkabau cultural heritage to the younger generation.

## 4.3. Develop Stage of CTL-Based Interactive E-worksheet

The next stage is the development stage. This development stage aims to assess the validity of the product in the form of Liveworksheet interactive e-worksheet learning media and then test it on students. This process includes several important steps, namely validation, practicality, and effectiveness. However, due to time constraints, this research was only conducted up to the validation stage. The development stage is crucial to ensure that the learning media designed is not only theoretical but also practical and useful for the actual learning process.

At the validation stage, the CTL-based interactive e-worksheets model is tested by experts to ensure that the resulting product meets the established validity standards. The main purpose of the validation stage is to ensure that this learning media is in accordance with the needs and applicable educational standards. The aspects examined in the validation process include the suitability of content, presentation, language, and graphics. This assessment is important to ensure that all elements in the e-worksheets can be used effectively in the learning context and in accordance with the principles of good design.

Validation is conducted by asking experts to fill in a specially designed validation questionnaire. This questionnaire includes numerical data and suggestions from the validators that serve to evaluate the level of validity of the product. Each aspect of the e-worksheets is examined in detail to determine whether it fulfills the set criteria. This process involves critical analysis of each element of the e-worksheet to ensure that the final product is of high quality and meets the learning objectives. The results of this validation process are presented in summary form which includes an evaluation for each predetermined aspect. A summary of these validation results is shown in **Table 4**.

**Table 4.** E-worksheet Validation Results.

| No | Aspect | Score Result (%) | Class |
|---|---|---|---|
| 1 | Contents | 100 | Highly Valid |
| 2 | Language | 93.75 | Highly Valid |
| 3 | Presentation | 100 | Highly Valid |
| 4 | Graphic | 92.5 | Highly Valid |
| Average | | 96.54 | Highly Valid |

**Table 4** shows that the CTL-based interactive e-worksheet obtained a validity value of 100% from the presentation aspect, the CTL-based interactive e-worksheet obtained a validity value of 93.75% from the language aspect, the CTL-based interactive e-worksheet obtained a validity value of 100% from the content aspect, and from the graphic aspect the CTL-based interactive e-worksheet obtained a validity value of 92.5. Based on these details, the average validity result of this CTL-based interactive e-worksheet is 96.56 with a very valid category. Thus, this CTL-based in-

teractive e-worksheet can be used as digital learning media for popular scientific article texts. After the validation stage, the next planned step was to test the practicality and effectiveness of the learning media on students. However, due to time constraints, this research has not yet reached that stage. Thus, the validation process is an important first step to ensure that the CTL-based interactive e-worksheet meets the quality standards and is ready for the next development steps. This validation is an important foundation for the successful implementation of learning media in educational practice.

## 4.4. The Impact of Interactive E-Worksheet on the Development of Merdeka Curriculum

The impact of interactive e-worksheet based on local wisdom on the development of the Independent Curriculum in schools is very important to know. Interacti on and courage to connect the life around them with new material. Interactive e-worksheets that integrate CTL in learning materials can increase student learning motivation. Interactive worksheets will have no impact if the school does not provide facilities for students to learn. This Liveworksheet as interactive e-worksheet can of course be accessed online using a computer or mobile phone. Students who are no longer allowed to bring cellphones and schools that do not have computers will not be able to implement interactive e-worksheet in the learning process. However, the school where the researchers conducted the research, namely SMP Negeri 1 Padang, has a computer that students can access to open the Liveworksheet interactive e-worksheet. Padang 1 Middle School has several computers that are still functioning for students to use to access the Liveworksheet interactive e-worksheet.

Another important thing to pay attention to is network access such as WiFi to open the Liveworksheet interactive e-worksheet. A weak wifi signal will make it difficult for students to open e-worksheets. However, one of the schools that researchers conducted observations, namely SMP Negeri 1 Padang, is a school that has adequate WiFi to open the Liveworksheet as interactive e-worksheet using a computer. This will of course maximize the function of the Liveworksheet interactive e-worksheets so that the e-worksheets that the researchers designed are expected to have a positive impact on the development of the Independent Curriculum in schools. Researchers hope that the e-worksheet that has been designed will be able to make it easier for teachers and students in the learning process. Teachers will no longer print worksheet physically but can do it directly digitally. Students will also feel motivated to learn because digital learning is appropriate to their time. This of course follows differentiated learning in accordance with the Independent Curriculum in schools.

Therefore, the following are the impacts that can arise from the existence of interactive e-worksheet based on local wisdom for the development of the Independent Curriculum in schools. First, improve students' memory and skills. CTL-based interactive e-worksheet can also improve students' memory and skills. This is because students can visualize and explore their daily lives and connect them with the material being studied, making it easier to absorb and understand the material. Second, integrating local values in the learning process, by using CTL-based Liveworksheet as interactive e-worksheet, the learning process can integrate local values which have important values in local culture.

## 4.5. Dissemination Stage of CTL-Based Interactive E-Worksheet

The results of this study demonstrate that the CTL-based interactive e-worksheet developed through the 4D model achieved a high degree of content validity, with an overall score of 96.54% based on expert evaluations across four dimensions: content, language, presentation, and graphics. While these findings establish a strong foundation for the instructional quality of the media, limiting the study to the Develop stage of the 4D model restricts its pedagogical implications to theoretical or expert-based evaluations. Therefore, this study was extended to the Dissemination stage to empirically assess the practical applicability and effectiveness of the e-worksheet in a real classroom context.

In the dissemination stage, the validated LKS was implemented in two classes, namely the control class and the experimental class involving 34 students of grade VIII of SMP Negeri 1 Padang. The learning sessions were integrated into regular Indonesian lessons covering popular scientific article texts. Data was collected through measurement of learning outcomes, along with observation sheets, student feedback sheets, and teacher reflections to evaluate the engagement and usability of the LKS. **Table 5** presents the result of hypothesis testing with the T-test of the experimental and control classes.

**Table 5.** The Result of Hypothesis Testing with the T-Test of the Experimental and Control Classes.

| Description | Experimental Class | Control Class |
|---|---|---|
| N | 34 | 34 |
| X | 88.044 | 83.032 |
| S | 8.8687 | 11.47 |
| $T_{statistic}$ | | 2.031 |
| Sig | | 0.046 |

The results of empirical implementation in the classroom showed a significant increase in student learning outcomes using the media compared to the control class that did not use interactive worksheet media. This shows that the CTL-based digital worksheet is not only aligned with the curriculum, but also effectively supports students' understanding and retention of learning materials. In addition, qualitative observations showed important changes in classroom dynamics. Students showed higher levels of participation, motivation, and curiosity during learning activities, especially when engaging with the interactive multimedia content (e.g., embedded videos, drag-and-drop exercises, and immediate feedback features provided by the Liveworksheet platform).

The CTL approach embedded in the e-worksheet encouraged students to connect lesson content with their personal experiences and local context. For instance, exercises asking students to analyze examples from their everyday environment and relate them to scientific concepts helped foster deeper learning. The incorporation of Minangkabau cultural elements also increased emotional resonance with the material and contributed to culturally responsive pedagogy, which is a key element in the Merdeka Curriculum.

From a technological standpoint, classroom trials confirmed that the worksheet's online format was accessible and functional using the school's available digital infrastructure. Students were able to interact with the e-worksheet using school-provided computers and WiFi, thus confirming the feasibility of broader implementation in similar educational contexts. However, challenges such as occasional internet latency and varied digital literacy levels among students suggest the need for additional support systems when scaling the intervention to schools with more limited resources.

Pedagogically, the completion of the Dissemination phase substantiates the e-worksheet's instructional value beyond theoretical design. It demonstrates that CTL-based digital learning media can effectively facilitate differentiated instruction, promote learner autonomy, and accommodate diverse learning styles—core tenets of the Merdeka Curriculum. Moreover, teachers reported that the automatic scoring and real-time feedback features reduced their workload in formative assessment, thereby enabling more personalized intervention. By extending the study to the full 4D cycle, this research offers strong empirical evidence of the educational benefits of CTL-based interactive e-worksheet in secondary school language learning. The findings not only validate the product design but also confirm its effectiveness in enhancing student engagement, promoting culturally relevant learning, and improving academic performance. Future studies are encouraged to expand the scope to other regions and subjects, as well as to examine long-term learning gains and teacher adoption behaviors.

## 4.6. Discussion

The validation results, which indicate that the CTL-based interactive e-worksheet achieved a very high validity score (average 96.54%), not only confirm the product's compliance with instructional design quality standards but also invite deeper pedagogical interpretation. From an educational perspective, this e-worksheet addresses longstanding challenges faced by teachers and students, particularly the lack of engagement and interaction in teaching popular scientific article texts.

A closer look at the validation trends reveals that the content and presentation aspects received perfect scores (100%), suggesting that the material is well-aligned with the learning outcomes specified in the Merdeka Curriculum and effectively embodies the principles of contextual teaching and learning (CTL). This alignment affirms that key CTL elements—such as experiential learning, reflection, and relevance to real-life contexts—have been successfully embedded into the media.

Although the language and graphic design aspects received slightly lower scores (93.75% and 92.5%, respectively), both remain within the "highly valid" category. These differences, however, highlight potential areas for refinement, such as improving language accessibility for students of diverse backgrounds and enhancing visual design to accommodate various types of digital devices.

Reflectively, this media development initiative moves beyond conventional teaching practices still prevalent in

schools, such as lecture-based instruction and standardized worksheets from MGMP textbooks. The Liveworksheet-based interactive e-worksheet provides a more constructivist approach, enabling students to build knowledge actively through interaction and exploration rather than passive reception. This approach is consistent with the differentiated learning paradigm of the Merdeka Curriculum, which emphasizes accommodating students' individual learning styles and paces.

The results of the electronic interactive worksheets also showed that the use of e-worksheets was more effective than the traditional printed worksheets. This can be seen from the level and percentage of grade qualifications obtained by students using the e-worksheets. In addition, the T-test results also showed that there was a significant difference between the values of the experimental and control class students.

Practically, the developed media helps overcome common constraints in classroom instruction, such as limited time for formative assessment and lack of diverse material presentation. The auto-grading feature in Liveworksheet not only enhances teacher efficiency in evaluation but also supports adaptive learning by offering immediate feedback to students.

The implications of these findings for language teaching and digital pedagogy are significant. First, this media demonstrates that digital tools can serve as more than just presentation aids; they can function as platforms for meaningful, contextual learning experiences. Second, the integration of local cultural elements (i.e., Minangkabau visual themes) showcases how educational media can embed local wisdom within a national curriculum framework, fostering students' cultural identity and emotional engagement with the learning content.

Third, from a teacher development standpoint, the successful implementation of this design can serve as a model for other educators to independently develop similar digital worksheets. This could drive a broader transformation toward a more innovation-friendly teaching culture and foster collaborative content development among teachers. It should be noted that although this study confirms the high validity of the media, practical implementation and effectiveness testing remain essential for evaluating its real impact in classroom settings. Future studies are therefore recommended to explore the extent to which this CTL-based e-worksheet can influence student motivation, literacy skills, and measurable learning outcomes through both quantitative and qualitative approaches.

# 5. Conclusions

Based on the results of the study, the conclusions that the authors get are as follows: (1) the manufacture of CTL-based interactive e-worksheets follows the 4D research model until the deployment stage; (2) the results of e-worksheet validation are included in the very valid category in terms of content suitability, presentation language, and graphics; and (3) product dissemination shows an increase in popular scientific article text reading skills in experimental and control classes. Therefore, the CTL-based interactive e-worksheet is feasible to use as a digital learning media for popular scientific article texts. The CTL-based liveworksheet interactive e-worksheet model for learning media for reading skills of popular scientific article texts of grade 8 students of SMP Negeri 1 Padang developed is categorized as very valid. The validity of the CTL-based liveworksheet interactive e-worksheet model is reflected in the validation results by validators on four aspects of learning media validation, namely content feasibility, linguistic feasibility, presentation feasibility, and graphical feasibility. This can be seen from the validity of this teaching material which obtained a validity value of 96.56% with a very valid category. Furthermore, based on the aspect of content feasibility, the validity value is 100% with a very valid category. Based on the aspect of linguistic feasibility, the validity value is 93.75% with a very valid category. Based on the presentation feasibility aspect, the validity value is 100% with a very valid category. Based on the feasibility aspect, the validity value is 92.5% with a very valid category.

The results showed that the CTL-based interactive e-worksheet was successfully developed using the 4-D development model, and the resulting e-worksheet was categorized as very valid by experts in terms of content suitability, language, presentation, and graphics. This shows that the e-worksheet is suitable to be used as digital learning media for popular scientific article text material. The use of CTL-based interactive e-worksheet can be an alternative to overcome students' low reading comprehension because it is packaged in an interesting and interactive form. This study has limita-

tions. First, the validation of the LKS was only carried out by a small number of experts. Second, the development of this e-worksheet was only tested in a limited environment. Based on the research findings, the researchers provide the following suggestions, (1) the CTL-based interactive e-worksheet developed in this research can be used by Indonesian language teachers as an alternative learning medium, especially for popular scientific article text material. (2) Curriculum developers can consider integrating CTL-based interactive into the curriculum to support the development of digital literacy skills and enhance student engagement. (3) Future research can expand the scope by testing the in different regions, grade levels, or language skills to increase the generalizability of the findings.

## Author Contributions

Conceptualization, A., E., S.A., F.N., F.L., I. and S.M., Z.; investigation, A., E., S.A., F.N. and F.L.; writing—original draft preparation, A., E., S.A., F.N. and F.L.; writing—review and editing, I., S.M., Z., V.T.D.J., R.H.U. and A.R.; visualization, V.T.D.J., R.H.U. and A.R. All authors have read and agreed to the published version of the manuscript.

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## Data Availability Statement

The research data is stored in Excel format and can be made available upon request to the journal.

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## Conflicts of Interest

The authors declare no conflict of interest.

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