The Development of E-Module Based on Problem Based Learning
For The Main Topic of Electrolyte and Non-Electrolyte Solvent

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Abstract: Technology development affects the quality of learning activity, so it needs some IT-learning-based media development. The purpose of this research is to develop e-module with the approach of problem based learning that is designed to increase protégé’s way of thinking in solving a problem. This research used development research approach with model of Borg & Gall. The data analysis considered the content validity, graphic validity, presentation validity and display validity of the e-module development. The purpose of validity was to find out how far the accuracy and austerity in developing the e-module. Based on the research result, e-module learning media that was developed, received very high category in the aspect of content suitability for 91.50%, suitability aspect to module characteristic was 95.50%, graphic aspect of 87.68%, readability and material presentation was 92.50%, and learning media display aspect for 89.30%. From those data, it can be concluded that developed e-module is worth to be used as one of chemical learning media.

Keywords: Development Research, E-Module, Problem Based Learning.

1. Introduction
Technology that is growing rapidly nowadays, has affected all life aspect, including the education aspect. To increase the quality of learning implementation need to be supported by the existence of technology-based learning media. Technology-based learning media is expected to increase protégé’s mindset in solving some learning problem. Protégé that uses IT-based learning media indirectly can also develop their ability in this aspect and growing the human resource quality. One of the technology-based learning that can be considered as learning supports is a module in a form of e-module. Electronic Module (e-module) is packed as more concrete material presentation and completed by the learning simulation supports.

E-module is a new learning media innovation by the printed module that has some benefit that is making the process of learning to be more interesting, interactive, can be done everywhere and every time, also can increase the learning quality. E-module can be developed through some learning methods and the other supporting media [1].

Problem Based Learning is a learning model that presenting some problem for the protégé that has the function as the intermediary for investigation and identification [2]. The application of problem based learning can be supported with source and suitable learning media as well as e-module.

The strength of e-module is that the protégé can easily access the material using any kind of gadget or computer so that everywhere and every time, so it is possible for the protégé to have direct feedback and received the subject material completely. The strength of this program is not only in the form of textual but also able to integrate audio, picture, animation, movie or video, so the information that is presented is tend to be richer than conventional book.

E-module learning media is expected to be able to attract interest and protégé independently so the process of learning can be done by student centered. Other than that, with the e-module learning
media the process of learning and teaching activity can be one everywhere and not only focusing in the classroom, but also can be done outside the classroom so it can increase the quality of learning.

Potency and problem in this research is received by the observation in SMAN 1 Siak, the problem that the school face, in general, that there is no e-module as learning media, even though the school has some facility that support the use of e-module. The school has the facility such as wifi in some spot inside the school that is able to be used for learning activity. Human resource that is supported by the facility is actually has the ability to create some e-module.

2. Literature Review

The development of e-module of problem-solving oriented needs some stages, starting from early investigation phase, designing phase, construction/realization phase, test/evaluation phase and revision also implementation phase. In the early investigation, it is identified 2 main problems that needed to be paid attention and have learning treatment as follows: the use of learning media is not optimal yet and the low quality of learning. Based on that study, it is designed some steps of solving in the form of e-module development that problem-solving oriented.

Next, designing phase of model is done the design of e-module and also supporting research instrument such as module assessment sheet, and student response questionnaire. In the outlines, e-module covers: (1) primary competence and indicator as learning target, (2) material essay that is designed so the student do the activity of problem-solving to find the concept of related subject, this part is also completed with picture, animation and simulation that possible in the printed module, (3) question example, (4) summary, (5) formative test simulation and (6) direct feedback that is automatically done after the student finished the formative test and (7) bibliography. In the realization phase, e-module and research instrument is designed based on the design that already created so it will produce the prototype.

E-module learning media of problem based learning that presented to be integrated with the problem based learning steps. Problem based learning is undergone by 5 syntaxes they are:

a. Orientate the Student to the Problem
b. Organize the Student to Study
c. Help Independent and Group Investigation
d. Develop and Present the Artifact then Show it
e. Analysis and Evaluation on Solving Problem Process

Before that it is done some research about the development of e-module, one of them is done by Santosa (2017) it is The Development of E-module to the Network Administration Subject of Grade XII with the Model of Problem Based Learning in Singaraja Bali Global IT Vocational School. The method that is used in this research was research and development (R&D), with the development model of ADDIE [3]. To know the student and teacher response to e-module is received by questionnaire method. The result reveals that: 1) e-module implementation result that is developed in the Network subject of grade XII of Computer and Network Engineering by using Problem Based Learning media in Singaraja Bali Global IT Vocational School is considered success for application through some test. 2) the result of student response data shows that the percentage of student that give very good is in the amount of 50%, the percentage that the student give good response is in the number of 50%, and there are no students that give response of enough, bad, or very bad. While the analysis result of teacher’s response shows the percentage of very good is in the number of 100%, and there are no teachers that response in good, enough, bad, or very bad [3].

The other relevant research is the research that is done by Nugroho (2015), it is about The Development of Chemical E-Module Based on Problem Solving with the Model of Application, the research result shows the worthiness of Chemical E-Module based on Problem Solving that is developed through R&D procedure that consist of 9 steps they are: 1) research and collecting information; 2) planning; 3) product development; 4) early test; 5) revision I; 6) main test; 7) revision II; 8) operational test and 9) final product, which qualified as “very worthy” for the material aspect by the percentage of 93.33% and media by the percentage of 92.22% according to the expert [4].

The next relevant research is the research that is done by Priatna (2017), which about the development of e-module of project based learning model in videography subject of grade X visual communication design in Sukasada Public Vocational School 1. The kind of the research that is used
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in this research is Research and Development with the development model of Dick and Carey. The result of the study reveals that: (1) the result of the design and implementation of e-module project based learning model in videography subject of grade X visual communication design in Sukasada Public Vocational School 1 is considered successfully applied through some test. (2) The data analysis result of the teacher shows that, the average score of the response is in the number of 50, when it is converted into table of response classification, it is considered into very positive category. While the students’ response to the development of e-module has the average score of 67.65, when it is converted into table of students’ response is in the very positive category [5].

3. Material & Methodology
3.1. Data
The date that was used in the development of e-module learning media was quantitative data. The data was obtained by scoring the validation questionnaire by material and media expert. The subject in this research was e-module of problem based learning in the subject of electrolyte and non-electrolyte solvent.

3.2. Methods
The method that was used in this research was Research and Development method that referred to Borg and Gall formulation. According Borg and Gall, the development research was a process that was used to develop and validated education material, such as learning material, textbook, learning method, instructional design, and etc. that was used in some research study (Borg and Gall, 1983:772). The purpose of this research was to develop and produce a module product that was already created with the development of problem based learning. Therefore, to reach the goal it was done some research steps: 1) Introduction Study: a) literature study, b) field survey, c) designing data collection instrument grids, d) designing the instrument to estimate the need of learning material, e) collecting field data. 2) E-Module Creating Step. 3) Validation Test: a) Validation by the media and material expert lecturer in Chemical Majors of FKIP and FMIPA UR, b) module revision as suit as the validation that was given by the lecturer.

Validity data analysis of e-module was calculated with this formulation:

\[
\text{Presetasise} = \frac{\text{Skor yang diperoleh}}{\text{Skor maksimum}} \times 100\%
\]

Table 1. The Result Validation by Expert

<table>
<thead>
<tr>
<th>No</th>
<th>Aspects being Assessed</th>
<th>Average</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Content Suitability With The Curriculum</td>
<td>91.50</td>
<td>Very High</td>
</tr>
<tr>
<td>2</td>
<td>Language Components</td>
<td>95.50</td>
<td>Very High</td>
</tr>
<tr>
<td></td>
<td>The Module Suitability With The Characteristics of Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Module</td>
<td>87.68</td>
<td>Very High</td>
</tr>
<tr>
<td>4</td>
<td>Graphics Component</td>
<td>96.87</td>
<td>Very High</td>
</tr>
<tr>
<td>5</td>
<td>Presentation Components</td>
<td>92.50</td>
<td>Very High</td>
</tr>
<tr>
<td>6</td>
<td>The Display of Learning Media Med Programming</td>
<td>89.30</td>
<td>Very High</td>
</tr>
<tr>
<td>7</td>
<td>Learning Media Programming</td>
<td>88.15</td>
<td>Very High</td>
</tr>
</tbody>
</table>

4. Results and Discussion
4.1. Result
This research is done to produce chemical e-module of SHS grade X by problem based learning to electrolyte and non-electrolyte solvent. The printed E-Module is arranged as suit as the core competence primary competence that suit 2013 curriculum. The e-module is completed by presenting e-module learning activity of problem based learning that can direct the protégé to problem based
learning steps. To attract the interest and motivation of the student, the e-module is completed with picture, illustration and easy to understand writing style.

This media is validated by 2 material expert and 1 media expert. After the analysis, the validation result of the e-module learning media is considered to be valid reviewed by some aspect that is valued by the experts. The validation result can be seen in Table 1.

The validation result is clearer as seen in the Figure 1.

![Figure 1. Expert’s Validation Result](https://www.estech.org)

### 4.2. Discussion

This media is validated by two material experts and one media expert. After the analysis, the validation result of the e-module learning media is considered as valid with the calculation by material expert I, material expert II and a media expert.

The validation result of the both material experts reveals that e-module has the percentage of 91.5% by the aspect of suitable content that fit with the curriculum, 95.5% from language aspect component, 87.68% from the aspect of module that suit the module characteristic, 96.87% for the aspect of graphic component, and 92.5% from presentation aspect. This shows that the e-module that is developed is very good and worthy to be used, by aspect of material accuracy of e-module, material content of e-module is very good to increase the ability of solving problem, writing language in the e-module is also very good. In the figure that is presented also suit the fact of daily life. However, to reach the validity of the e-module development, of course there is a process of revision from the validator. Validator material expert I say that the need of picture revision in the e-module, and also suits the picture to the discourse. While the Validator material expert II said that it needed material and reference addition in the e-module, because the presented material in the e-module is judged to be not covering al aspect in the table of content yet.

After the validation by the chemical material expert, then the e-module is validated by learning media expert. The validation result that is done by the media expert reveal that e-module has the percentage score of 89.3% for learning media display and 88.15% for the aspect of programming learning media, this shows the presentation of e-module, the ability to solve problem, writing style design, layout, the benefit of e-module, and e-module content that is developed gives very good benefit for the protégé.

Many feedback and suggestion is received from both material experts and media from the e-module that is developed and that is very helpful for perfecting the development process. According to the average percentage of validation result that is given by material experts and media expert, it
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shows that the aspect of e-module is already very good, e-module display is suited already and has quality the quality so the e-module that is developed can be the supporting and alternative learning material for the protégé.

5. Conclusion

It is referring to the research result and discussion that is already delivered, it can be concluded that the quality product of chemical e-module of problem based learning to the subject of electrolyte and non-electrolyte can help the protégé in independent learning process. Therefore, the chemical e-module of problem based learning as one of alternative teaching source in teaching chemical.

References