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Development of Ethno-Vlog Integrated E-LKPD on Chemical Reaction Equations to Enhance Students' Scientific Literacy and Creative Thinking Skills

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Abstract

This study aimed to develop and evaluate an Integrated Ethno-Vlog E-LKPD (Electronic Student Worksheet) to enhance students' scientific literacy and creative thinking skills in chemistry learning. The research used a Research and Development (R&D) approach, employing a modified 3D model of Thiagarajan's 4D development, consisting of the definition, design, and development stages. The study involved 36 students from Grades X and XI at SMAK St. Gabriel Noemuti as participants. Data collection techniques included questionnaires, interviews, classroom observations, expert validations of content and media, and pretest-posttest assessments of scientific literacy and creative thinking. Quantitative analysis was conducted using pretest, posttest, and N-Gain scores to measure learning outcomes. The results showed that the average scientific literacy score was 81.43, with an N-Gain of 0.63, categorized as moderate, while the average creative thinking score was 81%, indicating a notable improvement. The integration of local wisdom through Ethno-Vlog videos in the E-LKPD helped students connect chemical concepts, particularly chemical reaction equations, with real-life phenomena in their surrounding environment. These findings suggest that the Integrated Ethno-Vlog E-LKPD is effective in supporting students' understanding, fostering scientific literacy, and enhancing creative thinking skills, providing a promising approach for contextual and culturally relevant science learning.

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INTRODUCTION

One of the prerequisites for realizing 21st-century life skills is literacy competence. According to Atmazaki et al. (2017), the fundamental literacies that must be mastered include reading and writing literacy, numeracy literacy, digital literacy, financial literacy, cultural and civic literacy, and scientific literacy. Scientific literacy, as defined in *Science for All Americans* (SAA), refers to knowing about nature, understanding major scientific concepts and principles, possessing scientific reasoning skills, and being able to learn and apply scientific knowledge for personal and social purposes (Jurecki & Wander, 2012). Meanwhile, according to PISA (Programme for International Student Assessment), scientific literacy is the ability to solve science-related problems, use scientific knowledge, identify issues, and draw conclusions based on evidence and facts (OECD, 2019). The scientific literacy skills of students in Indonesia are still categorized as low. This condition is evidenced by Indonesia's PISA results in scientific literacy. In 2012, Indonesia ranked 64th out of 65 countries (OECD, 2013). In 2015, Indonesia was ranked 62nd out of 69 countries (OECD, 2016), and in 2018, it ranked 71st out of 79 countries (OECD, 2019). These results indicate a persistently low level of scientific literacy. From 78 countries, Indonesia was placed 70th in scientific literacy (Kähler et al., 2020; Şadoğlu, 2018). This situation shows that Indonesian students have not yet been able to understand scientific concepts and processes adequately, nor apply scientific knowledge in daily life (Azura et al., 2021).

Ethnoscience-based chemistry learning has been shown to improve scientific literacy skills and the use of scientific knowledge (Sudarmin et al., 2024). The improvement of scientific literacy can be achieved through ethnoscience-based learning by creating learning environments and designing learning experiences that integrate culture as part of the learning process (Pertiwi & Firdausi, 2020). Learning that incorporates ethnoscience can strengthen students' understanding of scientific concepts because students are trained to examine local wisdom, culture, or phenomena and identify the scientific concepts embedded within them (Sumarni, 2025). Local culture plays an important role in fostering a sense of togetherness and building identity, encompassing valuable heritage, local crafts, traditional foods, or practices associated with specific ethnic communities that can be highlighted in diverse social contexts. In East Nusa Tenggara, particularly in North Central Timor Regency, there are various forms of local culture, such as the tradition of chewing betel nut (sirih pinang), traditional weaving (futus), and a traditional alcoholic beverage produced through generations known as *sopi* or *tua menu*. Among these cultural practices, the process of making *sopi* or *tua menu* can be integrated into chemistry learning.

The Global Creativity Index in 2019 shows that creative thinking skills in Indonesia are still relatively low. Indonesia ranked 85th out of 129 countries (Tyaningsih et al., 2021). Creative thinking is defined as the ability to generate or develop new ideas characterized by five dimensions: sensitivity, fluency, flexibility, originality, and elaboration. The importance of creativity is stated in the National Education System Law No. 20 of 2003, which explains that education aims to develop students' potential so that they become individuals who are faithful, competent, ethical, independent, and creative. Creative thinking ability, creative product creation, and creative action are collectively referred to as creativity (Khumaeroh & Sumarni, 2019). Teaching materials play an essential role in supporting successful learning. One important instructional tool is the Student Worksheet (LKPD), which provides exercises and tasks to help students better understand learning materials. Electronic LKPD (E-LKPD) has become one of the most needed teaching materials for both students and teachers, especially during online learning. E-LKPD can simplify and optimize learning by reducing limitations of space and time, making learning more effective (Syafitri & Tressyalina, 2020). The combination of video and blog media in vlogs has become increasingly popular and attracts wide audiences. Vlogs, or video blogs, are part of blogging activities that use video as the primary medium to convey messages, replacing text and audio (Priana, 2017). In line with this, Awal (2023) explains that ethno-vlogs—video blogs that integrate local knowledge into learning content—have become a growing topic in recent research. Several studies (Asmaningrum et al., 2021; Asnur et al., 2020; Daryono et al., 2021; Sari et al., 2022) have shown that the use of vlogs can increase students' learning motivation.

Based on interviews with a chemistry teacher at SMA Katolik St. Gabriel Noemuti, one of the schools in North Central Timor Regency, East Nusa Tenggara Province, chemistry learning has already implemented E-LKPD. Learning resources include teaching modules supported by instructional media such as PowerPoint presentations and videos, while learning methods commonly used are class discussions and group practicums. However, the learning materials have not yet been integrated with ethnoscience or local wisdom. The E-LKPD used is still predominantly textual rather than contextual, has not incorporated local culture, and has not measured students' scientific literacy and creative thinking skills. Therefore, this study aims to develop an electronic student worksheet (E-LKPD) to enhance students' scientific literacy and creative thinking skills. The E-LKPD will be integrated with vlog-based learning media that incorporates local culture from North Central Timor Regency, specifically the process of producing the traditional alcoholic beverage *sopi*. It is expected that through this learning approach, students will be able to reconstruct their prior knowledge meaningfully, thereby strengthening their scientific literacy and creative thinking skills in everyday life.

METHODS

This study is a Research and Development (R&D) study. The research model employed is the 4D model, which includes the stages of Define, Design, Develop, and Disseminate. In the Define stage, the researcher conducted a needs analysis, assessed availability, examined concepts, and determined tasks. During this analysis, the researcher identified problems in chemistry subjects through interviews and needs assessments to understand the issues present in schools. The problems identified included the availability of learning materials, teaching methods used by teachers, the use of learning media, content coverage, learning facilities and environment, as well as potential opportunities in learning activities and media utilization. Following this, a literature review was conducted by searching for and studying references from journals and other literature sources. Field studies were carried out through observations at SMAK St. Gabriel Noemuti and interviews with chemistry teachers to identify specific needs.

In the Design stage, the researcher developed the learning media product through several steps. The first step was media selection, which involved choosing appropriate learning media based on the needs analysis. The second step was format selection, which included designing the media format, consisting of the flow of material presentation and student activities. The third step was reference collection, involving the gathering of materials from multiple reference sources. The subsequent step was initial design, which involved creating the product layout, including the organization of content, arrangement of images, text, videos, student activities, and the setup of media to be included in Flipbook Maker and interactive LiveWorksheet worksheets. Additionally, research instruments were prepared during this stage. In the Develop stage, the researcher produced the final form of the learning media after revisions based on expert feedback and data from field trials (Trianto, 2012). The developed product was tailored to the results of the needs analysis. The product was then validated and assessed by two lecturers as content and media experts, as well as by two teachers as Vlog media experts. The instruments used in this study included product validation sheets and student response sheets. The research instruments were validated by instrument experts. Subsequently, the product's quality was assessed by one media expert, one content expert, and two teachers as ethno-vlog media experts. The collected data were analyzed using qualitative and quantitative methods and presented descriptively.Data analysis was conducted by converting qualitative assessments from media experts, content experts, and Vlog media experts into quantitative data using a Likert scale with the following ratings: Very Good (4), Good (3), Fair (2), and Poor (1). Validation assessments were analyzed by calculating percentages using the formula (Sudijono, 2009:43):

$$P = \frac{\text{Total Score Obtained}}{\text{Maximum Possible Score}} \times 100\%$$

Next, the average scores were converted into qualitative ratings according to the ideal assessment criteria. The reference for these criteria is presented in Table 1.

Table 1. Assessment Rating Categories for Product Validation

Score Interval	Criteria
32.5 < score ≤ 40	Very Suitable
25 < score ≤ 32.5	Suitable
17.5 < score ≤ 25	Not Suitable
10 < score ≤ 17.5	Very Unsuitable

RESULT AND DISCUSSION

The outcome of this research and development study was the creation of an electronic student worksheet integrated with an ethno-vlog, designed to enhance students' scientific literacy and creative thinking in accordance with the development stages of Thiagarajan's 4D Model. The explanation of each stage in the 4D model is as follows:

Define Stage

The Define stage is the initial phase in which the researcher collects information related to the learning process at the school by analyzing the problems and needs of educators during instruction. The purpose of this stage is to identify and define the issues in the school, which will serve as the preliminary basis for developing an electronic student worksheet (E-LKPD). To achieve this, the researcher conducted interviews with chemistry teachers and performed a literature review on the teaching materials used, particularly at SMAK St. Gabriel Noemuti and SMA Negeri Noemuti. This process aligns with Purwati and Suhirman (2017), who outlined three steps in the Define phase: preliminary research through observations and interviews to determine development needs, student analysis to understand their characteristics and learning requirements, and task analysis to examine content structure and learning objectives, which serve as the foundation for test design, teaching material selection, and product development. Observations and interviews conducted from September to October 2023 revealed that teaching materials were already in use, mainly printed books and LKPD. Learning activities often involved discussions and practical work; however, they had not integrated local wisdom or cultural elements, resulting in a predominantly textbook-based approach. During this stage, the researcher also reviewed relevant theories and information to support the development of an E-LKPD integrated with an ethno-vlog, focusing on the local wisdom of traditional **Sopi Timor** production. The results of the observations regarding the strengths and weaknesses of the current learning process are presented in Table 2.

Table 2. Observed Advantages and Limitations in School Learning

Strengths	Weaknesses
Teaching materials for grades X–XII are already available.	Some teaching materials and student worksheets (LKPD) are incomplete.
The content in the teaching materials and LKPD is still mostly textual rather than contextual.	Certain topics do not yet have accompanying LKPD, such as chemical reaction equations.
The school allows the use of mobile phones on campus.	Mobile phone usage is still limited to certain subjects and is restricted during examinations.

Table 2 shows that while teaching materials are available, they remain incomplete for certain topics, such as chemical reaction equations. The content presented is still largely textual and has not been linked to the students' surrounding environment or integrated with ethnoscience concepts. Although mobile phones or Android devices are allowed for learning, their use is still limited to certain topics and during examinations. Based on these observations, the researcher was motivated to develop an electronic student worksheet (E-LKPD) that integrates local cultural elements into the learning materials, particularly for the topic of chemical reaction equations.

Design Stage

In this stage, the researcher designed a product in the form of an electronic student worksheet (E-LKPD) integrated with an ethno-vlog. The study focused on the topic of chemical reaction equations in accordance with the school's curriculum, specifically the Merdeka Curriculum Phase E. The learning performance indicator (ATP) used was to write complete and balanced chemical equations that correspond to natural phenomena or global issues. Consequently, the researcher developed an E-LKPD that incorporates local wisdom and cultural elements related to chemical reaction equations. These elements were included in the E-LKPD through written discourse and videos, or ethno-vlogs, drawn from the students' surrounding environment to provide contextual and relevant learning experiences. The local culture integrated into the E-LKPD was the traditional process of making **Sopi**, presented in video or ethno-vlog format. The integration of ethno-vlogs into the E-LKPD aims to enhance students' scientific literacy and creative thinking skills, particularly in the topic of chemical reaction equations. In this stage, the researcher utilized several applications to support the development of the E-LKPD. Canva was used to design the content, which was then converted into a PDF file. This file was uploaded to the LiveWorksheet application to create interactive activities for students. Additionally, the Pdf Corporate Professional application was used to produce and convert the E-LKPD into an engaging flipbook format. The initial product of the E-LKPD integrated with ethno-vlog can be seen in **Figure 1**.

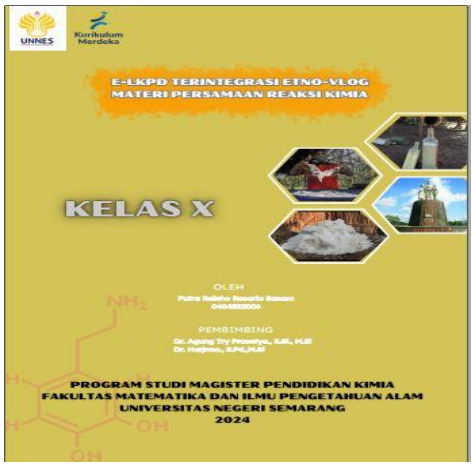

Figure 1. Display of the E-LKPD Integrated with Ethno-Vlog for the Topic of Chemical Reaction Equations.

Figure 1 shows the front cover of the developed E-LKPD integrated with an ethno-vlog. In the development process, the image displayed on the cover serves as an initial visual introduction, highlighting key details such as the title and an overview of the traditional processes of making **Sopi** and salt. This visual presentation is intended to support students' scientific literacy and creative thinking skills. The resulting E-LKPD integrated with the

ethno-vlog is further complemented with contextual discourse from the students' surrounding environment, as illustrated in Figure 2.

Figure 2. Contextual Discourse as a Learning Stimulus

The E-LKPD product is supported by a LiveWorksheet link, which allows students to complete and save all their work electronically, as shown in **Figure 3**. This figure illustrates the access link to LiveWorksheet, which students use to carry out the assigned activities and record all their responses. By integrating LiveWorksheet, the E-LKPD provides a platform for interactive learning, enabling real-time monitoring of students' work, promoting engagement, and facilitating the collection of data for assessment purposes.

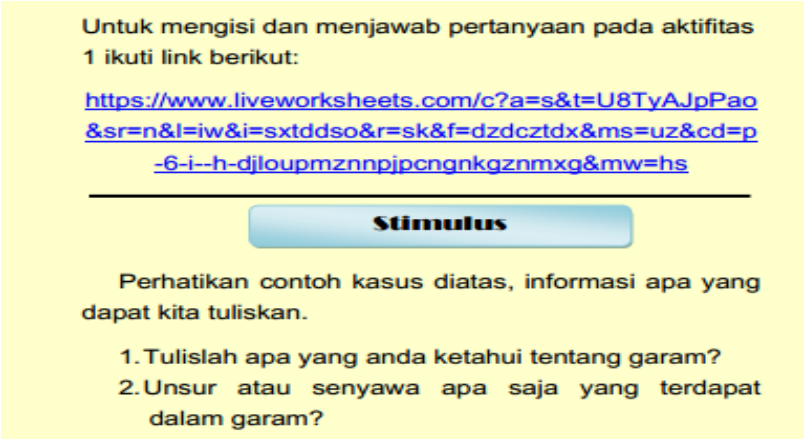

Figure 3. Access Link to LiveWorksheet for Student Activities

The E-LKPD integrated with an ethno-vlog is supported by a link to an ethno-vlog video available on YouTube, which presents the local wisdom of Sopi Timor production and its relation to the learning of chemical reaction equations, as shown in Figure 4. This ethno-vlog video is designed to help students reconstruct their knowledge contextually, connecting the chemical reaction concepts to their immediate environment or daily life. The ethno-vlog serves as an audiovisual learning medium that integrates ethnoscience concepts (Etno-Vlog). It is hosted on a YouTube channel and can be accessed anytime and anywhere. Students can view the ethno-vlog online via smartphones, laptops, or computers with internet access, or they can study offline by downloading the video. Each ethno-vlog video is carefully designed, incorporating text and background music, to present the topic of chemical reaction equations in an engaging and contextualized manner. By utilizing this media, students are expected to better understand chemical reactions through the lens of local cultural practices, fostering both scientific literacy and creative thinking skills.

Figure 4. Ethno-Vlog Video on Local Wisdom of Sopi Timor Integrated into E-LKPD

Figure 5. Thumbnail of the Ethno-Vlog on Sopi Timor Production

A **thumbnail** is the front image of a YouTube video that visually represents the content of the video. One of its main functions is to attract viewers' attention, encouraging them to watch the video or vlog on a YouTube channel. Therefore, thumbnails need to be unique and visually appealing. The thumbnail for the ethno-vlog is presented in **Figure 5**. The ethno-vlog combines elements of **ethnoscience**, integrating local community knowledge with scientific perspectives. **Sopi Timor** is a local cultural heritage that has been preserved and passed down through generations. The production of the vlog began with interviews conducted with selected resource persons. Questions posed to these resource persons focused on the ingredients and stages of the production process to ensure the authenticity and accuracy of the information, reflecting both local knowledge and scientific understanding.

Development Stage

The initial development of the E-LKPD integrated with the ethno-vlog was submitted to validators for evaluation. They provided feedback, suggestions, and recommendations to improve the E-LKPD, ensuring it was more effective than the previous version. The results of the validation indicated that the E-LKPD was suitable for small-scale trials, requiring only minor revisions based on the validators' input. The improvements made to the E-LKPD after incorporating the experts' recommendations are presented in Table 3.

Table 3. Suggestions and Revisions for the E-LKPD Integrated with Ethno-Vlog Based on Expert Feedback

No	Assessment Aspect	Revision
1	Content	1. Correct the writing of chemical reaction equations, including the phases of reactants and products
2	Media	1. Improve sentence structure 2. Correct typographical errors 3. Standardize font size and capitalization

Feasibility Results of the E-LKPD Integrated with Ethno-Vlog

Before being implemented in the learning process, the E-LKPD integrated with an ethno-vlog needed to undergo a feasibility assessment by experts. The instrument used was a validation sheet in the form of a questionnaire. The validators consisted of two experts (a content expert and a media expert) who evaluated the validity and accuracy of the developed product. The results of the content expert validation are presented in Table 4. The evaluation shown in Table 4 indicates that the E-LKPD received a "Highly Valid" rating from both content

experts. Specifically, Content Expert 1 obtained a score of 106, corresponding to 82.81%, and Content Expert 2 obtained a score of 110, corresponding to 85.93%, both falling into the "Highly Valid" category. The average score from the two validators was 84.37%, confirming the E-LKPD integrated with the ethno-vlog as highly valid. Based on these results, the product was deemed suitable for small-scale trials and implementation in school learning activities. The evaluation results from the content experts are also presented in a graph to compare the scores of Validator 1 and Validator 2 (Media Validator), as shown in Figure 6.

Table 4. Content Expert Validation Results for the E-LKPD

Content Expert Validation	Aspects Assessed	Score Obtained	Total Score	Percentage	Criteria
Expert 1	Scope of Content, Content Accuracy, Content Up-to-dateness, Curiosity Stimulation, Presentation Techniques, Supporting Materials, Learning Delivery, Contextual Components –	106	128	82.81%	Highly Valid
Expert 2		110	128	85.93%	Highly Valid
Average	–	108	128	84.37%	Highly Valid

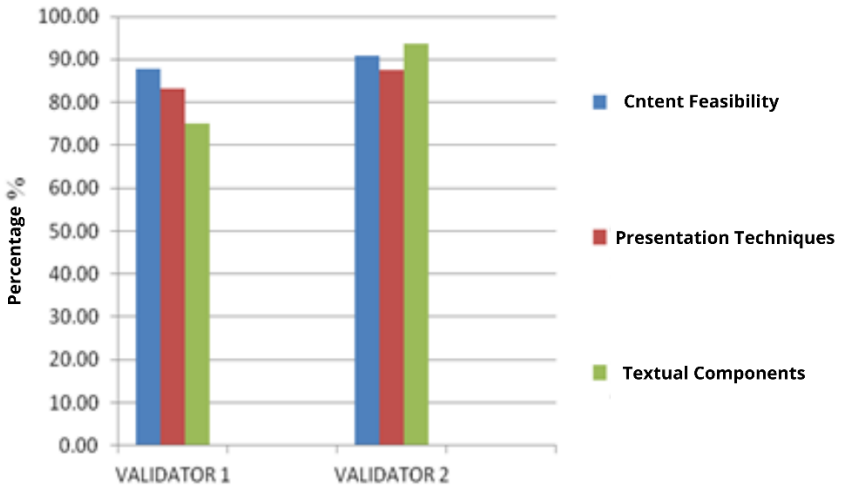

Figure 6. Validation Results from the E-LKPD Content Experts

Feasibility Results of the E-LKPD Integrated with Ethno-Vlog

The developed E-LKPD integrated with an ethno-vlog is designed not only to present knowledge about chemical reaction equations from a scientific perspective but also to connect theoretical concepts with real-life, contextual experiences in the students' surroundings. This approach enables students to construct knowledge by relating learning to their personal experiences and the world around them. The E-LKPD design is based on concrete phenomena from students' daily lives and integrates chemistry material with ethnoscience concepts, packaged in the form of videos, commonly referred to as ethno-vlogs. These resources guide students in discovering and understanding the concepts and theories being taught while actively engaging in the learning process.

The characteristics of the E-LKPD integrated with ethno-vlog for chemical reaction equations include its complete digital format, allowing students to learn independently. The E-LKPD consists of a cover, learning outcomes, learning objectives (ATP), detailed instructions for use, links to LiveWorksheet for completing Activities 1–3, links to the ethno-vlog related to chemical reaction equations, and evaluation questions at the end.

The learning materials and activities are contextual, incorporating simple discourses and ethno-vlog videos drawn from the surrounding environment and local culture. The integration of discovery learning with local cultural knowledge aligns with efforts to preserve cultural heritage, supported by government initiatives, while simultaneously enhancing the learning process in a meaningful way (Rihayati et al., 2021).

The development of the E-LKPD followed the 4D model, starting with the analysis phase, which involved reviewing relevant sources to create materials and identify local cultural practices related to chemical reaction equations. Existing teaching materials at schools were also examined to compare approaches and identify potential challenges. The analysis revealed that the chemistry content taught had not been linked to local culture or effectively integrated with technology. To address this, the E-LKPD was developed to connect scientific concepts with phenomena in students' surroundings and local wisdom, aiming to enhance scientific literacy and creative thinking through the provided evaluation questions. The E-LKPD was created using Microsoft Word and supported by platforms such as LiveWorksheet and Flip PDF Professional, which allow online access for both students and teachers. Flip PDF Professional provides multimedia features such as video, audio, and animation, creating an interactive flipbook with engaging design that can be easily accessed on computers, laptops, or Android smartphones (Watin & Kustijono, 2017).

CONCLUSION

The E-LKPD integrated with an ethno-vlog was declared highly feasible based on expert evaluations. The content expert assigned a score of 84.37%, the media expert 89.71%, and the ethno-vlog media 89.28%, all falling into the "Excellent" category. The use of the E-LKPD integrated with the ethno-vlog was effective in enhancing students' scientific literacy and creative thinking skills. The average score for scientific literacy was 81.43, supported by an N-Gain value of 0.63, categorized as moderate. The average score for creative thinking skills was 81. The E-LKPD features an integration of ethno-vlogs (videos on the local cultural practice of Sopi Timor production) and several contextual discourses related to chemical reaction equations. The product was developed using several supporting applications, including LiveWorksheet as a digital worksheet platform for student activities, Flip PDF Corporate to convert the E-LKPD into an interactive flipbook for a more engaging presentation, and YouTube to provide learning media showcasing the Sopi Timor production process. Students' responses to the E-LKPD developed for the eleventh-grade science class were very positive, with an average score of 81.19%, indicating high acceptance and satisfaction with the product.

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