



Ethnoscience-Based E-Magazine Using the Scientific Critical Thinking Model to Enhance Scientific Literacy

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Abstract: The importance of science literacy has grown significantly in this technological era; however, students' proficiency in this area remains inadequate. To address this issue, this study developed an ethnoscience-based e-magazine that used the Scientific Critical Thinking (SCT) model to improve students' understanding of acid-base concepts. This study aimed to test the validity, practicality, and effectiveness of the SCT-based e-magazine for acid-base material. The development process followed the ADDIE model, and a preliminary trial was conducted involving 28 students from Class XI IPA at SMAN 1 Alalak. Data were collected using test and non-test instruments. The analysis indicated that the SCT-based ethnoscience e-magazine demonstrated strong validity in content, presentation, language, and media design. The e-magazine proved highly practical in both individual and group settings, including limited trials, and demonstrated teachers' ability to use it effectively and manage the class. The high N-gain value for science competence confirmed its effectiveness in improving students' science literacy. Consequently, the SCT-based ethnoscience e-magazine is validated as a practical and effective tool for learning acid-base concepts. The development of the e-magazine contributes to learning as an efficient medium for accelerating the dissemination of science and facilitating scientific interaction.

Keywords: acid-base; e-magazine; ethnoscience; science literacy; scientific critical thinking

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INTRODUCTION

The contemporary era, characterized by rapid technological and scientific progress, necessitates a transformation in educational paradigms. Students are now required to possess a diverse set of 21st-century skills, encompassing essential life skills, workplace readiness, soft skills, interpersonal proficiency, and professional competencies (Abidin, 2018; Mardhiyah et al., 2021), enabling them to adapt to evolving times. Consequently, the education system must strive to enhance its standards, empowering students to realize their full potential and develop the soft skills crucial for effective learning (Pamungkas et al., 2018; Widayoko et al., 2019). A significant pathway to improving educational quality involves cultivating science literacy, an indispensable skill for students to thrive in a continually evolving global landscape (Adawiyah & Wisudawati, 2017).

In fact, the teaching of chemistry has not given sufficient emphasis to developing students' scientific literacy. It is common for teachers to overlook the relevance of chemistry in everyday life. Students at SMA Negeri 1 Alalak struggle to solve chemical issues, according to interviews with chemistry teachers. This is particularly true when the questions include mathematical operations, such as determining a solution's pH using acid-base equations based on the mole concept. Additionally, according to the 2013 Curriculum, they struggle to apply conceptual knowledge to novel or contextual challenges. Topics like acid-base ideas are part of the curriculum that require students to comprehend, apply, and evaluate metacognitive, factual, conceptual, and procedural knowledge (Fitriyana et al., 2019).

Furthermore, initial research based on needs analysis with a sample of students at SMA Negeri 1 Alalak, class XI IPA 3, has shown that students there rely solely on teacher-provided material and have not attempted to apply what they have learned in class. The majority of a teacher's pedagogical tools consist of printed books (Sari et al., 2021; Syahmani et al., 2022), which have not improved students' scientific literacy and remain unsuccessful in the classroom. Because there are not many good resources for chemistry education, students aren't very interested in reading, which, in turn, makes them passive and prevents them from engaging with their teachers. This agrees with Tarihoran et al. (2022), who argue that printed educational materials go stale over time and should be revised to reflect how information and communication technologies have advanced.

The need for learning media innovation as a chemistry learning resource is crucial because chemistry learning plays a key role in fostering higher-order thinking skills, such as analyzing, building arguments, and generating new ideas (Siahaan et al., 2021). Understanding how to apply scientific knowledge to real-life

situations is just as important as memorizing formulas when it comes to chemistry and science literacy more generally (Juwita & Rosidin, 2022). However, chemistry includes complex concepts and various complicated formulas (Rusek et al., 2022), and mastering them requires strong interpretation and reasoning skills (Talanquer, 2022). To overcome these limitations, learning approaches must prioritize science literacy and practical applications. This aligns with Ariyatun and Octavianelis (2020), who asserted that students have difficulty answering questions about social issues in the real world. Participation in problem-solving activities that mirror real-world situations can help students develop their scientific reasoning skills. Therefore, it is essential to improve scientific literacy skills while learning.

Improving students' scientific literacy also requires providing meaningful learning opportunities. Integrating ethnoscience into the learning process is one way to make learning more meaningful by tailoring it to the school context and student characteristics. (Kusumah et al., 2020). Ethnoscience bridges the gap between science and cultural practices (Nuralita, 2020), enabling students to explore their local environment and traditions scientifically (Atandau et al., 2021; Siagian et al., 2022). Students can develop a more solid grasp of scientific concepts and a more personal connection to the subject when they draw connections to known cultural practices; this method also underscores the significance of students' own local knowledge. Furthermore, as Nurcahyani et al. (2021) demonstrated, teaching ethnoscience can greatly enhance students' ability to understand and use scientific concepts.

The researcher created an ethnoscience e-magazine using the Scientific Critical Thinking methodology to address the issues highlighted in the requirements analysis and promote science literacy. An electronic magazine, or "e-magazine," is a publication that has transitioned from print to digital media (Neelamalar & Vivakaran, 2019; Palmeirao & Carneiro, 2020; Tarawi et al., 2020). E-magazines can be read anywhere because they are more flexible and easier to access anytime, anywhere via laptop or smartphone (Kurniawan et al., 2023; Putri et al., 2021; Syafii & Gusnia, 2021). One way to entice readers is to employ e-magazine media, which can display text alongside visually appealing images and vibrant colors (Juliani & Refelita, 2022). Chemistry learning activities that use videos/animations related to the material make students more enthusiastic, quicker to remember, and more likely to absorb the material. Electronic magazines as learning media for reduction and oxidation (redox) reactions have met the criteria for validity, practicality, and effectiveness (Arief et al., 2021). Similarly, Jariati and Yenti (2020) developed a digital magazine covering electrolyte and non-electrolyte solutions; the magazine also performed well in assessments of content validity and educational impact. Panggabean et al. (2022) established that the online magazine was up to snuff and helped students become more proficient thinkers.

An appropriate learning paradigm, such as the Scientific Critical Thinking (SCT) paradigm, is required to enhance scientific literacy and make e-magazines as effective as possible. Students' critical thinking, communication skills, and self-assurance can all benefit from this model's proven ability to combine aspects of the Problem-Based Learning and Inquiry approaches (Rusmansyah et al., 2019). In contrast, with the SCT model, students can learn to think critically, communicate well, and be confident in their abilities. The SCT model serves as a learning framework that provides students with opportunities to validate conceptual truths through various activities based on their understanding (Rusmansyah et al., 2020). Scientific activities in the SCT model are aligned with efforts to foster scientific literacy. Usman et al. (2019) concluded that students benefited from enhanced comprehension of scientific concepts, improved learning outcomes, and the development of analytical and evaluative abilities through the integration of inquiry and PBL methodologies.

There has been encouraging evidence that using e-magazines to teach chemistry can increase student interest and retention of the material. There are still gaps in the development of learning materials, despite many already having been created. To further enhance scientific literacy, ethnoscience-based e-magazines can use the SCT paradigm. Accessible across a wide range of platforms, such as PCs, Android smartphones, and iPads, e-magazines are appealing for the visual-text combination they offer (Adi et al., 2022). The purpose of this research is to use the Scientific Critical Thinking (SCT) paradigm to create an ethnoscience-based e-magazine, with the intention of using it as a medium for teaching acid-base subjects. The goal of this work is to encourage students in Class XI MIPA 1 at SMA Negeri 1 Alalak to learn chemistry in a way that is relevant to their culture, focuses on critical thinking, and is situated in its proper context.

METHODS

The development process used the ADDIE model, a framework consisting of five stages: Analysis, which involves analyzing needs by identifying existing problems and student products (Syahfitri et al., 2023). This stage involves identifying the problem's causes, and various analyses are conducted to determine students' needs and problems (Shofia et al., 2024). This stage's findings are based on interviews with teachers who report that their students are still struggling to grasp chemical concepts. Also, students' survey responses indicated a dearth of engaging learning materials and exercises that emphasized the instructor. In the second phase, "Design," the e-magazine's conceptual design is created. Formulating the learning concept in line with the curriculum, gathering materials, and assembling appealing visuals with a diversity of colors and images without

diminishing the magazine's attractiveness are the first steps in designing the e-magazine for learning activities. Ensure the presentation is engaging and not dull, and use a variety of texts with language tailored to students' characteristics to enhance understanding (Nuraida et al., 2022). The e-magazine's design is created in the Canva application. The third stage is development, during which material and media experts conduct validation tests (Bhoko et al., 2023). Articles, layout, language, and media used in the online magazine are all taken into consideration. There are also evaluations derived from single trials, experiments conducted on a smaller scale. In the fourth and final stage, "Implementation," we put the produced product through its paces by conducting a product trial, which may involve a limited class trial. Evaluation, the fifth step, compares the developed product's performance to the original expectations. We opted for the ADDIE development model since its fundamental steps are less complicated and it incorporates evaluations at each level to reduce the likelihood of mistakes. Figure 1 shows the research flow of the ADDIE model.

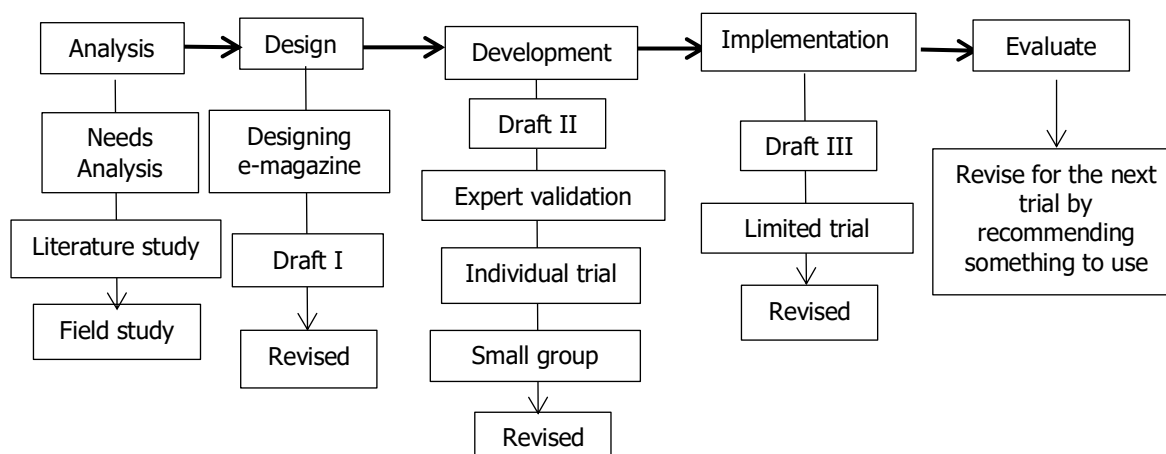


Figure 1. ADDIE model development design

In the 2022–2023 school year, 28 students from IPA 1 Class in SMAN 1 Alalak participated as research subjects. Three students from Class XI IPA 3 participated in the individual trials, while seven from the same class participated in the small-group trials. One professor of educational technology and four professors of chemistry education from FKIP ULM Banjarmasin performed the validation stage of the research instruments and learning gadgets before the trial. The tools and gadgets must be used. We tested the gadgets in both individual and small group settings to see how people responded. Any remaining deficiencies will be addressed through changes aimed at simplifying the learning process for students.

The purpose of this study was to assess students' scientific literacy. Seven essay questions, one for each science literacy indicator, made up the test instrument. Questionnaires, exams, non-test methods, and direct observation were all utilized in the data collection process. The first step of the study was to observe. To compile data for expert validation, small-group and individual trials, and the limited trial, we used questionnaires to gather student comments. We used a pre- and post-test design to compare students' scientific literacy levels before and after they used the digital magazine. Data that did not come from tests were gathered through observation, surveys, and an evaluation of the electronic magazine's validity. A Likert scale (1–5) was used to evaluate validity and practicality against the criteria listed in Table 1.

Table 1. Validity and Practicality criteria

Score	Category
$4.20 < V \leq 5.00$	Very valid
$3.40 < V \leq 4.20$	Valid
$2.60 < V \leq 3.40$	Quite valid
$1.80 < V \leq 2.60$	Less Valid
$1.00 < V \leq 1.80$	Invalid

Source: Syahmani et al. (2022)

The effectiveness analysis used both test and non-test instruments. Scoring for essay responses adhered to predetermined question weightings, and the resulting scores were converted utilizing Table 2.

Table 2. Science literacy assessment reference

Science literacy score	Criteria
81-100	Very good
61-80	Good
41-60	Medium
21-40	Low
0-20	Very low

Source: Arikunto (2013)

The results of the science literacy assessment were then reviewed using the N-gain score to assess the test's effectiveness. The results of the n-gain score analysis of science literacy competence were then converted into an n-gain classification using the criteria outlined in Table 3 below.

Table 3. Criteria for students' science literacy n-gain scores

Value n-gain score $\langle g \rangle$	Classification
$\langle g \rangle \geq 0.70$	High
$0.30 \leq \langle g \rangle < 0.70$	Medium
$\langle g \rangle < 0.30$	Low

Source: Hake (1999)

RESULT AND DISCUSSION

This development research led to the creation of an educational e-magazine that is grounded in ethnoscience. This online magazine was piloted at SMA Negeri 1 Alalak and centers on acid-base topics, incorporating the Scientific Critical Thinking (SCT) paradigm. The E-magazine is an interactive, internet-based medium enriched with articles, images, animations, and videos, designed to support students in developing realistic scientific thinking and accessing contextual information related to acid-base concepts. Moreover, the E-magazine promotes students' digital literacy by encouraging the use of electronic media in line with technological advancements in education.

The goal of the analysis phase is to ensure the designed product meets real requirements, identifying issues with existing learning activities. The research toolbox consisted of a literature review, an observational component, and a questionnaire. The results demonstrated that students' scientific literacy needs to be enhanced because currently available learning materials are insufficient. The current resources are not very interesting, and they do not help students understand how their surroundings and culture impact their education. It is evident from the survey results that students find the printed books used in education nowadays uninteresting and rarely read them. Students also expressed an interest in electronic learning media and learning materials that connect culture to education. The investigation also found that students are struggling to grasp the concepts covered in class, as the emphasis remains squarely on the instructor rather than on hands-on scientific exploration. The result is an online journal covering acid-base theory and practice according to the SCT model, with an emphasis on ethnoscience. Created with Canva, the e-magazine is well-organized, simple, and straightforward. In addition, the e-magazine content was curated to promote scientific thinking and learning through articles, scientific activities, images, videos, and supplementary animations.

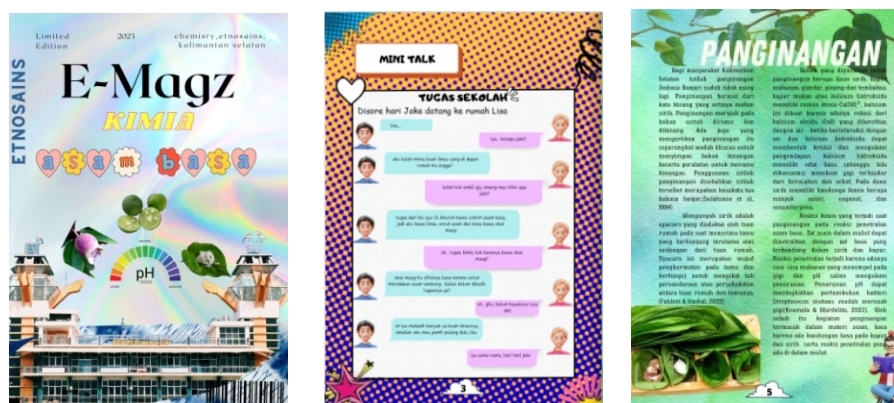


Figure 2. Design of an Ethnoscience E-Magazine with Acid-Base Material Based on the SCT Model

The development phase assessed the feasibility of the E-magazine. This aligns with Ni'mah et al. (2018), who emphasized that validity testing is essential to minimize structural and content errors. At this phase, five

validators conducted the validity test to produce the initial draft of the e-magazine, followed by the revision stage. The eligibility aspects assessed were content, presentation, language, and media. The results of the e-magazine validity test are shown in [Figure 3](#).

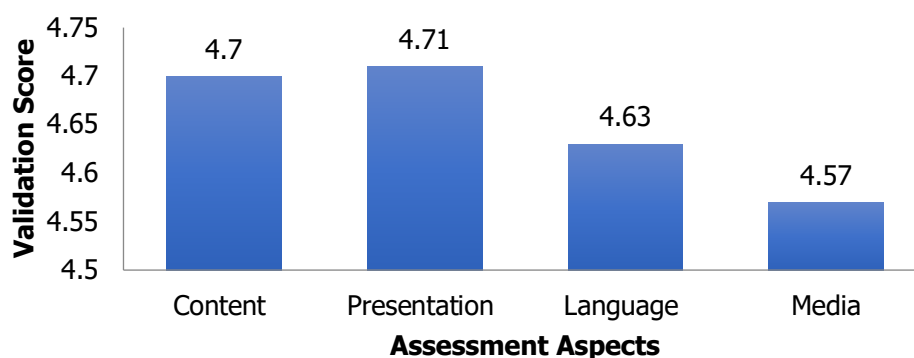


Figure 3. Analysis of validation ethnosience E-magazine based on the SCT model

The product is suitable for use, as shown in [Figure 3](#), where the average validation score was 4.66, which falls within the valid range. The content aspect is deemed valid with a score of 4.70. This grade reflects how well the content fits the course outline, how accurate it is, how well it helps students become better communicators and artists, and how effectively it uses technology. Additionally, the presentation component was legitimate, receiving a score of 4.71. Incorporating interactive elements such as movies, photos, animations, scientific tasks, and crosswords into the e-magazine makes the content more engaging and helps readers retain what they have learned. A legitimate linguistic aspect, with a score of 4.63, ensuring the material is easily understandable to readers; the language is straightforward and follows the criteria set by the Indonesian language ([Adawiyah et al., 2022](#)). The media aspect score is 4.57, indicating validity. Validators suggested improving the chemical notation, font and color use, page numbering, and title clarity. The presentation of material in the media must be structured and easy to understand, using images and animations relevant to the material's context ([Dwiqi et al., 2020](#)). The results of this study are in line with [Jariati and Yenti \(2020\)](#), who found that the validity test results for e-magazines are deemed very valid.

The use of examples of activities in the surrounding environment in learning is very helpful because it provides meaning for students, thus improving their science literacy. [Utari et al. \(2020\)](#) state that the ethnosience approach involves applying science to people's lives, thereby connecting culture and science to shape students' character. The assessment of the presentation aspect obtained valid results (4.71). This e-magazine contains complete materials and supporting elements in its presentation, including videos, images, animations, mini talks, chemmotiva, acid-base articles in daily life, scientific activities, Banjarmasin specialty chocolate, and crossword puzzles. Incorporating additional knowledge and interesting facts into the media can increase interest and the variety of content, thereby enhancing students' knowledge ([Nadzif et al., 2022](#)). Some validators opined that the presentation in the ethnosience electronic magazine was systematic.

The linguistic feasibility component yielded respectable outcomes (4.63). The results show that the SCT model ethnosience e-magazine follows proper and decent Indonesian grammar and is easy to understand. Students will find it more appealing than traditional textbooks because of its informal, engaging language. ([Maryati et al., 2018](#)). Meanwhile, the media aspect obtained valid results (4.57). Learning media must display writing in an attractive and consistent style, size, spacing, and color ([Laksmi & Suniasih, 2021](#)). The suggestions and input given by the validators in this aspect are to improve the writing of phase symbols and reversible reaction arrows, replace page numbering in the preface and table of contents with Roman letters, add names to the pictures of experts, change colors, and change the font type to bold in the title to make it clearer.

After validation and expert feedback, adjustments were made, and additional readability tests were conducted in both solo and small-group trials. The findings from the former yielded an average of 4.47, which is considered good. Still, the electronic journal needs a few tweaks here and there to accommodate student feedback, especially about errors. At the same time, the small-group trial's readability was 4.56, which is considered extremely satisfactory. The electronic magazine received mostly positive feedback from students, with no constructive criticism. Educators' and students' reactions to the SCT-based ethnosience online magazine were the subjects of the subsequent evaluation. The student responses produced a very satisfactory mean score of 4.29. The educators' replies were even more impressive, with a superb mean score of 4.67. The findings of the additional metrics for (a) the e-magazine's pedagogical implementation and (b) the proficiency of classroom management were quite satisfactory. Teachers' adept use of digital resources has improved student learning, leading to these outcomes. These findings corroborate those of [Mulyani et al. \(2018\)](#), who found that students' progress in class is directly related to the quality of classroom management. Improved classroom

management leads to more engaged and motivated students, who are better able to learn and contribute to class discussions. This demonstrates that the ethnoscience e-magazine created using SCT is appropriate for educational purposes. Teacher evaluations of e-magazine use and classroom management are noteworthy, as teachers have a significant impact on students' reading and writing. Developing students' capacities for inquiry and conceptual thinking is an area that many educators still fail to address in their focus on content mastery (Fuad et al., 2020).

To determine how well the SCT-based ethnoscience e-magazine worked, a small experiment was conducted as part of the evaluation phase. Results from both the pre- and post-tests measuring students' science literacy competencies were used to determine the effectiveness. The seven essay questions that made up the science literacy test were all directly related to the newly created content and were designed to measure science literacy indicators. Students' pre- and post-test scores on these variables were used to analyze their progress over the brief trial period of the ethnoscience e-magazine based on SCT. Results from the N-gain analyses of the components of science literacy indicated significant progress. With a combined score of 0.79, the greatest N-gain scores were recorded in the areas of "explaining phenomena scientifically" and "designing and evaluating scientific investigations," which are considered excellent. Alternatively, the medium-level N-gain score of 0.68 was reported in the "interpreting data and evidence scientifically" domain, the lowest of the three. The fact that students' science literacy improved after using the SCT-based ethnoscience e-magazine indicates that it is quite successful. The presentation of materials in a real-life setting, along with an engaging interface that encourages students to explore and learn, has led to this significant improvement (Bahriah, 2015). Table 5 presents the N-gain values that were computed for each indicator of science literacy.

Table 4. Science literacy n-gain values per aspect

Aspects of Science Literacy	Question Items	Pre-test	Post-test	N-gain	Description
Describe an event based on scientific phenomena	4,7	19,04	82,74	0,79	High
Develop a systematic research design	1,2,3,6	13,39	82,14	0,79	High
Interpreting data and evidence scientifically	5	19,05	73,81	0,68	Medium

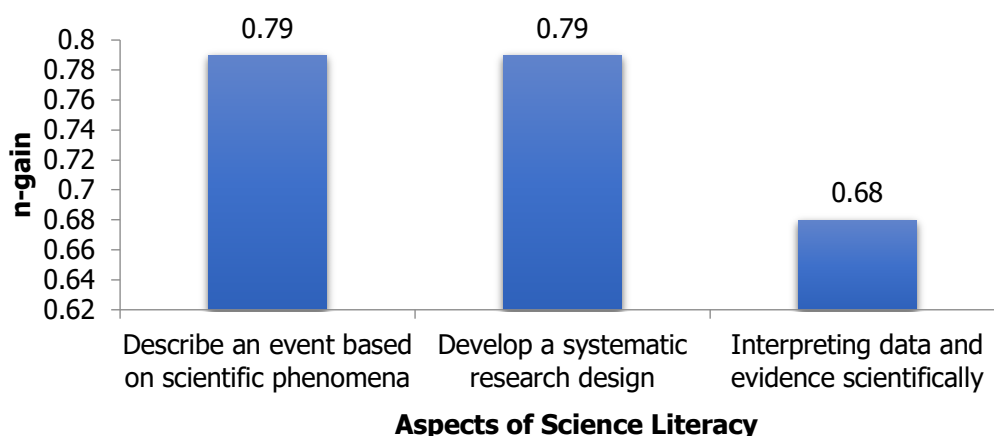


Figure 4. n-gain score of the science literacy aspect

The N-gain value of 0.79 indicates that students have shown significant improvement in their ability to understand and explain various natural phenomena scientifically. Students are required to connect the scientific knowledge they have learned with real-world events around them (OECD, 2017). This area has seen a significant improvement as a result of the applied learning model's design. Students are encouraged to draw on their own life experiences to make meaningful connections to the material during the orientation phase of SCT. This helps them better understand scientific topics. The SCT learning paradigm is designed to help students become better scientists by teaching them to think critically, draw on their own expertise to make educated guesses, and apply what they have learned to new situations (Bahriah, 2015; Rohmi, 2017). An n-gain value of 0.79, which is considered strong, was produced by the second component of scientific literacy, which is planning and assessing scientific research. Using their responses to questions about acids and bases as a benchmark, the results demonstrate that students' grasp of scientific concepts has grown. This aspect requires students to identify scientific questions that can be investigated and to determine the most effective procedures for testing their

hypotheses (OECD, 2017). In learning that utilizes the SCT model in the scientific activity stage, students conduct investigations to solve the presented problems and engage in practical activities (Arisoy & Aybek, 2021; Rusmansyah et al., 2019; Yerdelen & Sungur, 2019). In this phase, learners are trained to determine the dependent variable, the independent variable, and the appropriate control variables based on the given problem. They are taught to apply systematic steps in evaluating and designing scientific research (Rohmi, 2017).

Lastly, with an n-gain value of 0.68, which falls within the moderate range, discussing scientific data and evidence is part of science literacy. Science literacy questions concerning the interpretation of data and evidence related to acid-base materials can be confidently answered by students based on the n-gain value acquired. This part requires students to conduct their own research, analyze the results, and develop valid scientific conclusions. At the presentation stage of scientific activity outcomes, the SCT model helps students grow by teaching them to revise their representations of facts (Rusmansyah et al., 2023). In addition, students can be expected to draw logical conclusions based on the data they have collected (Ishak et al., 2017; Rohmi, 2017). Students' obstacles in this regard are a lack of basic understanding of chemical concepts, which makes it difficult to understand and explain data. In addition, the lack of direct experience in conducting experiments and scientific observations can reduce students' ability to analyze and interpret data. In addition to the pre-test and non-test results, practicality was assessed through several instruments: 1) teacher feedback questionnaire; 2) student feedback questionnaire; 3) observation assessment of electronic magazine implementation, and (4) observation evaluation of classroom management. The scores of 4.76, 4.30, 3.29, and 3.40, respectively, indicate the high practicability of the e-magazine as a learning tool.

The research concludes with an evaluation phase, which aims to collect data to improve the e-magazine. This stage is carried out throughout the research stages to anticipate and minimize errors, resulting in a high-quality SCT-based ethnoscience e-magazine. Evaluation is carried out based on validator assessments, learner responses, and implementation in classroom learning activities (Putri et al., 2022). During the evaluation at the design stage, it was necessary to explore the acid-base material further, and during the evaluation at the development stage, the validators assessed and approved several improvements to the e-magazine. These included incorporating ethnoscience content, refining chemical reaction notation, optimizing colors and fonts to improve readability, and including chemists' names. The implementation stage evaluation was conducted as a limited trial, with future expansion to field testing recommended for wider validation.

The ethnoscience e-magazine innovation, which uses the SCT model, offers a creative approach for students to understand learning. The e-magazine not only presents scientific content but also includes scientific activities designed to improve students' science literacy. Through the scientific activities featured in the e-magazine, learners are invited to analyze, evaluate, and build scientific arguments based on the information they find (García-Carmona, 2023). The development of this ethnoscience e-magazine makes learning more contextualized by connecting science to the surrounding culture. By engaging in the discovery process and applying the material to real-world concepts, students can learn chemistry more effectively and retain their understanding better (Polman et al., 2021; Winarti et al., 2022). In addition, the influence of surrounding culture facilitates students' exploration of facts, phenomena, or social problems, which are then integrated with scientific knowledge (Dewi et al., 2019). This research contributes to creating a learning medium that enhances science literacy and disseminates scientific knowledge in a format that is easily accessible to students around the world. In addition, it serves as a learning tool that presents interactive and engaging content, such as videos, images, quizzes, and articles, encouraging students to engage in the learning process actively. These findings can serve as a reference for teachers in developing learning media that promote learner literacy across various educational contexts (Putri & Kumara, 2025).

CONCLUSION

This study concludes that the Moku Hesi Miti birth ritual in the Abui community in Alor Regency reflects the core cultural values essential to their ethno-parenting practices. These core values include reverence for new life and blessings, reflected through the symbolism of breast milk and ancestral blessings, communal interdependence, demonstrated by the role of the "Tree of Release" and family support, the enforcement of morality and discipline through social norms and taboos, as well as character formation and the transmission of cultural identity. Collectively, these values contribute to Abui ethnic parenting by shaping children into independent, virtuous individuals deeply connected to their ancestral heritage, ensuring their physical and spiritual well-being from an early age. A deep understanding of Moku Hesi Miti underscores that traditional wisdom can align with contemporary holistic parenting goals, offering valuable insights for culturally relevant modern parenting practices. To sustainably preserve and utilise Moku Hesi Miti values, it is recommended to develop a digital archive or local museum that documents every aspect of the ritual in detail, including informant narratives, symbolism, and meaning, so that future generations and researchers can access it. It is important to incorporate material on Moku Hesi Miti into the elementary and secondary school curricula in Alor Regency as part of local cultural education to instil understanding and pride among the younger generation. Community initiatives should also be encouraged, such as holding workshops or regular community-level meetings involving

traditional leaders and the younger generation to facilitate the direct transmission of knowledge and experience. Thus, Moku Hesi Miti is not merely a ritual but a reflection of a robust value system that can serve as the foundation for more culturally sensitive community health programs and effective cultural preservation strategies amid the dynamics of modernisation.

REFERENCES

- Abidin, Y. (2018). *Pembelajaran Multi Literasi: Sebuah Jawaban Atas Tantangan Pendidikan Abad Ke-21 Dalam Konteks Ke-Indonesiaan*. Refika Aditama.
- Adawiyah, R., Andayani, Y., Rudyat, L., & Savalas, T. (2022). Pengembangan Modul Kimia Etnosains Terintegrasi Model Culturally Responsive Transformative Teaching (CRTT). *Journal of Classroom Action Research*, 4(4), 123–128.
- Adawiyah, R., & Wisudawati, A. W. (2017). Pengembangan Instrumen Tes Berbasis Literasi Sains dalam Aspek Menjelaskan Fenomena Ilmiah Materi Pokok Energi. *Indonesian Journal of Curriculum*, 5(2).
- Adi, P., Astuti, P., Rohmadi, M., Nirmalasari, R., Astuti, P. A. P., Rohmadi, M., & Nirmalasari, R. (2022). Analysis of Media Development Needs E-Magazine Material Inheritance of Islamic Integrated Nature for Grade IX Students at Islamic Junior High School. *Jurnal Penelitian Pendidikan IPA*, 7(1), 17–21.
- Arief, M., Effendi, R., & Ramdhani, M. A. (2021). Pengembangan E-Magazine Berbasis Literasi Sains pada Materi Reaksi Redoks. *Jurnal Pendidikan Sains Indonesia*, 9(1), 44–55.
- Arikunto, A. (2013). *Prosedur Penelitian Suatu Pendekatan Praktis*. Rineka Cipta.
- Arisoy, B., & Aybek, B. (2021). The Effects of Subject-Based Critical Thinking Education in Mathematics on Students' Critical Thinking Skills and Virtues. *Eurasian Journal of Educational Research*, 2021(92), 99–120.
- Ariyatun, A., & Octavianelis, D. F. (2020). Pengaruh Model Problem Based Learning Terintegrasi STEM terhadap Kemampuan Berpikir Kritis Siswa. *JEC: Journal of Educational Chemistry*, 2(1), 33.
- Atandau, E. C. R. K., Lalang, A. C., Lestarani, D., Naat, J. N., & Lawa, Y. (2021). Pengembangan Bahan Ajar Kimia Berbasis Lectora Inspire pada Materi Pokok Kimia Unsur Terintegrasi Etnosains untuk Siswa Kelas XII SMA/MA. *Jurnal Beta Kimia*, 1(1), 7–14.
- Bahriah, E. S. (2015). Kajian Literasi Sains Calon Guru Kimia Pada Aspek Konteks Aplikasi Dan Proses Sains. *Edusains*, 7(1).
- Bhoko, M., Fikri, K., & Bate, F. (2023). Pengembangan Media Pembelajaran Interaktif pada Materi Fingerpicking Gitar Kelas XI Semester II SMA Negeri 1 Golewa Kabupaten Ngada. *Jurnal Citra Pendidikan*, 3(4), 1253–1260.
- Dewi, C. A., Khery, Y., & Erna, M. (2019). An Ethnoscience Study in Chemistry Learning to Develop Scientific Literacy. *Jurnal Pendidikan IPA Indonesia*, 8(2), 279–287.
- Dwiqu, G. C. S., Sudatha, I. G. W., & Sukmana, A. I. W. I. (2020). Pengembangan Multimedia Pembelajaran Interaktif Mata Pelajaran IPA untuk Siswa SD Kelas V. *Jurnal Edutech Undiksha*, 8(2), 148–163.
- Fitriyana, N., Marfuatun, M., & Priyambodo, E. (2019). The Profile of Students' Analytical Thinking Skills on Chemistry Systemic Learning Approach. *Scientiae Educatia*, 8(2), 207.
- Fuad, A., Karim, H., & Palennari, M. (2020). Pengembangan Media Pembelajaran E-Magazine Sebagai Sumber Belajar Biologi Siswa Kelas XII. *Biology Teaching and Learning*, 3(1).
- García-Carmona, A. (2023). Scientific Thinking and Critical Thinking in Science Education: Two Distinct but Symbiotically Related Intellectual Processes. *Science and Education*, 34(1), 227–245.
- Hake, R. R. (1999). *Analyzing Change/Gain Scores*. Dept. of Physics, Indiana University.
- Ishak, M., Jekti, D. D. S., & Sridana, N. (2017). Pengaruh Penerapan Pendekatan Saintifik menggunakan Model Pembelajaran Discovery dan Kooperatif Tipe STAD Terhadap Kemampuan Berpikir Kreatif Peserta Didik SDN 13 Ampenan. *Jurnal Pijar MIPA*, 12(1).
- Jariati, E., & Yenti, E. (2020). Pengembangan E-Magazine Berbasis Multipel Representasi untuk Pembelajaran Kimia di SMA pada Materi Larutan Elektrolit dan Non Elektrolit. *Journal of Natural Science and Integration*, 3(2), 138.
- Juliani, S., & Refelita, F. (2022). Desain Dan Uji Coba Media Pembelajaran Berbasis E-Magazine dengan Pendekatan Dilemmas Stories Sebagai Sumber Belajar pada Materi Larutan Elektrolit Dan Nonelektrolit. *Journal Education and Chemistry*, 4(1), 22–28.

- Juwita, E., & Rosidin, U. (2022). Analisis Kemampuan Literasi Sains Siswa Kelas IX MTs Negeri 1 Lampung Barat pada Materi Bioteknologi Berbasis Etnosains. *Jurnal Edukasi Matematika dan Sains*, 10(2), 232–242.
- Kurniawan, R., Zahrah, F., Yuliati, I., Terpadu, M., Roihan, A., Malang, L., & Madura, I. (2023). Development of Madrasah E-Magazine Through Online FlipHTML5 to Improve Writing and Reading Literacy. *MAHAROT: Journal of Islamic Education*, 7(1), 2580–3999.
- Kusumah, R. G. T., Walid, A., Sugiharta, I., Putra, E. P., Wicaksono, I., & Erfan, M. (2020). Construction of High School Chemistry Module, Based on Problem-Based Learning (PBL) on Salt Hydrolysis Material for Gifted Students. *Journal of Physics: Conference Series*, 1467(1), 1–14.
- Laksmi, N. L. P. A., & Suniasih, N. W. (2021). Pengembangan Media Pembelajaran E-Comic Berbasis Problem Based Learning Materi Siklus Air Pada Muatan IPA. *Jurnal Imiah Pendidikan dan Pembelajaran*, 5(1).
- Mardhiyah, R. H., Aldriani, S. N. F., Chitta, F., & Zulfikar, M. R. (2021). Pentingnya Keterampilan Belajar di Abad 21 sebagai Tuntutan dalam Pengembangan Sumber Daya Manusia. *Lectura: Jurnal Pendidikan*, 12(1).
- Maryati, I. F., Gummah, S., & Sukroyanti, B. A. (2018). Pengembangan Bahan Ajar Berbasis Majalah Siswa Pintar Fisika (MSPF) Untuk Meningkatkan Hasil Belajar Siswa. *Ilmiah IKIP Mataram*, 5(1), 58–62.
- Mulyani, S., Rudibyani, R., & Efkar, T. (2018). Efektivitas LKS Berbasis Multipel Representasi Dalam Meningkatkan Kemampuan Berpikir Kritis. *Jurnal FKIP UNILA*, 1(1), 1–12.
- Nadzif, M., Irhasyurna, Y., & Sauqina, S. (2022). Pengembangan Media Pembelajaran Interaktif IPA Berbasis Articulate Storyline Pada Materi Sistem Tata Surya SMP. *Jupeis: Jurnal Pendidikan dan Ilmu Sosial*, 1(3), 17–27.
- Neelamalar, M., & Vivakaran, M. V. (2019). A Critical Analysis of the Jihadi Discourse Through Online Magazines with Special Reference to "Wyeth" Magazine. *India Quarterly: A Journal of International Affairs*, 75(4), 456–471.
- Ni'mah, S., Lestari, N. C., & Adawiyah, R. (2018). Pengembangan Dan Uji Validitas Perangkat Pembelajaran SMA Berbasis Kurikulum 2013 Pada Konsep Sistem Pencernaan. *Jurnal Pendidikan Hayati*, 4(1), 22–30.
- Nuraida, N., Susanti, T., & Jailani, M. S. (2022). Desain E-Magazine Pada Mata Pelajaran Biologi Bermuatan High Order Thinking Skill (HOTS) Untuk Siswa SMA/MA. *Jurnal Biotek*, 10(1), 83–101.
- Nuralita, A. (2020). Analisis Penerapan Model Pembelajaran Berbasis Etnosains Dalam Pembelajaran Tematik SD. *MIMBAR PGSD Undiksha*, 4(1), 1–8.
- Nurchayani, D., Yuberti, Irwandani, Rahmayanti, H., Ichsan, I. Z., & Rahman, M. (2021). Ethnoscience Learning on Science Literacy of Physics Material to Support Environment: A Meta-Analysis Research. *Journal of Physics: Conference Series*, 1796(1), 1–8.
- OECD. (2017). *PISA for Development Assessment and Analytical Framework*. OECD Publishing.
- Palmeirao, C., & Carneiro, A. (2020). Pedagogical Triangulations: From the Online Forum to the E-Magazine: A Praxiological Experience About School and Its Actor During COVID19 Confinement. *Proceedings of the 9th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-Exclusion*, 116–119.
- Pamungkas, A. S., Mentari, N., & Nindiasari, H. (2018). Analisis Kemampuan Berpikir Reflektif Siswa SMP Berdasarkan Gaya Belajar. *NUMERICAL: Jurnal Matematika dan Pendidikan Matematika*, 2(1), 69.
- Panggabean, F. T. M., Silitonga, P. M., & Sinaga, M. (2022). Development of CBT Integrated E-Module to Improve Student Literacy HOTS. *International Journal of Computer Applications Technology and Research*, 11(05), 160-164.
- Polman, J., Hornstra, L., & Volman, M. (2021). The Meaning of Meaningful Learning in Mathematics in Upper-Primary Education. *Learning Environments Research*, 24(3), 469–486.
- Putri, D. G., Zulfarina, Z., Zulfarina, Z., Syafii, W., & Syafii, W. (2021). Development of Augmented Reality for Biology E-Magazine. *Journal of Educational Sciences*, 5(3), 511.
- Putri, N. A., Edwita, A. R., & Supriatna, S. (2022). Pengembangan Media Pembelajaran E-Magazine Berbasis Pendekatan Saintifik Pada Pembelajaran IPA Materi Sifat-Sifat Cahaya Kelas IV SD. *Efektor*, 9(2).
- Putri, S., & Kumara, H. A. (2025). Penerapan Project Historia Magazine Untuk Meningkatkan Kreativitas Siswa Dalam Pembelajaran Sejarah Di Kelas X E 3 SMAN 1 Ciamis. 12(1), 53–68.
- Rohmi, P. (2017). Peningkatan Domain Kompetensi Dan Pengetahuan Siswa Melalui Penerapan Levels of Inquiry Dalam Pembelajaran IPA Terpadu. *Edusains*, 9(1), 14–23.

- Rusek, M., Vojir, K., Bartova, I., Kleckova, M., Sirotek, V., & Strofova, J. (2022). To What Extent Do Freshmen University Chemistry Students Master Chemistry Calculations? *Acta Chimica Slovenica*, 69, 371–377.
- Rusmansyah, R., Effendi, A. M., Mahdian, M., & Aufa, M. N. (2023). Scientific Critical Thinking Model to Improve Scientific Literacy and Self-Regulation Skills in Buffer Solution Learning. *EduChemia (Jurnal Kimia dan Pendidikan)*, 8(2), 130-144.
- Rusmansyah, R., Yuanita, L., Ibrahim, M., Prahani, B., & Isnawati, I. (2019). Validity and Reliability of Science Critical Thinking Learning Model to Improve Critical Thinking Skills and Self-Efficacy of Chemistry Teachers Candidates. In *6th International Conference on Educational Research and Innovation*.
- Rusmansyah, R., Wahyuni, L., Syahmani, & Juwida, H. (2020). Melatih Kemampuan Berpikir Kritis, Keterampilan Komunikasi Dan Self Efficacy Siswa Menggunakan Model Scientific Critical Thinking (SCT). *Paedagogia: Jurnal Kajian, Penelitian dan Pengembangan Kependidikan*, 11(2), 93–98.
- Rusmansyah, R., Yuanita, L., Ibrahim, M., Isnawati, & Prahani, B. K. (2019). Innovative Chemistry Learning Model: Improving the Critical Thinking Skill and Self-Efficacy of Pre-Service Chemistry Teachers. *Journal of Technology and Science Education*, 9(1), 59–76.
- Sari, R. D., Agustini, R., & Widodo, W. (2021). The Effectiveness of Science E-Magazine of Socioscientific Issues-Based Inquiry Model to Improve Critical Thinking Skill of Junior High School Students. *Studies in Learning and Teaching*, 2(3), 10-20.
- Shofia, R. N., Rakhmawan, A., Tamam, B., Wahyuni, E. A., & Hadi, W. P. (2024). Peningkatan Literasi Sains Peserta Didik Melalui Pembelajaran Dengan Pendekatan Kontekstual Berbantuan E-Magazine Eco Explorer. *Jurnal Natural Science Educational Research*, 7(2), 110–117.
- Siagian, G., Sirait, D. E., Situmorang, M. V., & Silalahi, M. V. (2022). Pengembangan E-LKPD Berbasis Etnosains Untuk Melatih Keterampilan Literasi Sains Pada Materi Zat Makanan. *Jurnal Penelitian dan Pengabdian Masyarakat Nommensen Siantar (JP2NS)*, 2(2), 63–87.
- Siahaan, R., Sitorus, M., & Silaban, S. (2021). The Development of Teaching Materials Oriented to Critical Thinking Skills for Chemistry Class XI High School. *Jurnal Pendidikan Kimia*, 13(1), 60–68.
- Syafii, W., & Gusnia Putri, D. (2021). E-Magazine Based on Augmented Reality Digestive as Digital Learning Media for Learning Interest. *Journal of Education Technology*, 5(3), 417–424.
- Syahfitri, J., Panjaitan, C. J., & Anggreni, F. (2023). Pengembangan Media Petualangan Cerdas Berbasis Permainan Dengan Model ADDIE. *Jurnal Ilmiah Pendidikan*, 8(1), 1–19.
- Syahmani, S., Iriani, R., Riana, S., & Bakti, I. (2022). E-Magazine Development with Social Emotional Learning Approach on Colloid Material in Context of Local Wisdom. *Tadris: Jurnal Keguruan dan Ilmu Tarbiyah*, 7(2), 289–304.
- Talanquer, V. (2022). The Complexity of Reasoning About and with Chemical Representations. *JACS Au*, 2.
- Tarawi, O., Noer, A. M., & Linda, R. (2020). The Development of Acid-Base E-Chemistry Magazine as Interactive Teaching Materials. *Journal of Physics: Conference Series*, 1440(1).
- Tarihoran, A. C., Izzati, N., & Fera, M. (2022). Validitas Media E-Magazine Pada Materi Barisan Dan Deret Kelas XI SMA. *Jurnal Kiprah*, 10(1), 1–11.
- Usman, E. A., Cahyati, M. T., & Putri, Y. A. (2019). Meta Analisis Pengaruh Penerapan Model Inquiry Based Learning Dalam Pembelajaran Fisika Untuk Menjawab Tantangan Kurikulum 2013 Pada Abad 21. *Physics Education*, 12(4), 873–880.
- Utari, R., Andayani, Y., & Savalas, L. R. T. (2020). Pengembangan Modul Kimia Berbasis Etnosains Dengan Mengangkat Kebiasaan Petani Garam. *Jurnal Pijar MIPA*, 15(5), 478–481.
- Widayoko, A., Femilia, P. S., Lesmono, A. D., Sudjatmi, H., Prastiwi, V. D., & Munfarikha, N. (2019). Description of Students' Scientific Literacy Competencies on the Scientific Issue of Flat Earth Theory. *Anatolian Journal of Education*, 4(2), 31–38.
- Winarti, A., Almubarak, A., Saadi, P., Ijirana, I., Aminah, S., & Ratman, R. (2022). Culturally Responsive Chemistry Teaching (CRCT) of College Students as A Novice Teacher: Does It Matter? *JTK (Jurnal Tadris Kimiya)*, 7(2), 175–189.
- Yerdelen, S., & Sungur, S. (2019). Multilevel Investigation of Students' Self-Regulation Processes in Learning Science: Classroom Learning Environment and Teacher Effectiveness. *International Journal of Science and Mathematics Education*, 17(1), 89–110.