VALIDITY AND PRACTICALITY OF E-MODULES ON CHEMICAL KINETICS BASED ON LOCAL WISDOM

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Abstract

The low level of conceptual understanding and collaboration skills of students in Chemistry Kinetics at Lingga State Senior High School 1 class XI-1 is an important issue that requires innovation in contextual teaching materials. This study aims to determine the validity and practicality of the Chemistry Kinetics E-Module integrated with the local wisdom of Daik Lingga's Malay specialty food, Kepurun. Kepurun is a typical Malay food that connects abstract chemistry learning with real life through chemical kinetics material. The research method used was Research and Development with the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The interactive e-module was developed using the Canva application. The validity test of the e-module based on local wisdom was divided into media expert validity and material expert validity. The media expert validity test was conducted by a lecturer and ICT teacher at SMAN 1 Lingga. The material validity test was conducted by a chemistry lecturer and chemistry teacher at SMAN 1 Singkep Barat. The results of the media expert and material expert validity tests showed an average percentage of 93.4% with a category of highly valid. The practicality test was conducted by a chemistry teacher at SMAN 1 Lingga and students in class XI-1, achieving an average percentage of 93% in the very practical category. These two results prove that the Local Wisdom-based chemical kinetics e-module meets the standards of theoretical feasibility and ease of field implementation.

Keywords: E-Module, Chemical Kinetics, Kepurun, ADDIE, Validity, Practicality

A. Introduction

Chemical kinetics material in senior high schools is often presented in an abstract manner, resulting in low conceptual understanding among students. This is a significant problem at Lingga 1 State Senior High School, where learning outcomes are below the minimum passing grade. An innovative solution is needed through the development of interactive and relevant teaching materials. Therefore, the development of e-modules on chemical kinetics based on *local wisdom* is expected to improve students' learning outcomes and their scientific process skills, particularly in the material on reduction and oxidation reactions (Siregar et al., 2022) . This approach not only aims to increase learning motivation through contextual content but also to overcome learning difficulties in material considered complex, such as those found in students with special needs diagnosed with slow learning (Sanjoyo et al., 2023).

The use of such e-modules can also optimise chemistry learning by utilising materials that are easily found in the surrounding environment for practical activities, overcoming time constraints and laboratory facilities in schools, especially during the pandemic (Komisia et al., 2022) . This *research and development* (R&D) offers innovation by developing interactive e-modules on chemical kinetics. The essential innovation lies in the integration of *the local wisdom* of the Daik Lingga Malay community, namely the process of making traditional Kepurun food from sago (Gemilang et al., 2019).

This contextual integration serves to bridge the abstract concept of reaction rate with real phenomena. Methodologically, this e-module was designed using the Canva application (Rahmah, 2024) , which is fully integrated into the ADDIE development model (Bahauddin, 2019). The ADDIE model, which consists of the stages of Analysis, Design, Development, Implementation, and Evaluation, was chosen because of its systematic structure and its ability to ensure the quality and effectiveness of the teaching materials developed (Jufrida et al., 2022). The development of this interactive e-module is expected to be a solution in improving students' understanding of chemical kinetics concepts, which are often considered difficult, along with the use of digital technology in learning (Rifki Nomizar et al., 2023) & (Adawiyah & S, 2021). Previous studies have also adopted the ADDIE model for the development of modules based on local wisdom, demonstrating its success in producing valid, practical, and effective teaching materials (Widayanti et al., 2022) &(Iriani et al., 2020) . Furthermore, the ADDIE development model has also proven effective in developing e-modules based on scientific approaches and creative thinking skills, as well as descriptive text e-modules with local wisdom content in differentiated learning (Larasati & Rukmana, 2024).

This study aims to produce a chemistry kinetics e-module based on *local wisdom* that has been tested for its validity (theoretical feasibility) and practicality (ease of implementation) in contextual science learning in chemistry kinetics for Grade XI students. This is in line with the need to develop teaching materials that integrate local wisdom to increase student motivation and understanding of learning materials (Pane et al., 2022) . This need has prompted similar research to develop teaching modules based on local wisdom, such as studies that integrate Baduy local wisdom into science modules to instil conservation values, as well as the development of biology e-modules based on North Maluku local wisdom to meet students' needs for interactive teaching materials (Ayushandra & Wuryastuti, 2022; Hake, 1998) & (Haerullah et al., 2023).

B. Method

The research model used is *research* and *development*. The model used is the ADDIE model (*Analysis, Design, Development, Implementation, and Evaluation*) (Bahauddin, 2019) . The initial stage conducted by the researcher was interviews, observations, and curriculum

analysis to identify the needs of students. This analysis stage consisted of needs analysis, curriculum analysis, learner characteristic analysis, and technology and media analysis. In the *design* stage, the researcher began designing and determining e-modules (pre-modules) with a local wisdom theme. The format for compiling e-modules on chemical kinetics based on local wisdom for chemistry learning applied the module compilation format by (Kemdikbud, 2017) . In the development stage, the resulting product in the form of an e-module was validated by competent experts, namely media and material validators. The product design in the form of a pre-module was validated and revised into a valid and practical module. The assessment aspects by media experts and material experts were adjusted to the development requirements. The purpose of expert validation was to validate the material so that it was valid and ready for use in learning. The results of expert validation are used to assess the quality of the product in terms of validity and practicality. At the implementation stage, activities are carried out to prepare the classroom, teachers, and students. This study focuses on the stages of analysis, design, development, and limited testing for practicality. The subjects and procedures for developing subjects in the feasibility and practicality tests include:

a. Expert validators: two subject matter experts (lecturers from the Faculty of Teacher Training and Education, Chemistry Department, UMRAH and chemistry teachers at SMAN 1 Singkep Barat) and two media experts (lecturers from the Faculty of Teacher Training and Education, Language Department, UMRAH and ICT teachers at SMAN 1 Lingga).
b. Feasibility testing: one chemistry teacher at SMAN 1 Lingga and 10 grade XI students at SMA Negeri 1 Lingga.

The development procedure was carried out systematically: needs and curriculum analysis; *storyboard* and instrument design; e-module development using Canva; and limited implementation for practicality testing. The research instruments used in this study included media and expert validation sheets and practicality sheets. The validation sheet was used to provide suggestions, comments, and input regarding the validity of the developed instrument. The validity of interactive learning media was validated by two media experts and two subject matter experts. The results of the validation by both media and subject matter experts were used to analyse and improve the developed product. The media expert assessment grid consisted of 3 aspects and 15 indicator statements.

Validation is carried out by media experts to determine the suitability of the media. Media experts focus on evaluating the visual design, readability of the modules, flow of material presentation, and accuracy of illustration placement. The product assessment sheet by media experts is compiled in the form of a scale, with a rating range of 1-5. Scoring according to*et al*., 2015) , the scoring rules are outlined in the following table.

Table 1. Scoring

No.	Assessment aspect	Assessment Score
1	Strongly disagree	1
2	Somewhat disagree	2
3	Neutral	3
4	agree	4
5	Strongly agree	5

Source: (Nadler et al, 2015)

To determine the practicality category of the module, the data obtained from this assessment will be analysed quantitatively.

Table 2. Likert Scale for Practicality Assessment Criteria

No.	Assessment criteria	Assessment score
1	Strongly agree	4
2	Agree	3
3	Disagree	2
4	Strongly disagree	1

Source: (Sugiyono, 2015)

The data processing and analysis techniques in this study involved quantitative data from validator assessments and user responses, which were analysed using average feasibility percentages. Product criteria were deemed highly valid or highly practical if the average score percentage was above 81.26%. Validity analysis is an analysis technique in which validators validate all aspects presented in the table. Validation data was obtained from lecturers and teachers, while the practicality results of teachers and students were analysed for all aspects using the following formula:

$$Nilai\ validasi = \frac{jumlah\ skor\ yang\ diperolah}{Maximum\ Scorejumlah\ skor\ maksium}\ x\ 100$$

The determination of the validation level is based on the criteria in the following table:

Table 3. Criteria for Determining the Percentage of Validity Level

No.	Percentage	Category
1	81.26%–100%	Highly valid and can be used without revision
2	62.51%–81.25%	Valid or usable but requires minor revision
3	43.76%–62.50%	Not valid; not recommended for use as major revision is required
4	25.00%–43.75%	Highly invalid and should not be used

Source: (Arikunto, 2013)

The results of the practicality test have a rating scale with four categories, with the highest score being category 4 (strongly agree) and category 1 (strongly disagree), as shown in Table as follows:

Table 4. Practicality Assessment Scale

No.	Category	Score
1	Strongly agree (SA)	4
2	Agree (A)	3
3	Disagree (D)	2
4	Strongly disagree (STS)	1

Source: (Sugiyono, 2015)

The practicality results were obtained by analysing the practicality questionnaires completed by students and teachers. The practicality data on media use was analysed using percentages (%), using the following formula:

$$\text{Skor (\%)} = \frac{jumlah\ skor\ yang\ diperoleh}{jumlah\ skor\ maksimum} \times 100\%$$

After the percentages were calculated, they were grouped according to the criteria in the table:

Table 5. Practicality Assessment Criteria

No.	Percentage	Description
1	81.26%–100%	Very practical and can be used without revision
2	62.25%–81.25%	Practical (usable but requires minor revisions)
3	43.76%–62.50%	Not practical (not recommended for use as major revisions are required)
4	25.00%–43.75%	Very impractical (should not be used)

Source: (Arikunto & Jabar, 2018)

The e-module on chemical kinetics based on *local wisdom* developed in this study is considered practical if it has a practicality value of ≥ 62.51%. If the practicality value in the study does not reach < 62.51%, then it will be revised again. If the practicality value has reached ≥ 62.51%, then the e-module is declared practical for use in the learning process.

C. Findings and Discussion

This study produced a product in the form of *a local wisdom-based* chemistry learning e-module for chemistry learning. The first objective of this study was to determine the validity level of the learning e-module integrated with *local wisdom* in chemical kinetics material in chemistry learning. The second objective of this study was to determine the practicality level *of the local wisdom-based* electronic module (e-module) in chemical kinetics material based on the responses of teachers and students. The *local wisdom*-based chemical kinetics e-module developed in this study has a cover appearance as shown in Figure 1.

Figure 1. E-Module Cover Display

The menu list page displays several menus that can be selected by users, consisting of lesson plans, concept maps, materials, evaluations, and an exit button, as shown in Figure 2.

Figure 2. Menu List Page

This learning medium in the form of a chemical kinetics e-module based on local wisdom consists of four learning activities. Each learning activity discusses the material, videos in the form of *YouTube* links, sample questions, practice questions, and self-assessment. The material page list display is shown in Figure 3 below.

Figure 3. Material List Page

Expert assessment of media and materials will be calculated to determine the validity of products in the form of e-modules on chemical kinetics based on *local wisdom*. The e-module assessment instruments were adapted and modified from (Ministry of Education and Culture, 2017) , (Daryanto, 2013) , and (Junaedi, 2021) used to assess the feasibility of expert validators. The results of the questionnaire validation are confidential and based on a Likert scale in the assessment according to the existing assessment criteria. Checklists are

provided in the columns provided, and comments and suggestions for improvement are given at the end of the assessment by the validators on the validation sheet to determine the level of validity of the e-module on chemical kinetics based on *local wisdom*. Prior to the trial implementation by grade XI-1 chemistry students, the validation results will be used to evaluate the e-module so that it is feasible and practical for use in the student trial phase. The results of the media expert and material expert validation calculations are shown in the following table:

Table 6. Media Assessment Results

No.	Aspect	Lecturer Score	Teacher Score	Average	Maximum Score	Category
1	Components/Systematics of E-Module	25	25	25	25	100
2	Audio and Visual	26	28	27	30	90
3	Software Engineering	28	20	19	20	95
	Category average		95			

Based on the assessment by two media experts, the average results for the e-module component/systematics aspect were 100%, the audio and visual aspect was 90%, and the software engineering aspect was 95%. All aspects in the category obtained an average of 95% with the criterion "highly valid". The material assessment was carried out by teachers and lecturers who have the ability and experience in chemistry learning. The assessment carried out by material experts consisted of learning and material aspects. The results of the assessment by material experts, both lecturers and teachers, are shown in Table 7 below.

Table 7. Results of Material Assessment

No.	Aspect	Lecturer	Teacher	Average	Maximum score	Category
1	Learning	28	28	28	30	93.3%
2	material	26	28	27	30	90
	Average category: 91.7%					

Based on the assessment by two subject matter experts, the average score for the learning aspect was 93% and for the material aspect was 95%, with an average of 91.7% for both aspects, which is considered "highly valid". The validity results from two media and material experts obtained an overall average of 93.4%, which is considered highly valid. These results indicate that the e-module has met the standards of theoretical and design feasibility, with minor revisions made at the *Development* stage (ADDIE) based on expert input. The practicality of the e-module learning media was assessed by teachers and students, with the results shown in Table 8 below.

Table 8. Practicality Results of Teachers and Students

No.	Test Aspect	Average Percentage Score	Category
1	Teacher practicality	92	Very practical
2	Practicality of students	94	Very practical
3	Average	93	Very practical

An average score of 93% places the e-module in the very practical category, indicating that the product is easy to implement, understand, and use for self-instructional learning. Based on the validity assessment by two media experts and two subject matter experts, an average of 93.4% was obtained, categorised as valid. This is in line with the research conducted on (Bahauddin, 2019) , which obtained a validity score of 93.25%, categorised as

highly valid (very high). *The* validity of this *local wisdom-based* chemical kinetics e-module product was then measured through assessment by subject matter experts and media experts, while its practicality was evaluated based on responses from teachers and students (Chidayati et al., 2021) . The results of validation by subject matter experts showed that the average material validity score was 0.833, which is in the high category, while media experts gave a design validity score of 0.933 and a pedagogical validity score of 0.976, both of which are also in the high category (Pratiwi et al., 2021) . Overall, these findings indicate that the e-module has an excellent level of validity from a material and media perspective, supporting its potential for use in contextual science learning (Kurniawan et al., 2021) .

The practicality results obtained by chemistry teachers and Grade XI students at SMA Negeri 1 Lingga showed a percentage of 92% for teacher practicality and 94% for student practicality. The average practicality results for teachers and students were 93%, categorised as highly practical. Previous research conducted on the obtained a practicality result of 93% for teachers and 90% for students, categorised as highly feasible, indicating that the e-module is feasible and easy to use in the learning process. The results of the e-module validation by media and material expert validators, which showed a very valid category of 93.4%, and the practicality results, which showed a very practical category of 93%, indicate that the chemistry kinetics e-module based on *local wisdom* has very high validity and feasibility. The validation results of the module from subject matter experts indicate a good category, while a small-scale trial with students yields a very good category, indicating the module's high suitability (Inggamer & Siregar, 2023) .

E. Conclusion

This study developed a local wisdom–based chemical kinetics e-module integrating *Kepurun*, a traditional Malay dish from Daik Lingga, through the systematic stages of the ADDIE instructional design model. The findings demonstrate that the product meets high standards of feasibility in terms of validity and practicality, confirming its appropriateness as a contextual learning resource in senior high school chemistry. First, the e-module achieved a validity score of 93.4%, categorized as very high. Expert validation covering content accuracy, instructional design, and media aspects indicates that the module is theoretically sound, pedagogically appropriate, and visually well-structured. The integration of local cultural elements into chemical kinetics material enhances contextual relevance, supporting meaningful learning by linking abstract scientific concepts to students' sociocultural experiences. The structured validation process further ensured that the product met quality standards prior to field implementation. Second, the practicality level reached 93%, also categorized as very high, based on teacher and student responses in class XI at Lingga 1 State Senior High School. The e-module was considered user-friendly, clearly organized, and easy to implement within classroom instruction. Its interactive and self-instructional features facilitated independent learning and promoted student engagement. The contextual presentation of chemical kinetics concepts through familiar cultural practices contributed to improved comprehensibility and positive learner attitudes. Overall, the findings confirm that the local wisdom–based chemical kinetics e-module is both valid and practical for instructional use. The integration of regional cultural heritage within a structured instructional design framework provides an effective approach to enhancing contextual science learning. This study contributes to the growing body of

research on culturally responsive teaching materials in chemistry education and supports the broader implementation of local wisdom–integrated digital modules in similar educational contexts.

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