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Development of Chemistry's Learning Module Oriented Local Wisdom of Central Sulawesi for High School in Basic Acid Solution Materials

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Abstract

Development research has been carried out to produce a high school chemistry learning module that oriented Central Sulawesi's local wisdom in acid-base solutions. This research was conducted using research and development (R&D) methods. The goal of this study was to ascertain the validity and applicability of the developed learning modules. Development of the learning module is expected to be used by teachers as users and for students in their independent learning, increasing the understanding of concepts and getting to know local wisdom in the Central Sulawesi region. The validity of the learning module was determined by a validation test conducted by specialists in the topic, medium, and user. In contrast, the practicality of the learning module was determined by the outcomes of the module's implementation by students. The validation results showed that the average score of the material expert of 2,66 was categorized as "valid," the average score of the media expert was 3,29 with the category "valid," and the average score of the user was 3,53 with the category "valid." The results implementation of learning modules using students' response questionnaires obtained respectively, a percentage of 29% of students responded was "very practical," 64,4% of students responded war "practical," 6% of students responded was "impractical," and 0% of students respond was "very impractical." Based on these results, it can be concluded that the development module was "valid" and "practical" in using the learning process.

Keywords: Learning module, local wisdom, acid-base solution

Introduction

Increasing students' mastery and understanding of the subject matter is the main goal in the learning process at school. The level of success in the learning process cannot be separated from the role of a teacher. As a component in the learning process, the teacher plays an essential role in achieving educational goals. Teachers are expected to be able to create learning conditions in such a way that they can stimulate students to learn actively (Aidha, 2016)

Chemistry includes knowledge of chemistry in facts, theories, principles, and laws based on scientific findings and scientific work. Therefore, in learning chemistry in high school, the teacher must package the presentation of the material to help students understand the material well. Chemistry is a subject in high school that some students consider problematic. That is because the material in chemistry subjects includes abstract, rote, and count things, making it difficult for students to understand. Most students find it challenging to understand and apply many formulas during chemistry learning (Sari et al., 2014). One of the objectives of high school chemistry subjects is to develop reasoning skills in inductive and deductive analytical thinking by using chemical concepts and principles to explain various natural events and solve qualitative and quantitative problems. High school chemistry subjects include discussing the nature of acid and base solutions known through their effects on indicators. An indicator is a chemical substance whose color depends on the acidity or alkalinity of the solution. The hand that is usually used is litmus paper. When red litmus paper is dipped in an alkaline solution, it turns blue; when blue litmus paper is immersed in an acid solution, it turns blue. The color of litmus becomes darker red with a lower pH value, while the color of litmus becomes darker blue with a higher pH value, even when the concentration of the solution remains constant. As a result of the fact that acids and bases have varied strengths, the topic of the nature of acid-base solutions in human existence is exceptionally vast. (Duwiri & Siregar, 2016)

The material for acid-base solutions in class XI consists of 57% concepts that are abstract, 28% are concepts that can be practiced/demonstrated, and 15% of the material can be taught through direct

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experience (Aprianti et al., 2011). The application of the topic of the nature of acid-base solutions in human life is comprehensive, so to equip students, an educator must be able to choose the right learning source, one of which is the module (Duwiri & Siregar, 2016)

Learning using modules can make students learn independently without or with teacher guidance; in addition, in the module, there is also control over learning outcomes through the use of competency standards in each module that students must achieve (Saputra et al., 2016)

The module in chemistry learning is used as a supplementary learning resource for students studying the material. In addition, by using the module, students can learn independently. According to Oka (2010), independent learning is a way of active learning and participation to develop each individual who is not tied to teachers, lecturers, face-to-face meetings in class, and school friends.

The module can support the teacher's role in the learning process because the teacher's role in learning using modules can be minimized so that learning is more student-centered, and the teacher acts as a facilitator in the chemistry learning process, no longer dominating knowledge (Khotim et al., 2015). A module is a form of visual media in printed teaching materials that have distinctive characteristics. Modules such as learning media can be explored to help students understand concepts in chemistry both in macro, micro, and symbolic aspects (Russel et al., 1997). Modules are practical when they are easy to understand to achieve specific competencies. In addition, the efficiency of the module is also based on affordable doubling costs, while it is feasible to determine from the systematics of writing modules that are easy to understand, material relevant to the competencies measured, and the current references used (Rahayu & Sudarmiatin, 2010).

The chemistry learning process can be meaningful for students when chemistry material is oriented to local wisdom in the local area. Students feel directly and quickly sensed instantly by students (Wati et al., 2017). One of the efforts to introduce local wisdom from an early age is learning based on local knowledge. Local understanding can be linked to science because science knows about the symptoms and intricacies found in nature. The nuances of local wisdom can be included in these subjects (Saputra et al., 2016). To connect local knowledge with chemistry subject matter in the world of education, we need teaching material that can be a bridge in a module (Wati et al., 2017). The module is expected to be a vehicle for distributing messages or learning information that stimulates thoughts, attention, and interest to facilitate the teaching and learning process (Lusia & Arief, 2013).

One form of local wisdom found in the Central Sulawesi region is the availability of natural resources. Existing plants can be associated with learning chemistry, especially acid-base solutions. Many plants around produce a sour taste and have alkaline properties. Students can better understand and relate the material obtained with reality in everyday life.

Local wisdom can be interpreted as a form of local wealth or an area in the state of beliefs, knowledge, norms, culture, customs, insights, and so on that are inherited and maintained so that they become an identity and guidelines for teaching how to act appropriately in living life (Utari et al., 2016). Other researchers in the area have also carried out relevant research on incorporating local wisdom in learning; based on research conducted by (Suastra, 2010), it was found that knowledge based on local culture has an average value of 58.63.

The availability of learning modules, exceptionally high school chemistry learning modules oriented to local wisdom on acid-base solution material, is still rarely found in schools. The interviews at SMAN 5 Palu showed that the local wisdom-oriented high school chemistry learning module was not yet available. Students' learning resources were student chemistry textbooks; students were only centered and depended on the teacher. So based on this problem, researchers are interested in developing a learning module. It is hoped that teachers can use it in learning and assisting students in learning independently, increasing understanding of concepts, especially in acid-base solution material, and linking the values of local wisdom in the Central Sulawesi region.

This paper is intended to describe the development of a high school chemistry learning module oriented to local wisdom in Central Sulawesi on acid-base solutions.

Methods

This research uses Research and Development (R & D) research and development methods adapted from Sugiono's development model. The product produced in this study is a high school chemistry learning module oriented to the local wisdom of Central Sulawesi on acid-base solutions. The stages used in this study include: 1) potential and problems, 2) data collection, 3) product design, 4) design validation, 5) design revision, 6) product trial (Sugiono, 2010).

As for the stages of development, this research involved various parties referred to as research subjects, namely material experts, media experts, users, and class XI students of SMAN 5 Palu. This research was conducted in class XI MIA 3 SMAN 5 Palu. A module is valid if the module can evaluate what should be considered (Suryani et al., 2014). In this study, the learning module developed was validated by material experts, media experts, users and tested on class XI students of SMAN 5 Palu.

Validation

The data for this study were gathered in quantitative and qualitative data. Quantitative data were obtained from the results of the validation

questionnaire of material experts, media experts, users and the effects of student response questionnaires, namely the average value in the aspect of content feasibility, presentation feasibility aspect, contextual feasibility, linguistic feasibility, graphic feasibility, and orientation of local wisdom values. In the learning module. This data uses a Likert scale with the alternative responses are very good (SB) score 4, good (B) score 3, poor (K) score 2, and very poor (SK) score 1 (Sugiono, 2010). Meanwhile, qualitative data was obtained from suggestions and input from experts to correct and reduce errors and imperfections in the preparation of the module, which was then used as material for revision.

Based on the validation sheet that material experts have filled out, media experts and users, the average score for each aspect of the assessment is calculated using the formula:

$$\overline{X} = \frac{\sum x}{\text{n}} \, x \, 100\%$$

The average score obtained is converted into qualitative form based on **Table 1**.

Table 1. Product assessment criteria

Average score	Criteria
3.25 – 4.00	Very good
2.50 – 3.25	Good
1.75 – 2.50	Less
1.00 – 1.75	Very poor

(Widoyoko, 2012)

To determine the level of validity of the developed module, the average score of all aspects refers to the interval determining the level of validity of the learning module presented in **Table 2**.

Table 2. Interval for determining the level of validity of the learning module

Average score	Criteria
1 ≤ Va < 1.8	Invalid
1.8 ≤ Va < 2.6	Non-valid
2.6 ≤ Va < 3.2	Quite valid
3.2 ≤ Va < 4.2	Valid
4.2 ≤ Va < 5	Very valid

(Hobri, 2010)

Revision

After validation by experts, the next step is the product revision process. Revisions are carried out to correct and reduce errors in the learning modules developed. The revision process is based on suggestions, criticisms, and inputs given by material experts, experts, media, and users through validation questionnaire sheets and discussions conducted. After revision, the developed learning module was tested on students to determine the practicality of the module to be used in learning.

Practicality

In this study, what is seen is the usability of the learning module through the implementation of the use of the learning module by using a student response questionnaire sheet. The practicality of the resulting learning module is determined based on the large percentage of students who fall into the category of strongly agree and agree. The percentage of eligibility is determined using the formula:

$$\% = \frac{\text{Observed score}}{\text{Expected score}} \, x \, 100\%$$

Based on the calculation, the percentage range for the qualitative criteria can be determined as follows in **Table 3** (Arikunto,1996).

Table 3. Eligibility percentage scale

Average score	Scale	Criteria
76% < score ≤ 100%	4	Very worth it
51% < score ≤ 75%	3	Worthy
26% < score ≤ 50%	2	Decent enough
0% < score ≤ 25%	1	Not worth

Results and Discussion

Potential and problem analysis

The analysis phase includes an analysis of potential problems; the authors analyze the existence of a local wisdom-oriented chemistry learning module. Based on the results of a literature study and a survey conducted by the author, it was found that there was already a local wisdom-oriented learning module. However, there was no chemistry learning module for acid-base solution-oriented to local wisdom for class XI SMA. The results of interviews with chemistry teachers at SMAN 5 Palu said that there was no local wisdom-oriented Chemistry learning module for acid-base solutions. The problem obtained by the researcher is how to develop learning modules oriented to local wisdom in Central Sulawesi on acid-base solutions.

Data collection

The data collection stage collects material related to acid-base solutions, analyzes the material, and determines standard criteria for making modules from various sources. Next, contain references that will be used to prepare learning modules and take pictures and illustrations related to local wisdom adapted to the material developed in the module.

Product design

At this stage, the researchers designed the learning module that was developed, namely the high school chemistry learning module oriented to the local wisdom of Central Sulawesi on the acid-base solution material. Stage of the researcher determined the media suitable for the learning objectives, chose the format and carried out the initial design of the module development, the development method used, and the source of module development (Pohan et al., 2014). The design of the module is adjusted to standards which include 1) Module framework consisting of introduction, table of contents, list of figures, list of

tables, core competencies, essential competencies, indicators, instructions for using modules, module components, final objectives, material descriptions, sample questions, practicum, summary, questions, answer keys for bibliography and glossary, 2) Design/display of modules and 3) illustrations in the form of pictures to complement the material presented, then the results of product designs that have been developed are consulted with the supervisor. The module design is also carried out by integrating the results of various studies on module development that have been published (Annoson & Walker, 2013).

Design validation

At this stage, the product validation that has been designed is carried out, namely in the learning module. Three experts carried out validation, namely material experts, media experts, and chemistry teachers as users. Based on the validation results carried out by material experts, the average assessment score for all aspects was 2.66, which was categorized as entirely valid. The results of media expert validation obtained an average score of 3.29 for all elements in the valid category. The validation results by users received an average score of 3.53 with a valid category. According to Sawitri et al. (2014), a quality learning module is appropriate if it meets the standards of validity assessed by experts or experts.

Product revision

Product revisions are carried out to correct errors and deficiencies based on the results of expert validation. Yuliawati et al. (2013) stated that the suggestions and input obtained can be used to improve a product before it is used in learning. In addition to expert validation data, data in the form of criticism and suggestions for learning modules were also obtained. Furthermore, improvements or revisions are made to minimize errors or imperfections in the learning modules developed to improve the modules' quality and are worthy of being tested on students.

Product trial

Products that have gone through the validation and revision stages are then tested. The trial was conducted on 20 class XI MIA 3 SMAN 5 Palu students. This trial is intended to determine the practicality of the learning modules developed in the learning process. In the product trial, students have distributed learning modules and studied them. After finishing studying the learning module, students were distributed an assessment response questionnaire to assess the practicality of the module; in addition, students were asked to write down their comments and suggestions on the usability of the module. According to Mercedes (2009), applying a prototype module in a lesson can be proven by the emergence of positive student responses at the implementation time.

Based on student responses to the learning module from the questionnaire given, 29% of students responded very practically, 64.4% of students responded practically, 6% students responded impractically, and 0% of students responded very impractically. From the results of student responses, this learning module is practical and can be applied in learning.

Conclusion

Based on the study results, it can be concluded that the results of material expert validation and media expert validation have an average score of 2.66 and 3.29, respectively, indicating the category is entirely valid and valid. The results of user validation obtained an average score of 3.53 with a valid category. And the results of the student response analysis showed that 29% of students responded very practically, 64.4% of students responded practically, 6% reacted impractically, and 0% of students responded very impractical. These results indicate that the learning module developed is valid and practical to use in learning.

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