
The Development of Chemical Modules Based on POE (*Predict, Observe, Explain*) in the Solution Colligative Properties Subject as a Learning Resources for Senior High School/Equal

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Abstract: The study aims to develop POE-based learning resources in the form of modules for senior high school chemistry on the solution colligative properties subject. The research method used is development research. Development research used 4-D model which are carried out in four stage: Define, Design, Development, and Disseminate. In the research only on the stage of development. The developed POE-based learning source prototype was validated by 4 validators, 2 people as experts and 2 people as users. The research data was obtained through a validation sheet filled by the validator. The results of the assessment of the four validators in each aspect assessed by the category are very good. The conclusion shows that the POE-based modules produced for senior high school chemistry learning on solution colligative properties are valid in terms of content and construction.

Keywords: Module Based on POE, Chemistry of Senior High School, Colligative Properties of Solution

1. Introduction

Most learning in schools has not emphasized the use of process skills, students generally find it difficult to bridge chemical learning material with phenomena in the environment. Applying chemistry applicable is an effort to recognize natural phenomena in order to get benefits for life. *National education 21st Century by National Education Standards Agency (BSNP), requires student-centered learning.* Chemistry learning must emphasize the relationship between the material being studied (content) and the problems that exist in the real life (context) of students (BNSP, 2010). Students can be actively involved in the learning process if the available learning resources are adequate, in this case at least need to be prepared chemical learning resources such as modules and medias based on learning models that support and facilitate the implementation of the 2013 curriculum, because textbooks are available in addition to a limited number not referring to the curriculum so that not all students can use books. The teacher understands that in implementing chemistry learning is very necessary for the media to facilitate the present of messages but many teachers have not prepared the media to carry out the learning process for various reasons. To overcome the problem of availability of learning resources, it is necessary to provide a solution through the design of modules and appropriate media. Andi Prastowo (2014) states that the module is one of the means as a learning resource for Learning Resources by

Design types which are learning resources that are intentionally planned and made to achieve goals. The use of learning modules and media can improve professional competence, pedagogics and can increase teachers' confidence in managing classroom learning.

The POE model is a learning model that can be used in learning science and based on constructivist theory by exploring the knowledge that previous students have and interpreting and relating to everyday life through the three main stages in a sequence of predictions, observations and explain observations (explain) (Warsono, 2012). Indrawati (2009) the POE model can investigate the ideas of students and their way of applying knowledge to real conditions so that students can build new knowledge based on the knowledge they already have that are interrelated.

Kearney (2004) opinion that POE with three stages in learning includes prediction, observation, and explanation. At the prediction stage, students are directed to make predictions and estimate the results of observations that will be carried out. Students observe the phenomena that occur during the observation phase, comparing observations with predictions and explaining observations by self-knowledge means that POE is more directed towards understanding the concepts of science of students. Rahayu's (2013) study concluded that the use of POE learning models increased the completeness of student learning outcomes. It is expected that the development of learning resources based on the POE model is useful in supporting learner-centered learning.

The statement of Aria Tanti and Dodi (2016) based on POE learning resources requires students to play an active role and provide an understanding that learning activities originate from the point of view of students not from teachers or experts. The suspected POE module and mediation base can be used to stimulate students to think scientifically by linking learning content with real-life contexts according to 2013 curriculum demands.

Material Colligative Properties of the Solution learned in class XII SMA / MA is mostly related to real life. The existence of POE-based learning resources on the material of the colligative nature of the solution is expected so that students can see the benefits of learning the material of the colligative nature of the solution and its wear in everyday life so that the desired contextual learning can be achieved.

Based on the background it is necessary to the development of learning resources POE-based for senior high school chemistry on the solution colligative properties subject.

2. Methodology

Is a research development that refers to the Research and Development (R & D) research approach. The development process using a 4-D model (Define, Design, Development, Disseminate) is one design model that is estimated to be suitable for the development of POE-based learning resources. Research on the development of Four-D models in the development of learning resources carried out by researchers was modified without going through the dissemination stage because the purpose of research in developing learning resources was to develop valid / feasible or good learning resources. Testing the feasibility in a large scope requires quite high costs because so in this study only until the stage of developing has not carried out the deployment phase. Detailed research procedures for developing learning resources are described in Figure 1.

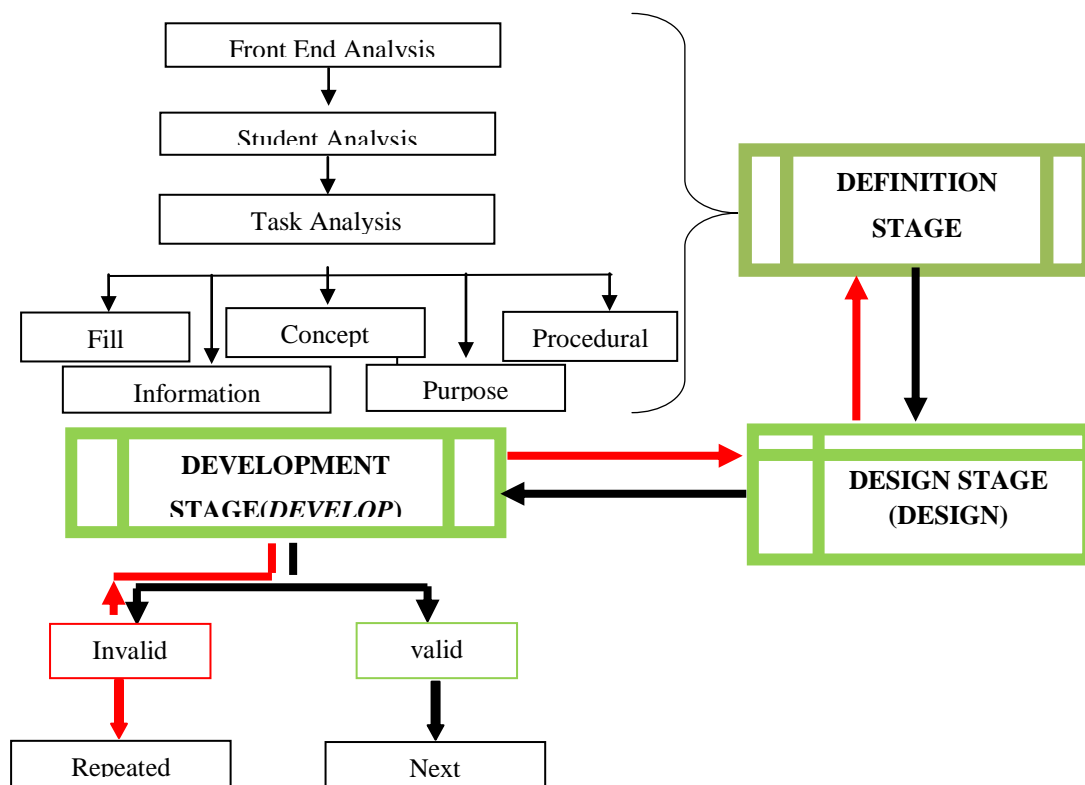


Figure 1.4-D model development procedure

The research subjects were validators who were material experts and the teacher respondents consisted of 2 chemistry teachers as users. While the object in this study is a POE-based chemical learning resource that can be used as a learning resource for the XII class of SMA / MA.

The learning resources developed were assessed by the validator to test validity by using a validation sheet. Validation sheets are prepared based on aspects such as content feasibility, language feasibility, graphic eligibility, and presentation eligibility.

Validation sheets for validators are arranged on a Likert scale with intervals "very valid to invalid". Likewise with the teacher and student response sheets using a Likert scale.

Table 1. Scale of Validator Assessment

Persentase	Information
80,00 – 100	Very Good / Very Valid / Very Decent
60,00 – 79,99	Good / Valid / Decent
50,00 – 59,99	Poor / Invalid / Inadequate
0 – 49,99	Not good

(Riduan, 2012)

3. Results and Discussion

Development research that produces chemical learning resource products the subject of Colligative Properties A valid POE-based solution according to the validator and practical according to the user (teacher and students).

The explanation of each stage of POE is as follows:

a. Predict Stage

At this stage the module leads students to predict the answers to the questions presented based on the facts and principles given in relation to the material to be studied. The description in the module guides students to be able to predict things that can be known from facts and principles in accordance with the learning objectives. In the initial view of POE-based lectors inspire media, motivating students to think and predict the relationship of content and context.

b. Observe Stage

At this stage, students must understand the material presented systematically and be equipped with examples of questions and independent exercises so that they can help students to strengthen their understanding. In addition, at the observe stage students can also carry out simple experiments that can be carried out independently at home so as to help solve problems related to the material that exists in everyday life. The presence of experiments in the form of experiments in the media makes students more focused on observing experiments and various information, through observation, hearing, so that this media show is also a more variation in learning.

c. Explain Stage

At this stage, a picture or questions are presented as concept maturation. This stage is equipped with a discourse in the form of material applications in everyday life to facilitate students to realize the benefits of learning the material. Students are asked to write their own conclusions in the form of facts, concepts, principles, formulas, and applications. At the end of the learning, students are required to complete evaluation questions so that they are able to solve problems such as the 2016 revised edition of the 2013 curriculum requirements. The initial design in the form of a prototype learning resource by the research team was validated and tested for practicality to users (teachers and students). The development phase is carried out after passing the design stage. The results of the Development stage are learning resources based on Predict, Observe, and Explain on the subject of Colligative Properties of solutions based on expert and practical based on user responses (teachers and students).

1) Results of Validation Product

The validation phase aims to refine the prototype that is designed according to input, and evaluation of the learning resources compiled. Validation was carried out by validators, namely lecturers as material experts and media experts. Validation was done twice by each validator which was used as data and analyzed for each aspect. During the validation process, the researcher along with the validator conducts a discussion to improve the learning resources developed. Suggestions and inputs given by the validator are references in making improvements to produce learning resources with valid categories.

Learning resources Colligative Properties of Solutions that are compiled, validated and revised in accordance with the suggestions and input given for improvement, so that the resulting learning resources in the form of modules and media are valid.

Each validator assesses all aspects contained in the validation sheet. The highest score was obtained in the aspect of language feasibility with a score of 92%, while the lowest score was obtained in the aspect of graphic eligibility with a score of 87.71%.

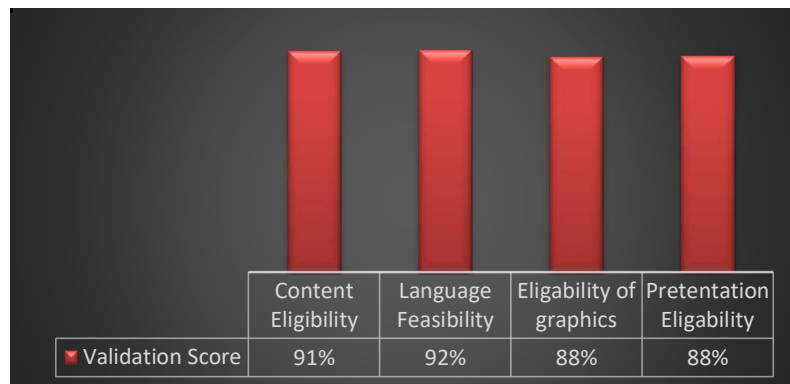


Figure 1: Recapitulation Chart of Average Score Validator Assessment

a) Aspects of content eligibility

Content eligibility is an assessment of the contents of the module, which has 7 assessment components, namely the completeness of the material; breadth of material; depth of material; accuracy of concepts, principles, facts, data and examples; reasoning, linkages, communication (write and talk), and application; material interest; accuracy of questions, pictures, diagrams, illustrations, notations, symbols, icons and reference references, in this case obtaining an average score of validation is 91.07% included in the valid category. Three components that get an average percentage value of 100% (completeness of material; breadth of material; depth of material), 3 components get an average percentage value of 87.5% (accuracy of concepts, principles, facts, data, and examples; accuracy of questions, images, diagrams, illustrations, notations, symbols, icons and reference libraries; material interest) and 1 component get an average percentage value of only 75% illustrating that reasoning, which still needs to be improved, is still less related to the surrounding environment to be more attractive to users, communicative but less applicable in terms of the examples presented in the module.

Presentation of material for each meeting in the module in accordance with KD. The truth of the concept and suitability of the description of the material with the basic competencies is intended so that students do not feel hesitant when carrying out learning using the colligative nature of learning modules based on the opinion of Abdul Majid (2008). Validator assessment for the media that is developed is also in accordance with KD as well as the truth of the concept presented. Reflecting learning is centered on students and facilitates teachers / learners in learning.

b) Aspects of Eligibility for Presentation

Assessment of the feasibility aspects of the presentation include systematic presentation in accordance with the stages of the POE model; presentation; contains instructions for using modules, glossaries, bibliography, and summaries; presentation of the introduction; presentation of the contents section; and presentation of the closing part.

The average score of the validator in the aspect of presentation eligibility is 88.30% included in the valid category. Validator gives an assessment that the learning material contained in the module is in accordance with the stages of the POE learning model and has presented a summary of the right learning.

Preparation of modules in accordance with the Self Instructional criteria by the Ministry of National Education which states that the module must contain a summary of learning materials, assessment instruments, practice questions and simple and communicative language so as to be able to teach students independently

The results of the validation of the presentation of the feasibility of the lectora inspire media, in this case the presentation of the sequence of impressions according to the order of the material and the stages of the POE, represent the learning objectives so that the potential to improve communication and understanding of students.

c) Aspects of Language Feasibility

The language feasibility aspect explores about the language used in the module with assessment components, namely straightforward language; the use of communicative, dialogical and interactive languages; suitability with the level of development of students, the suitability and integration of the flow of thinking; and the use of terms, symbols, or icons with a validator average score is 92%. Validator's assessment of sentence structure is correct, effective, and the terms used are standard and contain helpful instructions and information exposure to easily understand and motivate users.

d) Advisability Aspects of Integrity

Advisability of integrity that assesses module size, layout, color, placement, space, and use of variations in modules. The assessment score of the validator on the aspect of eligibility for the average graph is 87.71% valid category. The illustrations / images presented according to the validator are clear and related to the concept. Developed of module includes color images and attractive to users. The use of color in the presentation of modules as Ashyar opinion, is useful to build the interest of readers can even enhance realism and create an emotional response. The integrity of the media presented in terms of color is very interesting, the use of letters and size is in the good / feasible category. The images presented are good, can make it easier because they are more alive, communicative.

2) The Results of Trial Practical

a) Teacher's Responses

The practical used of research product modules The practicality of the use of research product modules by teachers in the field of chemical studies, as a whole gives an overview that the teacher's response with an average score of 86.67% of the categories can be used. Teachers are quite easy to use the media, making it easier to deliver messages so that they can increase self-confidence

b) Student Responses

The trials use of modules developed for students in two schools through questionnaires, overall, the average response of students is 86.13% giving an indication that the module can be used properly. For the media being tested, students feel happy, enthusiastic and very learning activities and appear to be able to overcome saturation in the learning process.

4. Conclusion

In corresponding with the results of the study and discussion it can be concluded that the POE-based chemical learning resources on the colligative nature of the solution for class XII SMA / MA were developed valid based on the aspects of content and construction feasibility.

Recommendation

Based on the conclusions of the research carried out, it is recommended that the POE-based chemical learning resources subject to the colligative nature of the solution can be used as a learning resource for the XII class of SMA / MA. The author hopes that the research can be continued with the application of POE-based learning resources designed in several schools.

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