PUSTAKA DIDAKTIS
JURNAL MEDIA DAN MODEL PEMBELAJARAN

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Evaluation of Content and Construct Validity of Learning Tools Based on Culturally Responsive Transformative Teaching Model with Socioscientific Issues Approach

Ahmad Aris Arifin[1]*, Agus Ramdani[2], Yayuk Andayani[3]
[1]Program Studi Magister Pendidikan IPA, Pascasarjana, Universitas Mataram,
[2]Program Studi Pendidikan Biologi, FKIP, Universitas Mataram
[3]Program Studi Pendidikan Kimia, FKIP, Universitas Mataram
*Corresponding Author: ahmadarisarifin01@gmail.com

Abstract
This study aims to evaluate the content and construct validity of learning tools based on the Culturally Responsive Transformative Teaching model with a Socioscientific Issues approach. The research method used is Research and Development (R&D) with a 4D development design consisting of the define, design, develop and disseminate stages. The development stage is limited to validity testing by six expert validators to assess the learning tools, including the ATP, teaching module, e-module, student worksheets (LKPD), scientific argumentation skills test instrument, and scientific attitude questionnaire. The validity testing at this stage consists of content and construct validity. Data collection techniques involve validation questionnaire sheets. Data analysis techniques use Aiken's V validity index, and reliability testing uses the Percentage of Agreement method. Based on the results of content validity and construct validity tests, the learning tools based on the Culturally Responsive Transformative Teaching model with a Socioscientific Issues approach are categorized as highly valid, as the validity index is greater than 0.8. The reliability test results using the Percentage of Agreement method indicate that the inter-validator agreement percentage is reliable, as the agreement percentage exceeds 75% for all components of the learning tools, including the ATP, Teaching Module, E-Module, Student Worksheets (LKPD), Argumentation Test Instrument, and Scientific Attitude Questionnaire.

Article History
Received: March 3, 2025
Reviewed: March 20, 2025
Published: August 01, 2025

Key Words
Validity, learning tools, Culturally Responsive Transformative Teaching Model, Socioscientific Issues Approach.

How to Cite: Arifin, A.A., Ramdani, A., & Andayani, Y. (2025). Evaluation of content and construct validity of learning tools based on culturally responsive transformative teaching model with socioscientific issues approach. *PUSTAKA DIDAKTIS: Jurnal Media dan Model Pembelajaran, 1*(1). 20-37.

INTRODUCTION

Since 2020, Indonesia has implemented the Merdeka Curriculum, which demands globalization and a paradigm shift in education. This policy aims to develop a more holistic education encompassing character development, skills, and students' thinking abilities (Vhalery et al., 2022). One of the themes of the Merdeka Curriculum implementation is local wisdom. The development of a curriculum based on local wisdom is an effort to integrate traditional cultural values into the educational curriculum to produce academically and non-academically competent graduates who possess character aligned with the noble values of the Indonesian nation (Karsiwan et al., 2023).

The Merdeka Curriculum has very positive objectives; however, its implementation in the field still faces several challenges at the stages of planning, execution, and assessment of learning (Mukhibin et al., 2022). Rindayati et al. (2022) revealed that teachers still encounter difficulties in preparing learning devices, which include Learning Outcomes (LO), Learning

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Objectives (LO), and Learning Pathways (LP). Rosidah et al. (2021) indicated that teachers are unprepared to implement authentic assessments, while Utari et al. (2023) stated that teachers still do not understand the national assessment within the Merdeka Curriculum. In line with implementing the local wisdom theme in the Merdeka Curriculum, teachers still face challenges integrating local wisdom through learning, particularly through teaching materials (Arifin et al., 2022; Arifin et al., 2024a).

Interviews with several teachers in senior high schools revealed that 75% had never integrated local wisdom or raised social science issues in the community within their teaching materials. According to the implementation of the Merdeka Curriculum, the local wisdom theme is applied; however, its execution remains limited to cultural Saturday activities. Thus, integrating local wisdom in learning, especially in learning devices, has not yet been conducted. Teachers' statements during interviews indicated a strong need for innovative learning resources based on local wisdom combined with social science issues to support the implementation of the Merdeka Curriculum concerning the local wisdom theme.

Facilitating the integration of local wisdom through learning devices, the Culturally Responsive Transformative Teaching (CRTT) model is one of the most suitable models to be applied. The CRTT model is developed based on Culturally Responsive Teaching (CRT) principles. CRT was developed to create meaningful learning by connecting learning with students' cultural context (Gay, 2000). CRT is built from students' cultural experiences, acknowledging that diverse heritage and languages influence attitudes and approaches to learning (Bergantz & Gale, 2020). Educators must understand that there is a strong relationship between culture and students' ways of thinking, as culturally responsive learning utilizes students' diverse knowledge, experiences, and cultures to enhance learning effectiveness and relevance (Walker, 2023).

According to Aceves & Orosco (2014), culturally responsive feedback is a form of individual support teachers provide to students, considering their cultural preferences and backgrounds. Teachers offer individual support by understanding students' preferences and cultures. This strategy integrates students' responses, ideas, languages, and experiences into the feedback cycle while inviting them to build new understandings of their current learning (McIntyre & Hulan, 2013).

The concepts and principles of CRT outlined above have subsequently been developed into Culturally Responsive Transformative Teaching (CRTT) by Rahmawati & Ridwan (2017) and Rahmawati et al. (2019) by adding the transformative concept. The transformative idea in CRTT adds a new dimension to culturally responsive teaching (CRT). This transformative concept aims to transform students' understanding and attitudes towards culture by emphasizing the addition of relevant values and knowledge to students' cultural contexts, thereby enabling the integration of what students acquire through learning into their daily lives.

The advantages of the Culturally Responsive Transformative Teaching (CRTT) model can help address issues such as the lack of relevance of learning materials to students' needs, environments, motivations, and interests in learning (Adawiyah et al., 2022). Applying the CRTT model allows students to learn in a manner that is more connected to their daily lives and accommodates the cultural diversity around them (Rahmawati et al., 2020b). Furthermore, this model creates more contextual learning as students are already familiar with their cultures (Dwipayana et al., 2020). In this research, the cultural aspects highlighted relate to the Pedak Api tradition of the Narmada community, Ngome, Bebonto, and Awik-Awik.

The Pedak Api tradition is a birth ceremony that coincides with the naming ceremony, conducted on the seventh or ninth day after childbirth (Zuhriah & Warto, 2019). The Pedak

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Api tradition is relevant to the biology learning concept concerning the topic of interactions between abiotic components (the fire in the Pedak Api process) and biotic components (the baby positioned above the fire) (Arifin et al., 2024b). Ngome and Bebonto are farmers' traditional practices in Narmada for caring for rice plants after planting. Ngome refers to removing pests that may hinder rice growth, while Bebonto serves to scare away birds and other animals, such as rats, from eating the rice. Both activities are significantly relevant to the rice field ecosystem's food chain and food webs. Awik-Awik is a customary law that arises from community habits to protect their environment from damage, ensuring that sources of life remain sustainable for future generations (Irrubai, 2019).

Learning through applying the CRTT model, which facilitates the integration of local wisdom aspects of the community, is also potentially combined with the Socioscientific Issues (SSI) approach. From 2017 to 2023, SSI, which integrates aspects of science and complex social issues, has become a primary focus in efforts to create more contextual and relevant science learning for students. This reflects a transformation in the approach to science learning, where science is no longer taught in isolation but is positioned as an inseparable part of the real environmental context (Priyanka & Selamat, 2021). Additionally, SSI research also examines teachers' role in integrating socioscientific issues into the curriculum and how learning materials can be adjusted to achieve more contextual science learning (Munawaroh & Mustafid, 2023).

SSI-based learning is context-dependent (Cebesoy, 2021), addressing open-ended, unstructured, and complex issues (Karahan & Roehrig, 2017; Saglam & Eroglu, 2022), which are controversial and problem-oriented, introducing current socioscientific topics (Asmah, 2022) that require various considerations, perspectives, and solutions (Cebesoy, 2021; Es & Ozturk, 2021). The SSI approach is not only related to issues or problems occurring in life (Sadler et al., 2016), such as cloning (Ozden, 2015), genetic modification of organisms (Herman et al., 2020), pharmacogenomics (Cebesoy, 2021), and global warming (Herman, 2015), but also discusses controversial conceptual issues, such as the theory of evolution and climate change (Andryani et al., 2016; Sadler et al., 2016). SSI can also be sourced from local community issues (Subiantoro & Ariyanti, 2013). In this research, the SSI aspects are derived from local community issues, such as tree logging, open burning of rice straw post-harvest, and gold mining in Sekotong (Arifin, 2024d).

The issue of tree logging has implications for climate change, as trees play a crucial role in absorbing carbon dioxide from the atmosphere. It is essential to prevent tree logging to maintain environmental cycles and reduce greenhouse gas emissions, which are further exacerbated by the open burning of rice straw (Iqbal & Ruhaeni, 2022; Risfany et al., 2022). Other socioscientific issues related to gold mining in Sekotong can threaten ecosystem sustainability due to deforestation, land degradation, water and air pollution, all of which can accelerate global climate change (Pangemanan et al., 2022; Arifin et al., 2024c). Taking these considerations into account, it is crucial to integrate socioscientific issues such as the environmental degradation caused by tree logging, the air pollution and soil fertility reduction resulting from open burning of post-harvest rice straw, and the ecological and social impacts of gold mining in Sekotong into the learning process. This integration should be implemented through well-designed learning devices that not only enhance students' conceptual understanding but also develop their critical thinking, problem-solving abilities, and environmental awareness. Therefore, this research aims to design and develop learning devices that are grounded in the Culturally Responsive Transformative Teaching (CRTT) model while incorporating a Socioscientific Issues (SSI) approach. Through this approach, students will be encouraged to

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

engage with real-world challenges, analyze scientific and ethical dimensions of environmental issues, and cultivate a sense of responsibility toward sustainable development.

RESEARCH METHOD

Type of Research

The type of research employed in this study is Research and Development (R&D) with a 4D development design (Thiagarajan et al., 1974). Learning device design using the 4D model consists of four stages: define, design, develop, and disseminate. This research is limited to the development stage. In the define stage, an analysis of the front-end, learner analysis, concept analysis, task analysis, and specification of learning objectives is conducted. In the design stage, the preparation of test standards, selection of media and formats, and the initial design of learning devices based on the Culturally Responsive Transformative Teaching model with a Socioscientific Issues approach are carried out. The development stage involves validation testing by experts and reliability testing. The validity test or expert appraisal aims to produce a valid and reliable product based on expert assessments before conducting field trials.

Implementation Procedure

The validity test is conducted by two expert validators and one practitioner validator. The validity test utilizes the assessment results from the validators to determine the validity of the learning devices (teaching modules, e-modules, and student worksheets) and the instruments for assessing scientific argumentation skills, as well as the scientific attitude questionnaire that has been developed. The validation tests used at this stage consist of content and construct validity. Content validity measures the extent to which the instrument accurately encompasses all aspects of the concept to be measured, such as the alignment of the developed devices with the syntax of the Culturally Responsive Transformative Teaching model with a Socioscientific Issues approach and their alignment with indicators of scientific argumentation and scientific attitudes. Construct validity reflects structure, framework, language, and graphical representation construction.

Data Collection Techniques

Data collection techniques involve using validation questionnaires to assess the validity of the e-module as the primary product developed, teaching modules, student worksheets, instruments for assessing scientific argumentation skills, and the scientific attitude questionnaire (Appendix 14). The scoring guidelines utilize a Likert scale from 1 to 5, with the following scoring criteria: very poor (score of 1), poor (score of 2), adequate (score of 3), good (score of 4), and very good (score of 5) (Riduwan, 2016). The validation results are used to determine whether the developed products are suitable for use.

Data Analysis Techniques

The data analysis technique at this stage employs Aiken's V index analysis and reliability testing using the Percentage of Agreement as follows:

Validity Testing

The data analysis process for each statement item on the validation questionnaire utilizes the following Aiken's V formula:

PUSTAKA DIDAKTIS
JURNAL MEDIA DAN MODEL PEMBELAJARAN
Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

$$V = \frac{\Sigma s}{(n\ (c-1)}$$

Symbol		Description
V	=	Validity Index
Σs	=	r – lo
r	=	Score given by the evaluator
lo	=	The lowest validity rating, which is (1)
c	=	The highest validity rating, which is (5)
n	=	Number of validators

Based on the validity test results from the three validators, data interpretation was subsequently conducted according to the validity criteria. The level of validity is determined based on Table 1:

Table 1. Validity Levels of the Devices

Value Range	Validation Level
V ≥ 0,4	Less valid
0,4 > V < 0,8	Valid
V ≥ 0,8	Highly valid

Reliability Testing

Reliability analysis uses the Borich Percentage of Agreement (PA) method. In this study, six validators are utilized, and the analysis is performed by combining the six validators. The combination of validator pairs is determined using the following equation:

$$\text{Validator Combinations} = \frac{n(n-1)}{2}$$

Based on the equation above, (n) represents the number of validators used. After the calculation, 15 validator pairs that must be assessed for their Percentage of Agreement (PA) were obtained. The combinations of validator pairs are (V1,2), (V1,3), (V1,4), (V1,5), (V1,6), (V2,3), (V2,4), (V2,5), (V2,6), (V3,4), (V3,5), (V3,6), (V4,5), (V4,6), and (V5,6). Following this, the PA is calculated using the formula:

$$PA = (1 - \frac{A-B}{A+B}\ )\ x\ 100\%$$

According to the equation above, (A) represents the higher evaluator score, while (B) represents the lower score. The higher score (A) is always subtracted by the lower score (B). An instrument is considered reliable if the percentage of agreement is greater than or equal to 75%. If it is less than 75%, further testing for clarity and agreement from the observers is required (Borich, 1994).

RESULT AND DISCUSSION

Learning Devices Based on the Culturally Responsive Transformative Teaching Model with a Socioscientific Issues Approach. The learning devices were developed following the 4D design steps, and the results are as follows.

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Results of the Define Stage

The define stage consists of five steps: (a) front-end analysis, which identified issues related to the limitations of learning resources and learning devices that integrate local wisdom and socioscientific issues through the learning process; (b) learner analysis, which revealed a percentage of 75.76 regarding students' interest in local wisdom-based learning, and a percentage of 81.08 regarding students' interest in learning that addresses socioscientific issues; (c) task analysis to assess the alignment of assignments given with the learning objectives to be achieved; (d) concept analysis, which involved outlining the criteria for achieving learning objectives in accordance with the learning goals and developing the content concepts to be included in the developed learning devices; and (e) specification of learning objectives that serve as the foundation for developing learning devices, including Learning Pathways, Teaching Modules, E-modules, Student Worksheets, and Instruments for Scientific Argumentation Tests.

Results of the Design Stage

The design stage consists of four steps: (a) preparation of test standards to measure students' scientific argumentation and attitudes; (b) selection of media, including a virtual aquatic ecosystem media and student worksheet media to maximize the learning process; (c) selection of formats; and (d) initial design of learning devices, which includes Learning Pathways (ATP), Teaching Modules, E-modules, Student Worksheets, Argumentation Test Instruments, and Scientific Attitude Questionnaires.

Results of the Develop Stage (Validation Testing)

The validation test aims to obtain expert feedback regarding the quality of the developed products and is conducted twice to achieve optimal final results. The critiques and suggestions provided by the experts regarding the weaknesses and shortcomings of the e-module will serve as a basis for further refinement, ensuring its validity for use in learning. The validated e-module is based on the CRTT model with the SSI approach. In addition to the e-module, experts also evaluated the ATP, Teaching Module, Student Worksheets, Scientific Argumentation Test Instruments, and Scientific Attitude Questionnaires. Below is a summary of the validation results:

Results of Content Validity

Content validity measures how well an instrument encompasses all aspects of the concept being assessed, including the alignment of the e-module and learning devices with the CRTT (Culturally Responsive Transformative Teaching) model syntax, the SSI approach, and indicators of argumentation and scientific attitudes. A high level of content validity ensures that the developed learning tools effectively support students in constructing arguments and developing a scientific mindset. This validation process involves expert judgment to evaluate whether the content, structure, and learning objectives are well integrated.

The results of the content validity assessment for the e-module and learning devices are presented in Table 2, providing an overview of their appropriateness and relevance in achieving the intended learning outcomes. These findings highlight the extent to which the materials reflect the theoretical framework and pedagogical goals, confirming their suitability for implementation in classroom settings designed to foster culturally responsive and scientifically grounded learning. The validation results also serve as a foundation for further refinement and enhancement of the instructional tools prior to broader application.

PUSTAKA DIDAKTIS
JURNAL MEDIA DAN MODEL PEMBELAJARAN
Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Table 2. Results of Content Validation of Learning Devices

Component	Aiken's V Index		Average	Descriptions
	Validation Stage I	Validation Stage II		
Learning Pathways (ATP)	0.863	0.952	0.907	Highly valid
Teaching Module	0.812	0.932	0.872	Highly valid
E-Module	0.821	0.967	0.894	Highly valid
Student Worksheets (LKPD)	0.807	0.949	0.878	Highly valid
Argumentation Test Instrument	0.843	0.940	0.891	Highly valid
Scientific Attitude Questionnaire	0.857	0.952	0.904	Highly valid

Based on Table 2, it is evident that the average of all components of the learning devices, including ATP, Teaching Module, E-Module, LKPD, Scientific Argumentation Test Instrument, and Scientific Attitude Questionnaire, has a content validity index greater than 0.8, thus categorizing them as highly valid.

Results of Construct Validity

Construct validity reflects structure, framework, language, and graphical representation construction. The results of the construct validity for ATP, Teaching Module, E-Module, LKPD, Scientific Argumentation Test Instrument, and Scientific Attitude Questionnaire are presented in Tables 3 and 4:

Table 3. Results of Validation of Learning Devices: Presentation Feasibility Aspect

Component	Aiken's V Index		Average	Descriptions
	Validation Stage I	Validation Stage II		
Learning Pathways (ATP)	0,979	1	0,989	Highly valid
Teaching Module	0,861	0,972	0,916	Highly valid
E-Module	0,844	0,938	0,891	Highly valid
Student Worksheets (LKPD)	0,850	0,954	0,902	Highly valid
Argumentation Test Instrument	0,833	0,958	0,895	Highly valid
Scientific Attitude Questionnaire	0,833	0,938	0,885	Highly valid

Table 4. Results of Validation of Learning Devices: Language Feasibility Aspect

Component	Aiken's V Index		Average	Descriptions
	Validation Stage I	Validation Stage II		
Learning Pathways (ATP)	0,771	0,854	0,813	Highly valid
Teaching Module	0,778	0,875	0,827	Highly valid
E-Module	0,833	0,958	0,896	Highly valid
Student Worksheets (LKPD)	0,792	0,906	0,849	Highly valid
Argumentation Test Instrument	0,764	0,917	0,841	Highly valid
Scientific Attitude Questionnaire	0,750	0,917	0,834	Highly valid

Based on Tables 3 and 4, the average results of the construct validity for the presentation feasibility and language feasibility aspects of the learning devices, including ATP, Teaching Module, E-Module, LKPD, Scientific Argumentation Test Instrument, and

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Scientific Attitude Questionnaire, show a construct validity index greater than 0.8. This indicates that the developed learning tools meet the criteria for being highly valid, demonstrating their clarity, coherence, and suitability for effectively facilitating student learning and assessment.

Validator Suggestions and Revision Results

Based on the suggestions and feedback from the validators, revisions were made to the e-module and the CRTT-based learning devices with the SSI approach. These revisions included adjustments to the ATP, Teaching Module, E-Module, LKPD, Scientific Argumentation Test Instrument, and Scientific Attitude Questionnaire. The validator suggestions and the results of the revisions are presented in the following tables:

Table 5. Validator Suggestions and Revision Results for ATP

No	Suggestion	Improvement
1	Replace the word "understanding" in the learning objectives with a more operational verb.	"understanding" has been replaced with the verb "describing."
2	Correct the typo in "identifying" in the learning objectives	The typo "mengindentifikasi" has been corrected to "mengidentifikasi."
3	Specify the work to be produced in the learning objectives for each learning activity.	The work to be produced has been added to the learning objectives.
4	Align the learning objectives with the ABCD aspects, particularly aspects C (Condition) and D (Degree)	The learning objectives have been adjusted to meet all ABCD aspects.

Table 6. Validator Suggestions and Revision Results for Teaching Module

No	Suggestion	Improvement
1	Add a cover page for the teaching module	A cover page has been added.
2	Mention video links that support the material in the media section.	Video links used to support the material have been added in the media section of the teaching module.
3	Align the process skills elements with the designed learning activities	The process skills elements have been aligned with the designed learning activities.
4	Differentiate the learning objectives from the criteria for achieving the learning objectives.	The learning objectives and the criteria for achieving the learning objectives have been revised.
5	Specify the methods used in the teaching model section	The methods used have been added based on the activities conducted to ensure a comprehensive and structured approach to data collection and analysis. These additions aim to enhance the clarity and accuracy of the research process, aligning the methodology with the objectives of the study while ensuring that all relevant aspects of the conducted activities are well-documented and systematically integrated.
6	Add benefits for students learning the material in the meaningful understanding section.	Benefits for students in learning the taught material have been added at the end of the meaningful understanding paragraph.

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Table 7. Validator Suggestions and Revision Results for E-Module and LKPD

No	Suggestion	Improvement
1	Other habits/cultures should be added to e-modules and LKPD to support CRTT learning. In each learning activity, use one different culture.	A CRTT aspect has been added, namely the custom of farmers in Selat Village, Narmada Sub-district, West Lombok, in caring for rice plants after the planting period, commonly called Ngome and Bebonto. Ngome is the activity of cleaning grasses, snails, and other pests that can interfere with rice growth so rice plants can grow optimally. Bebonto or scarecrow scares birds and other animals, such as rats, from eating the rice.
2	Added video related to gold mining in Sekotong	Videos for each SSI aspect raised have been added, including videos on tree felling, straw waste burning, and gold mining.

Table 8. Validator Suggestions and Revision Results for Test Instruments and Questionnaires

No	Suggestion	Improvement
1	Incorporate the cultural aspects raised into the items of the scientific argumentation test.	Cultural aspects have been added to the scientific argumentation test instrument to align assessments with students' experiences and local wisdom, enhancing relevance and encouraging connections between science and societal contexts.
2	Revise the sentence structure of the statements in the scientific attitude questionnaire to be more concise and straightforward.	The sentence structure of the statements in the scientific attitude questionnaire has been revised to be more concise and straightforward.
3	Add scoring guidelines for the scientific attitude questionnaire with more specificity for each sub-indicator	Scoring guidelines for the scientific attitude questionnaire have been added with more specificity for each sub-indicator.

Results of Reliability Testing

The purpose of conducting reliability analysis using the Borich method, known as the Percentage of Agreement (PA), is to assess the consistency of evaluations or the level of agreement among multiple evaluators (validators). This method ensures that the assessment results are stable and reproducible across different evaluators, confirming the reliability of judgments on the quality of the e-module and learning devices. It measures the extent to which two or more evaluators reach a consensus in assessing key components, including content feasibility, presentation feasibility, and language feasibility. A high level of agreement indicates strong reliability, while discrepancies may require further clarification or revision. This process is essential to ensure that the developed learning materials meet quality standards and can effectively support the learning process. By achieving a high percentage of agreement, the validity and usability of the e-module and learning devices can be further strengthened.

In this study, six validators were involved in the evaluation process, and their assessments were analyzed by forming 15 validator pairs, each requiring a percentage of agreement calculation. The reliability of the instrument is confirmed if the percentage of agreement reaches or exceeds 75%, indicating a high level of consistency among evaluators. If the agreement percentage falls below this threshold, further refinements, clarifications, and discussions among validators are necessary to improve consistency. This process helps

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

minimize subjectivity and ensures that the developed e-module and learning devices meet the expected quality standards. The results of the validator agreement analysis are presented in Figure 1 for content feasibility, Figure 2 for presentation feasibility, and Figure 3 for language feasibility, providing a clear overview of the reliability assessment outcomes.

Additionally, the reliability analysis using the Percentage of Agreement (PA) method not only validates the consistency of expert evaluations but also plays a crucial role in refining the learning tools to ensure their effectiveness in educational settings. By identifying areas where discrepancies occur, this process allows for targeted improvements in content feasibility, presentation, and language aspects. These targeted revisions ultimately enhance the clarity, coherence, and usability of the e-module and learning devices, making them more accessible and effective for both educators and students. A high level of agreement among validators strengthens the credibility of the developed materials, ensuring that they meet established quality standards and can be effectively utilized to support student learning. Furthermore, this process minimizes subjectivity in evaluation, promoting a more objective and standardized assessment of the instructional materials. Such reliability testing is essential before the materials are implemented in real learning environments, as it provides a strong foundation for ensuring that the tools function as intended to foster meaningful and measurable educational outcomes.

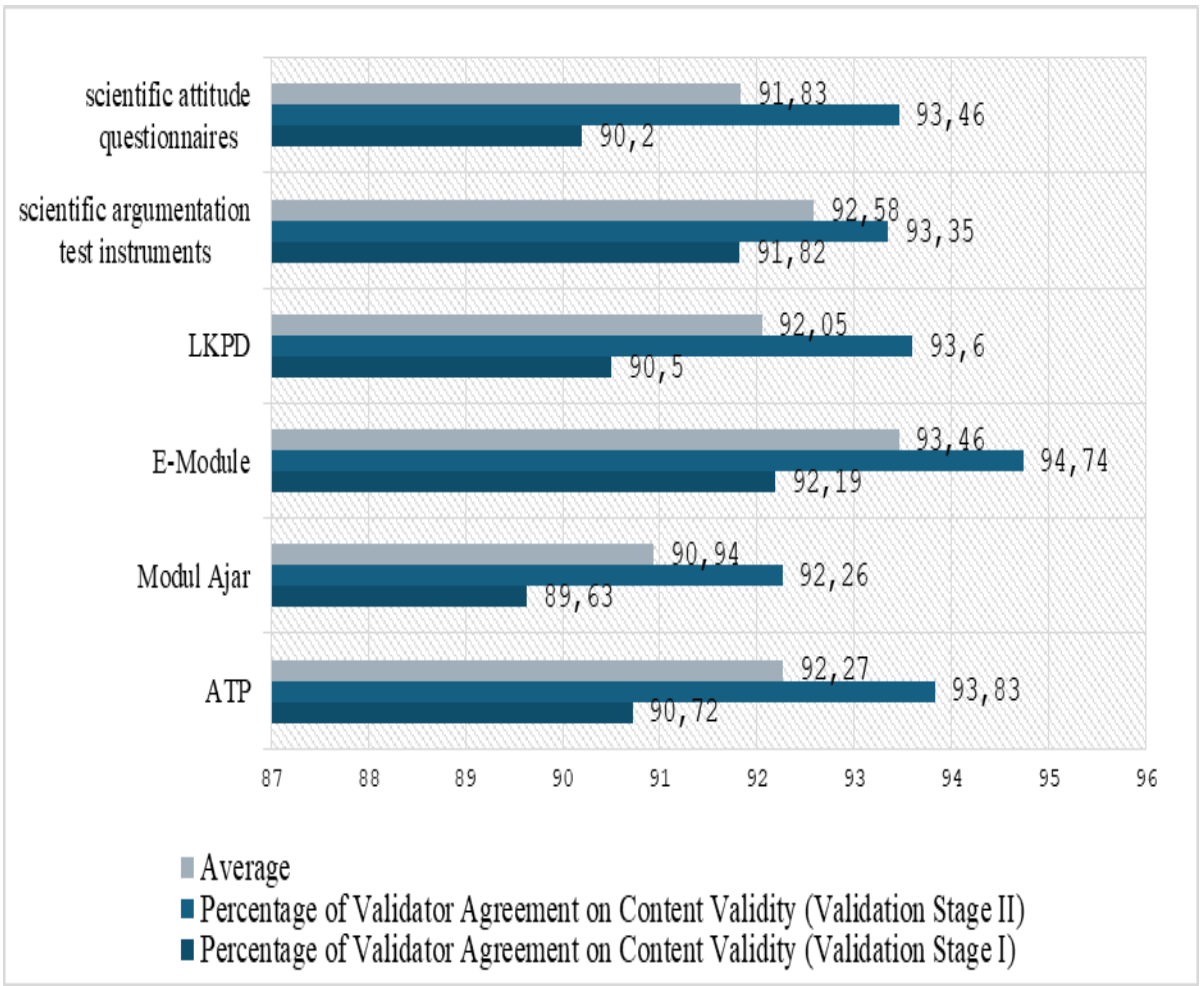

Figure 1. Percentage of Validator Agreement on Content Appropriateness Aspects (Reliable conclusion because the percentage > 75%)

PUSTAKA DIDAKTIS
JURNAL MEDIA DAN MODEL PEMBELAJARAN
Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

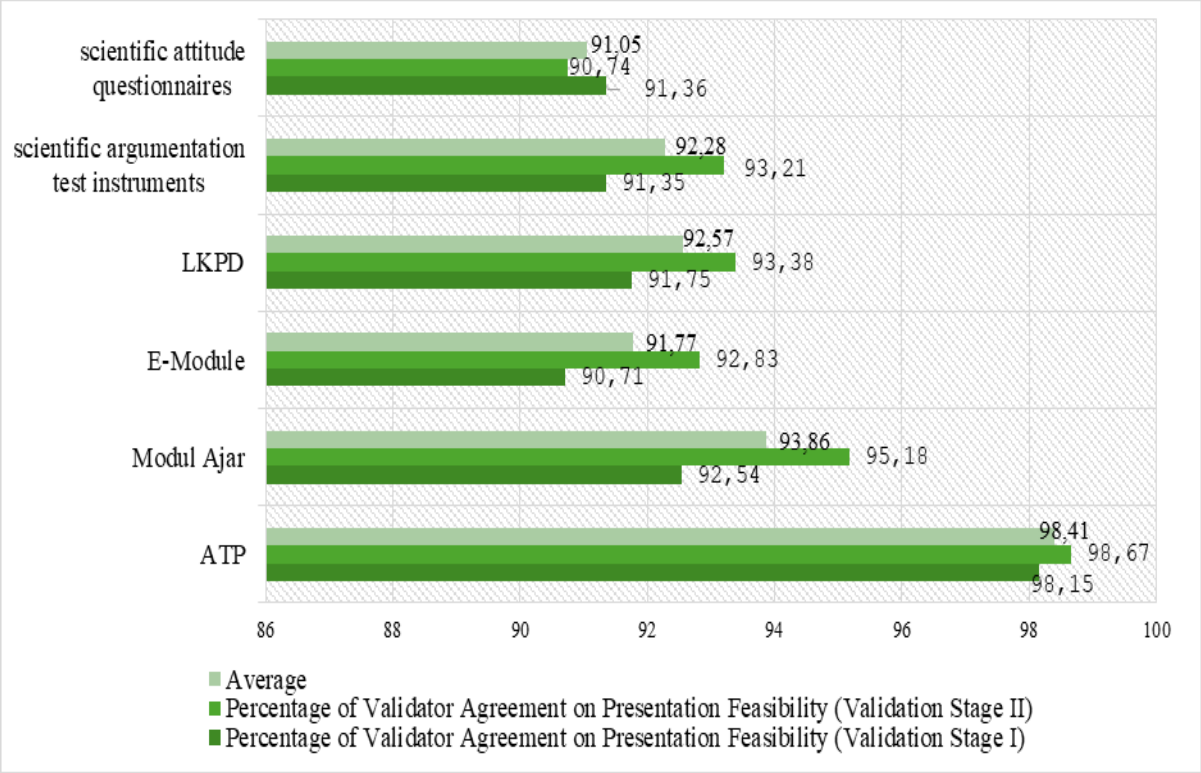

Figure 2. Percentage of Agreement on Presentation Feasibility Aspects (Reliable conclusion because the percentage > 75%)

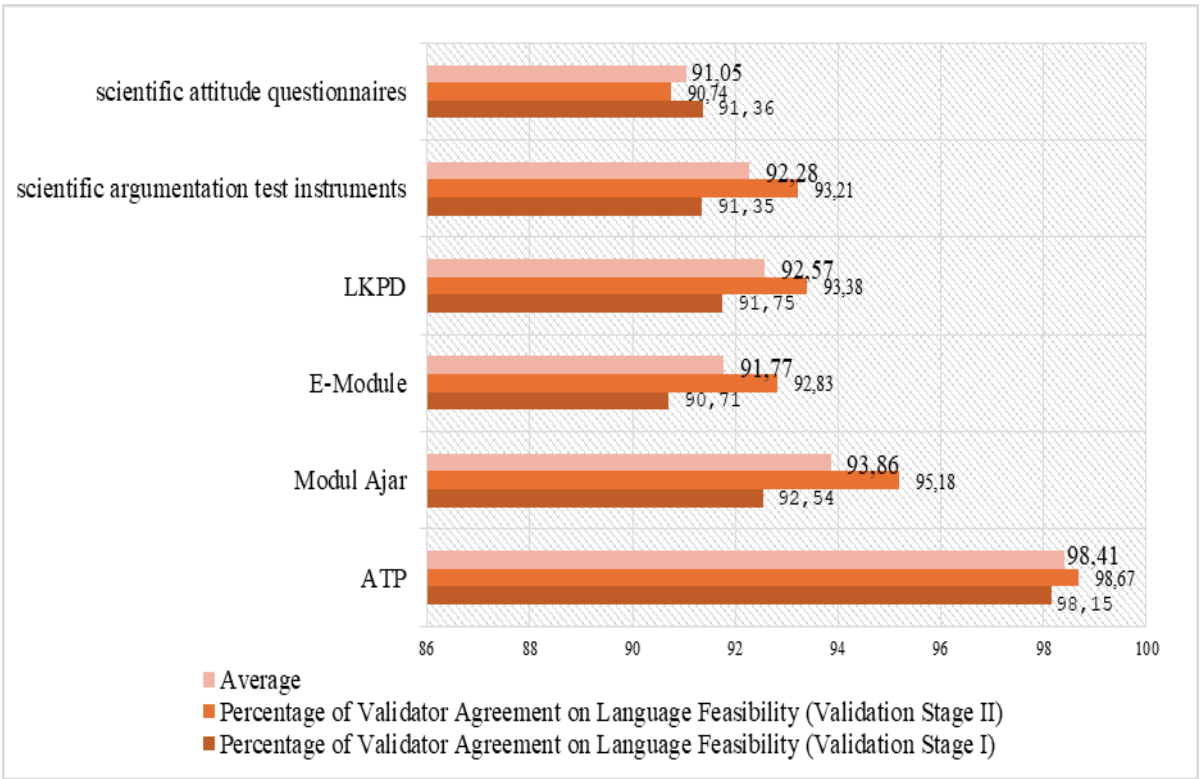

Figure 3. Percentage of Agreement on the Appropriateness of Language Aspects (Conclusion Reliable because the percentage > 75%)

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Based on the results of the reliability test using the Percentage of Agreement method, it can be concluded that the learning tools, which include ATP, Teaching Modules, E-Modules, LKPD, Scientific Argumentation Test Instruments, and Scientific Attitude Questionnaire Instruments, are declared reliable because the percentage> 75%.

Discussion

Content Validity Results

Content validity measures the extent to which an instrument accurately encompasses all aspects of the concept intended to be measured (Nengsih et al., 2019). The content validity assessed in this study includes the alignment of the e-module and the developed learning tools with the syntax of the CRTT model using the SSI approach and their conformity with indicators of scientific argumentation and scientific attitudes.

The results of the content validation for all components of the learning tools were rated as highly valid, with a validation index greater than 0.8. The content validation of the learning tools evaluated several essential aspects, particularly the clear integration of the CRTT model with the SSI approach in the learning activities and the measurement of the variables of argumentation and scientific attitudes. The assessment aspects of the ATP and Teaching Module include the correlation between Learning Objectives (LO) and Learning Outcomes (LO), the appropriateness of the model methods, materials, media, descriptions of learning activities, assessments, and time allocation. The average content validation result for the ATP was 0.907, categorized as highly valid. The average content validation result for the Teaching Module was 0.872, also categorized as highly valid.

The assessment aspects of the content validation for the e-module and LKPD evaluate the relevance of the CRTT-based e-module with the SSI approach, the relevance of the e-module in enhancing scientific argumentation skills and scientific attitudes, the accuracy and appropriateness of the e-module concerning biological sciences, the suitability of the presentation with the demands of student-centered learning, and the currency of the e-module. The average content validation result for the e-module was 0.894, categorized as highly valid. The average validation result for the LKPD was 0.878, also categorized as highly valid.

The assessment aspects of the content validation for the scientific argumentation test instruments and the scientific attitude questionnaire evaluate their relevance to the learning objectives, indicators of scientific argumentation skills, and indicators of scientific attitudes, the relevance of the instruments to the CRTT aspects with the SSI approach, the proportion of difficulty levels, and the accuracy of the presented assessment rubrics. The average validation result for the scientific argumentation test instrument was 0.891, categorized as highly valid. The average validation result for the scientific attitude questionnaire was 0.904, categorized as highly valid. These validation results indicate that the scientific attitude questionnaire is suitable for measuring scientific attitudes.

Overall, the content validation results demonstrate that the learning tools have met the standards of content validity, as they possess validation criteria greater than 0.4. In accordance with Purnami & Suarni (2021), a content validation index can be considered valid if the validation results are at least within the range of 0.4–0.8. Dzikro & Dwiningsih (2021) state that a learning tool can be deemed valid if it has a minimum percentage of 41-61%, or on a scale of 0.41-0.61, categorized as sufficiently valid and usable. Furthermore, an important aspect to focus on is the clear integration of the CRTT model with the SSI approach in the developed learning tools.

The significance of integrating cultural and socioscientific issues through the CRTT model with the SSI approach in education lies in its ability to create contextual learning, as students are already familiar with the cultural and socioscientific issues present in their daily lives (Dwipayana et al., 2020; Rahmawati et al., 2020b). This is consistent with the validation results indicating that the e-module and

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

learning tools were rated as highly valid from the content feasibility aspect by the validators, leading to the conclusion that the developed learning tools align with the steps of the CRTT learning model combined with the SSI approach and can facilitate the development of students' argumentation and scientific attitudes.

Construct Validity Results

Construct validity reflects constructing a structure, framework, language, and graphical representation (Nengsih et al., 2019). The structure and framework of the developed instruments must be logically and systematically organized, ensuring that each part is interconnected in supporting the measurement of the intended concept. Using clear, precise language appropriate for the student's developmental stage is crucial to avoid ambiguity and misunderstanding in interpreting items. Additionally, graphical aspects such as images, diagrams, and layout must support concept comprehension and not distract from the primary measurement objectives (Flake et al., 2017).

The results of the construct validation for the e-module and learning tools regarding the overall presentation feasibility were rated as highly valid. The construct validation of the presentation feasibility assesses several necessary aspects. The assessment aspects of the ATP and Teaching Module include the systematic arrangement, components of the Teaching Module containing general information related to the module's identity, initial competencies, Pancasila student profiles, facilities, and infrastructure, the learning model used, learning outcomes (LO), learning objectives (LO), meaningful understanding, triggering questions, and learning activities. The average validation result for the presentation aspect of the ATP was 0.989, categorized as highly valid. The average validation result for the Teaching Module was 0.916, which was also categorized as highly valid.

The assessment aspects of the construct validation for the presentation feasibility of the e-module and LKPD evaluate the relevance and consistency of the arrangement, the systematic presentation containing the e-module's identity, table of contents, list of images, list of videos, e-module description, usage instructions, and introduction, the appearance of the e-module including the cover and content sections, the composition and proportional size of the e-module, the appropriateness of the font type and size used, and ease of operation. The average validation result for the e-module was 0.891, categorized as highly valid. The average validation result for the LKPD was 0.902, which was also categorized as highly valid.

The assessment aspects of the construct validation for the presentation feasibility of the scientific argumentation test instruments and the scientific attitude questionnaire evaluate the systematic arrangement of the argumentation skills test instruments and the scientific attitude questionnaire, as well as the clarity of the instructions. The average validation result for the scientific argumentation test instrument was 0.895, categorized as highly valid. The average validation result for the scientific attitude questionnaire was 0.885, categorized as highly valid. Overall, the results of the construct validation for the presentation feasibility indicate that the CRTT-based learning tools with the SSI approach have met the standards of construct validity for presentation feasibility, as they possess validation scores greater than 0.4 (Purnami & Suarni, 2021).

The results of the construct validation for the e-module and learning tools regarding the language feasibility of each component have been rated as highly valid by the validators. The validation results indicate that the ATP received an index of 0.813, the Teaching Module received an index of 0.827, the E-Module received an index of 0.896, the LKPD received an index of 0.849, the argumentation test instrument was rated at 0.841, and the scientific attitude questionnaire received an index of 0.834. Overall, the results of the language feasibility validation by the validators are categorized as highly valid due to validation indices greater than 0.8. The assessment aspects of construct validation regarding language feasibility encompass readability, communicativeness, appropriate sentence

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

structure, ease of student understanding, and avoidance of ambiguous interpretations. The readability aspect refers to the ease of reading and understanding instructions or questions within the learning tools (Ernica & Hardeli, 2019). The communicativeness aspect assesses how much the language can convey the instructional goals or questions to the students (Haspen et al., 2021). Using precise and clear sentence structures that are easy to understand is necessary to reduce ambiguity and ensure correct interpretation by students. Questions that may lead to ambiguous interpretations should be particularly considered, especially in the components of the test instruments (Afrita & Darussyamsu, 2021).

Reliability Test Results (Percentage of Agreement)

The reliability test using the Percentage of Agreement method aims to assess the extent to which different raters or validators provide similar evaluations of the same object. One of the primary objectives is to evaluate the consistency of the assessments given by different raters regarding the same components or indicators (Januarti et al., 2023). An agreement level greater than 75% indicates that the assessment instruments demonstrate consistent results thus can be deemed reliable. Reliability analysis using the Percentage of Agreement can help enhance the validity of research results, as the obtained results can be trusted (Astuti et al., 2021).

In this study, six validators were utilized, and the analysis was conducted by combining the evaluations of all six validators, resulting in 15 validator pairs whose agreement percentages needed to be calculated. The combinations of validator pairs included (V1,2), (V1,3), (V1,4), (V1,5), (V1,6), (V2,3), (V2,4), (V2,5), (V2,6), (V3,4), (V3,5), (V3,6), (V4,5), (V4,6), and (V5,6). Subsequently, the PA calculation was performed for these 15 validator pairs. The results are deemed reliable if the percentage of agreement is greater than or equal to 75%. If it is less than 75%, the instruments must be re-evaluated for clarity and agreement from the validators (Januarti et al., 2023).

Based on the results of the reliability test conducted using the Percentage of Agreement method, it was found that each validated item had an average percentage greater than 75%. This result indicates that the validators exhibited consistency in their assessments of the components of the e-module and learning tools, which include aspects of content feasibility (Figure 4.12), presentation feasibility (Figure 4.13), and language feasibility (Figure 4.14), as the reliability test results using the Percentage of Agreement method showed a percentage level greater than 75%. Therefore, it can be concluded that the developed tools are reliable, as the percentage of validator agreement exceeds 75%.

Suppose the percentage of agreement is less than 75%. In that case, the developed instruments need to be evaluated and adjusted to improve clarity and minimize interpretative differences among raters, ultimately enhancing the quality and effectiveness of the instruments in the assessment process (Makhrus, 2018). Thus, conducting reliability tests using this method is crucial to ensure data trustworthiness and support more accurate decision-making in determining the reliability of the developed e-modules and tools (Astuti et al., 2021).

CONCLUSION

Based on the validity test results regarding content validity and construct validity, the overall learning tools based on the Culturally Responsive Transformative Teaching model with the Socioscientific Issues approach are categorized as highly valid, as the validity index exceeds 0.8. The reliability test results using the Percentage of Agreement method indicate that the percentage of agreement among the evaluators is deemed reliable, as the percentage of agreement exceeds 75% for all components of the learning tools, including ATP, Teaching Module, E-Module, LKPD, Argumentation Test Instruments, and Scientific Attitude Questionnaire.

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

RECOMMENDATIONS

In this study, the cultural aspects addressed are still limited to the traditions and customs in the Narmada community; it is essential to incorporate traditions and customs from other communities.

ACKNOWLEDGMENTS

The researchers express their gratitude to all parties involved, particularly the expert validators and practitioner validators who are Biology teachers at SMAN 1 Narmada, for their assistance in evaluating the validity of the learning tools based on the Culturally Responsive Transformative Teaching model with the Socioscientific Issues approach.

REFERENCES

Aceves, T. C., & Orosco, M. J. (2014). Culturally responsive teaching: innovative configuration-2. University of Florida, Collaboration for Effective Educator, Development, Accountability, and Reform Center. https://ceedar.education.ufl.edu/wp-content/uploads/2014/08

Adawiyah, R., Andayani, Y., & Savalas, L. R. T. (2022). Pengembangan modul kimia etnosains terintegrasimodel culturally responsive transformative teaching (CRTT). *Journal of Classroom Action Research*, 4(4), 123–128. https://doi.org/10.29303/jcar.v4i4.2395

Afrita, M., & Darussyamsu, R. (2020). Validitas Instrumen Tes Berpikir Tingkat Tinggi (HOTS) pada Materi Sistem Respirasi di Kelas XI SMA. *Jurnal Mangifera Edu*, *4*(2), 129-142. https://doi.org/10.31943/mangiferaedu.v4i2.83

Aiken, L.R. (1997). Psychological testing and assessment 9 th edition. USA: Allyn and Bacon.

Andayani, Y., Hakim, A., Doyan, A., & Handayani, A.A. (2022). Medaq api traditional ethnoscience study: Identification of chemical concept from indigenous knowledge of the Lombok people. *The 9th International Conference of The Indonesian Chemical Society Icics 2021: Toward a Meaningful Society*.

Andryani, F., Djafar, H., & Qaddafi, M. (2016). Penerapan pendekatan SSI (Socio-Scientifict Issues) dengan menggunakan media power point terhadap kemampuan berpikir kritis pada mahapeserta didik baru angkatan 2015 jurusan pendidikan fisika fakultas tarbiyah dan keguruan Universitas Islam Negeri Alauddin Makassar. *Jurnal Pendidikan Fisika Universitas Islam Negeri Alauddin Makassar*, *4*(2), 64-66. https://dx.doi.org/10.24252/jpf.v4i2.3705

Arifin, A. A., Andayani, Y., & Sedijani, P. (2024a). Rekonstruksi etnosains tradisi Pedak Api masyarakat Narmada dalam pembelajaran biologi. *Journal of Classroom Action Research*, *6*(1), 241-250. https://doi.org/10.29303/jcar.v6i2.6366

Arifin, A. A., Ramdani, A., & Andayani, Y. (2024b). Development of Learning Tools Based on the Culturally Responsive Transformative Teaching Model with a Socioscientific Issues Approach: Evaluation of Validity and Practicality. Jurnal Penelitian Pendidikan IPA, 10(11), 9141-9155.

Arifin, A. A., Ramdani, A., Andayani, Y., & Hariadi, I. (2024c). Pengembangan E-Modul Ekosistem Berbasis Model Culturally Responsive Transformative Teaching dengan Pendekatan Socio Scientific Issues Berbantuan Software 3D Pageflip Frofessional. Journal of Classroom Action Research, 6(3), 673-685.

Arifin, A. A. (2024d). Development of Mini Virtual Aquatic Ecosystem Learning Media Assisted by Professional 3D Pageflip Software. International Journal of Science Education and Science, 1(2), 45-51.

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Arifin, A. A., Armiani, S., Fitriani, H., & Efendi, M. H. (2022). Validitas Modul Biologi Terapan Berbasis Riset Pada Konsep Pemanfaatan Antosianin Kulit Terong Ungu Sebagai Biosensor. *Reflection Journal*, *2*(2), 82-96.

Asmah, D. W. (2022). Pengembangan handout berbasis Socio-Scientific Issues (SSI) pada materi virus untuk siswa kelas X IPA di MA Ma'rif. *Doctoral Dissertation*. Universitas Islam Negeri Kiai Haji Achmad Siddiq Jember.

Astuti, Y., Sutrio, S., & Verawati, N. N. S. P. (2021). Pengembangan Perangkat Pembelajaran Cooperative Tipe Group Investigation Untuk Meningkatkan Motivasi Berprestasi Dan Kemampuan Berpikir Kritis Fisika Peserta Didik. *ORBITA: Jurnal Kajian, Inovasi Dan Aplikasi Pendidikan Fisika*, *7*(1), 65-71.

Bergantz, L., & Gale, M. (2020, April). Culturally responsive teaching toolbox. In *Society for Information Technology & Teacher Education International Conference* (pp. 686-689). Association for the Advancement of Computing in Education (AACE).

Borich, G. (1994). Observation skill for effective teaching. New. York: Mac Millan Publishing Company.

Cebesoy, Ü. B. (2021). Pre-service science teachers informal reasoning patterns and risk perceptions in SSI: case of gene therapy. *European Journal of Science and Mathematics Education*, 9(4), 211-229.

Dwipayana, P. A. P., Redhana, I. W., & Juniartina, P. P. (2020). Analisis kebutuhan pengembangan multimedia interaktif berbasis konteks budaya lokal untuk pembelajaran IPA SMP. *Jurnal Pendidikan dan Pembelajaran Sains Indonesia (JPPSI)*, *3*(1), 49-60. https://doi.org/10.23887/jppsi.v3i1.24628

Dzikro, A. Z. T., & Dwiningsih, K. (2021). Kelayakan media pembelajaran berbasis laboratorium virtual pada sub materi kimia unsur periode ketiga. *Chemistry Education Practice*, *4*(2), 160-170. https://doi.org/10.29303/cep.v4i2.2389 https://journal.uny.ac.id/index.php/jk/article/viewFile/8421/pdf

Ernica, S. Y., & Hardeli, H. (2019). Validitas dan praktikalitas e-modul sistem koloid berbasis pendekatan saintifik. *Ranah Research: Journal of Multidisciplinary Research and Development*, *1*(4), 812-820.

Eş, H., & Öztürk, N. (2021). An activity for transferring the multidimensional structure of SSI to middle school science courses: i discover myself in the decision-making process with see-step!. *Research in Science Education*, 51(3), 889-910. https://doi.org/10.1007/s11165-019-09865-1

Gay, G. (2000). Culturally responsive teaching: theory, research, and practice (2nd ed.). New York, NY: Teachers College.

Haspen, C. D. T., Syafriani, S., & Ramli, R. (2021). Validitas e-modul fisika SMA berbasis inkuiri terbimbing terintegrasi etnosains untuk meningkatkan kemampuan berpikir kreatif peserta didik. *Jurnal Eksakta Pendidikan (Jep)*, *5*(1), 95-101.

Herman, B. C. (2015). The influence of global warming science views and sociocultural factors on willingness to mitigate global warming. science education, 99(1), 1-38. https://doi.org/10.1002/sce.21136

Herman, B., Zeidler, D., & Newton, M. (2020). Students' emotive reasoning through place-based environmental Socioscientific Issues. *Research in Science Education*, 50(1), 2081-2109. https://doi.org/10.1007/s11165-018- 9764-1

Iqbal, F. M., & Ruhaeni, N. (2022). Pengaturan emisi gas rumah kaca berdasarkan protokol kyoto dan implementasinya di Indonesia. *Dinamika Global: Jurnal Ilmu Hubungan Internasional*, 7(02), 225-246.

Irrubai, M. L. (2019). Implementasi nilai-nilai kearifan lokal *Awik-Awik* desa Sesaot dalam pembelajaran Ilmu Pengetahuan Sosial. *Sosio Didaktika*, *6*(2), 96-109.https://journal.uinjkt.ac.id/index.php/SOSIO-FITK/article/view/14414/0

Januarti, L., Verawati, N. N. S. P., & Gunawan, G. (2023). Validitas perangkat pembelajaran berbasis model kooperatif tipe group investigation untuk meningkatkan hasil belajar fisika peserta didik. *Empiricism Journal*, *4*(1), 1-7. https://doi.org/10.36312/ej.v4i1.1107

Karahan, E., & Roehrig, G. (2017). Case study of science and social studies teachers co-teaching socioscientific issues-based instruction. *Eurasian Journal of Educational Research*, 72(1), 63-82. https://doi.org/10.16986/huje.2018044772

Karsiwan, K., Wardani, W., Lisdiana, A., Purwasih, A., Hamer, W., & Sari, L. R. (2023). Sosialisasi Materi Kearifan Lokal Dalam Kurikulum Merdeka Pada Mata Pelajaran IPS Bagi Guru di Kota Metro Lampung. MALAQBIQ, 2(1), 12-22. https://doi.org/10.46870/jam.v2i1.513

Mahmud. (2011). Metode penelitian pendidikan. Bandung: Pustaka Setia.

Makhrus, M. (2018). Validitas model pembelajaran conceptual change model with cognitive conflict approach. *Jurnal Ilmiah Profesi Pendidikan*, *3*(1), 62-66. https://doi.org/10.29303/jipp.v3i1.54

Marisa, U., Yulianti, Y., & Hakim, A. R. (2020). Pengembangan e-modul berbasis karakter peduli lingkungan di masa pandemi COVID-19. In *Prosiding Seminar Nasional PGSD UNIKAMA*, 4(1), pp. 323-330.

McIntyre, E., & Hulan, N. (2013). based, culturally responsive reading practice in elementary classrooms: A yearlong study. *Literacy Research and Instruction*, *52*(1), 28-51. https://doi.org/10.1080/19388071.2012.737409

Munawaroh, A., & Al-Mustafid, F. Z. (2023). Pengembangan Buletin Berbasis Sosio-Scientific Issue sebagai Inovasi Media Pembelajaran Materi Pencemaran Udara. *Jurnal Tadris IPA Indonesia*, *3*(2), 200-209. https://doi.org/10.21154/jtii.v3i2.1593

Mukhibin, A., & Nafidhoh, B. (2023). Hambatan guru matematika dalam mengimplementasikan kurikulum Merdeka: Systematic literature review. Jurnal Ilmiah Pendidikan Matematika Al Qalasadi, 7(2), 127-137. https://doi.org/10.32505/qalasadi.v7i2.7152

Özden, M. (2015). Prospective elementary school teachers' views about socioscientific issues: a concurrent parallel design study. *International Electronic Journal of Elementary Education*, 7(3), 333-354. https://files.eric.ed.gov/fulltext/EJ1068052.pdf

Rosidah, C. T., Pramulia, P., & Susiloningsih, W. (2021). Analisis kesiapan guru mengimplementasikan asesmen autentik dalam kurikulum merdeka belajar. Jurnal Pendidikan Dasar, 12(01), 87-103. https://doi.org/10.53624/ptk.v3i1.104

Pangemanan, C., Lobja, X. E., & Nugroho, C. (2022). Identifkasi kerusakan lahan hutan akibat aktivitas pertambangan emas Desa Bowone Kecamatan Tabukan Selatan Tengah. *Geographia: Jurnal Pendidikan dan Penelitian Geografi*, *3*(1), 10-17. https://doi.org/10.53682/gjppg.v3i1.1403

Priyanka, L. M., & Selamat, I. N. (2021). Socio-Scientific Issue Based Instruction Pada Mata Kuliah Ilmu Lingkungan. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, *11*(1), 29-36. https://doi.org/10.23887/jppii.v11i1.60846

Vol.1, No.1 (August – 2025)
E-ISSN: 3110-1429
pp.20-37

Purnami, K. D., & Suarni, N. K. (2021). Media pembelajaran audio visual berbasis konservasi lingkungan pada topik siklus air kelas V SD. *Mimbar Ilmu*, *26*(3), 390-399. https://doi.org/10.23887/mi.v26i3.37829

Rahmawati, Y., & Ridwan, A. (2017). Empowering students' chemistry learning: the integration of ethnochemistry in culturally responsive teaching. *Journal of Chemistry*, 26(6), 813-830. https://www.ceeol.com/search/article-detail?id=600081

Rahmawati, Y., Ridwan, A., Faustine, S., & Mawarni, P. C. (2020b). Pengembangan soft skills siswa melalui penerapan Culturally Responsive Transformative Teaching (CRTT) dalam pembelajaran kimia. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 86-96. https://doi.org/10.29303/jppipa.v6i1.317

Rahmawati, Y., Ridwan, A., Rahman, A., & Kurniadewi, F. (2019). Chemistry students' identity empowerment through etnochemistry in culturally responsive transformative teaching (CRTT). In *Journal of Physics: Conference Series,* 1156 (1), p. 012032). IOP Publishing. https://doi.org/10.1088/1742-6596/1156/1/012032

Rahmawati1, Y., Ridwan, A., Cahyana, U., & Febriana, D. (2020a). The integration of Culturally Responsive Transformative Teaching to enhance student cultural identity in the Chemistry Classroom. *Universal Journal of Educational Research* 8(2): 468-476. https://doi.org/10.13189/ujer.2020.080218

Risfany, R., Difinubun, M. I., Andriyan, Y., & Difinubun, Y. (2022). Pengelolaan hutan mangrove berbasis simpanan karbon pada jenis bruguiera ghymnorriza di desa Waefusi Kecamatan Namrole Kabupaten Buru Selatan. *Jurnal Aquafish Saintek*, *2*(2), 18-30.

Rindayati, E., Putri, C. A. D., & Damariswara, R. (2022). Kesulitan calon pendidik dalam mengembangkan perangkat pembelajaran pada kurikulum merdeka. PTK: Jurnal Tindakan Kelas, 3(1), 18-27. https://doi.org/10.53624/ptk.v3i1.104

Sadler, T. D., Romine, W. L., & Topçu, M. S. (2016). Learning science content through socioscientific issues-based instruction: a multi-level assessment study. *International Journal of Science Education*, 38(10), 1622-1635. https://doi.org/10.1080/09500693.2016.1204481

Sağlam, H., & Eroglu, B. (2022). A mixed-method study on pre-service teachers' informal reasoning regarding nuclear energy use. *Journal of Turkish Science Education*, 19(2), 594-607. http://doi.org/10.36681/tused.2022.139

Subiantoro, A. W., & Ariyanti, N. A. (2013). Pembelajaran materi ekosistem dengan Socio-Scientific Issues dan pengaruhnya terhadap reflective judgment siswa. *Jurnal Pendidikan IPA Indonesia*, *2*(1), 41-47. https://doi.org/10.15294/jpii.v2i1.2508

Thiagarajan, S. (1974). Instructional development for training teachers of exceptional children. Washinton DC: National Center for Improvement Educational System.

Utari, A. R., Roza, Y., & Maimunah, M. (2023). Pemahaman Guru Matematika terhadap Asesmen Nasional pada Kurikulum Merdeka Belajar. JIPM (Jurnal Ilmiah Pendidikan Matematika), 11(2), 433-441. http://doi.org/10.25273/jipm.v11i2.12876

Vhalery, R., Setyastanto, A. M., & Leksono, A. W. (2022). Kurikulum Merdeka Belajar Kampus Merdeka: Sebuah Kajian Literatur. Research and Development Journal of Education, 8(1), 185-201.

Walker, A. (2023). Transformative potential of culturally responsive teaching: Examining preservice teachers' collaboration practices centering refugee youth. *Education Sciences*, *13*(6), 621.

Zuhriah, N. A., & Warto, T. S. P. (2019). Eksistensi sufisme dalam tradisi Pedaq Api di Lombok. *Jurnal Humanika*, 26(2), 119-128.