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Development of Chemistry Triangle Oriented Module on Topic of Reaction Rate for Senior High School Level Grade XI Chemistry Learning.

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Abstract—This study aims to produce chemistry triangle oriented module on topic of reaction rate, and to reveal the validity and practicality level of the generated module. The type of research used is EducationalDesign Research (EDR) with development model is Plompmodel. This model consists of three phases, which are preliminary research, prototyping phase, and assessment phase. The instrument used in this research is questionnaire validity and practicality. The data of the research were analyzed by using Kappa Cohen formula. The chemistry triangle oriented module validation sheet was given to 5 validators consisting of 3 chemistry lecturers and 2 high school chemistry teachers, while the practicality sheet was given to 2 chemistry teachers, 6 students of SMAN 10 Padang grade XII MIA 5 on the small groupevaluation and 25 students of SMAN 10 Padang grade XII MIA 6 on the field test. Based on the questionnaire validity analysis, the validity level of the module is very high with the value of kappa moment 0.87. The level of practicality based on teacher questionnaire response is very high category with a kappa moment value 0.96. Based on the questionnaire of student responses on small group evaluation, the level of practicality is very high category with a kappa moment 0.81, and the practicality is very high category with kappa moment value 0.83 based on questionnaire of student response on field test.

1. Introduction

Education is an effort which has a vital role to improve the quality of human resources and the individual potential. Education is a conscious and planned effort to create teaching and learning process atmosphere of students actively in developing their potential for having spiritual religion power, self control, intelligence, good manners, and skills needed by themselves, society, nation and state.

Innovations to the education as system are needed to improve the quality of education and produce competent graduates. Based on the Regulation of the Minister of National Education (Permendiknas) number 41 of 2007 on process standards, that framework of innovating educational system has been established vision, mission and strategy of national educational development[19]. Based on that regulation, a set of principles of educational implementation has been shifted paradigm of teaching to the learning paradigm. Learning is the process of interaction of learners with teachers and learning resources. Learning resources can be in the form of teaching materials. Teachers are required to develop teaching materials because by using teacher learning materials will be easier in implementing learning and students will be more helpful and easy in learning, one of the categories of teaching materials is module. Modules are a set of teaching materials that are presented systematically that can be used by students to study with or without a teacher, thus modules can serve as teacher substitutes. If

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a teacher has a function to explain something, then a module should be able to explain something with a language that can be easily received by learners[1].

The author has made observations about learning materials used by students in the process of chemistry learning as well as interviewing with chemistry teachers in several high schools in Padang. Based on the results of observations and interviews obtained information that the teaching materials used by teachers in the learning is a printed book that has not fully meet the demands of the curriculum 2013. In addition the learning materials used are not yet able to guide students to learn independently because of language used in the book is difficult to be understood by students. The learning materials used also have not used an attractive color combination, so it has not been fully able to motivate students to understand the concepts that exist. In addition, the learning materials used involve only two of the three levels of chemistry representation where the macroscopic and symbolic levels have not been accompanied by submicroscopic representations that can help students understand the chemistry concepts.

One of the problem in chemistry learning is that learning takes place is generally limited to two levels of representation namely macroscopic and symbolic. This is due to the learning at the sub-microscopic level is only explained through lectures and discussions, so that students consider the subject matter or learn and resulted in the quality of learning outcomes only visible from the level of good memorization and lack of deep understanding of the substance of the subject matter which he learned [2][3] .

In order to make students understand the chemistry in depth, the chemistry learning process needs to involve the three levels of chemistry representation which are the macroscopic level, sub-microscopic, and symbolic. Macroscopic level refers to phenomena that can be seen in real (concrete), such as chemistry phenomena occurring in everyday life or in a laboratory that can be observed directly. Sub-microscopic levels provide information about elementary particles such as atomic, molecular, and kinetic materials, using the theory to explain what happens at the molecular level and using representations of theoretical models, such as particles that cannot be seen directly. Symbolic levels are representations of a reality, such as representations of symbols of atoms, molecules, and compounds, both in the form of images, and algebra[4].

The linkage between the three levels representations (chemistry triangle) has been extensively researched with the conclusions of student learning outcomes by involving multi representation in chemistry learning are higher than conventional learning[5]. Another study was also conducted by Sunyono entitled "The effectiveness of multiple representation learning model in building the mental model of students on stoichiometric topics of reaction" in this research resulted in the level of practicality (cultivation and attractiveness) and high effectiveness in building mental models and increasing mastery of students' chemistry concepts[6]. Baruri reported that interactive CD learning media through chemistry triangle approach on topic of reaction rate in SMA is very suitable to be used as an alternative for teachers and students in the process of reaction rate learning[7]. In addition, Santi also reported that the electrolyte and non electrolyte based chemistry triangle learning media using android applications for the X class of SMA has a very high validity and practicality[8].

Based on the above problems, the authors conducted the development of chemistry triangle oriented module for reaction rate material which aims to facilitate learners in the learning process and can help learners to learn independently and understand abstract concepts on the material reaction rate. This research entitled "Development of Chemistry Triangleoriented Module on Topic of Reaction Rate for Senior High School Level Grade XI Chemistry Learning ".

2. Methodology

The type of research used in this study was Educational Design Research. Educational design Research is systematic study about planning, developing, and evaluating educational intervention (such as program, learning strategy and material, product, and system) as solution from several issues existing[9]

Development model used wasPlomp Model which is developed by TjeerdPlomp. This model consists of three phases, which are preliminary research, prototyping phase, and assessment phase.

The subject in this research is 3 chemistry lecturers of FMIPA UNP, 1 chemistry teacher of SMAN 10 Padang, 1 chemistry teacher of SMA Bunda Padang, and 34 students grade XII of SMAN 10 Padang.

The preliminary investigation was done to identify and analyze the requirements needed in development of chemistry triangle oriented module on topic of reaction rate. On the preliminary phase were done needs analysis, curriculum analysis, studentanalysis, and concept analysis. Based on the analysis result at preliminary investigation was done prototyping stage.

Prototyping stage produces four types of prototypes, which are prototype I, prototype II, prototype III, and prototype IV. On each of prototypes was done formative evaluation. Formative evaluation was done based on tessmer formative evaluation. Tessmer formative evaluation includes four stages, which are self-evaluation, expert review and one-to-one evaluation, small group evaluation, and field test.

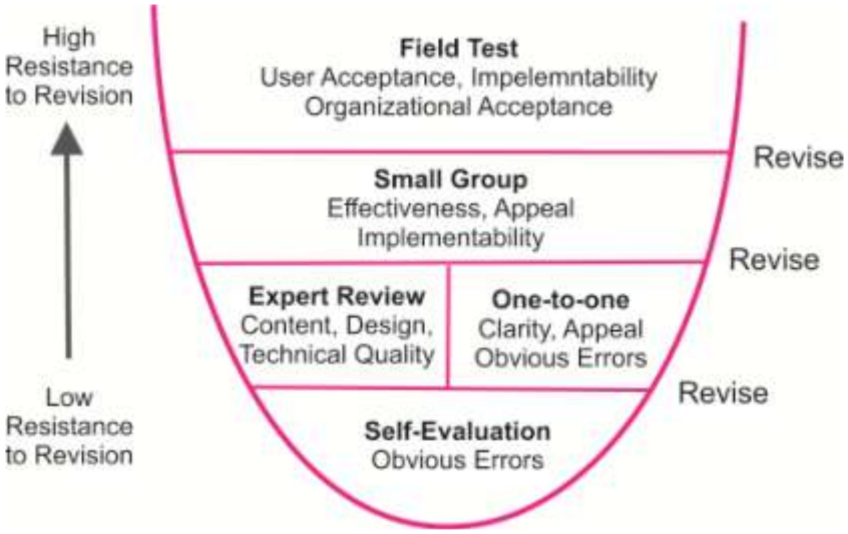

Figure 1. Layers of formative evaluation[9]

The instruments used in this research was; 1) the instruments on the preliminary stage include requirements questioner, and interview guidelines. 2) Validity sheet, 3) practicality questioners. The instrument at the preliminary investigation stage was a questionnaire requirement given to high school students of class XI, and interview guidance given to high school chemistry teacher in Padang functions to identify problems in chemistry learning process especially reaction rate. The validation sheet functions to assess the prototype generated in terms of component content, constructs, language, and graffiti. Practicality questionnaires function to evaluate the prototypes that have been generated in terms of usability, efficiency of learning time, and benefits.

Data obtained from the validation sheet and the practicality sheet were analyzed using the Cohen kappa formula to obtain the kappa moment.

$$\text{Kappa moment (k)} = \frac{P_o - P_e}{1 - P_e}$$

Were*k*is Kappa moment describing validity of theproduct, P_o isrealized proportion; counted by summing the score given by validators and then divided it by maximum total score, and $P_e$is Unrealized proportion; counted by substracing the maximum total score with the sum of total score given by validator, which then devided by maximum total score.

Table 1. The category of decision based on Kappa moment (k)[10]

Interval	Category
0,81-1,00	Very high
0,61-0,80	High
0,41-0,60	Medium
0,21-0,40	Low
0,01-0,20	Very Low
> 0,00	Invalid

3. Result and Discussion

3.1 Results

3.1.1 Preliminary Stage

Needs analysis
Based on the results of interviews conducted on 3 high school chemistry teachers in Padang, and questionnaires to 20 high school students of XI class known that the teaching materials used in the learning process of chemistry on the topic of reaction rate using printed books that have not fully meet the demands of curriculum 2013 which demands students to be more active in learning processes, learning materials cannot lead students to learn independently because the language used of books are difficult to understand by students, learning materials used only involve 2 levels of macroscopic and symbolic chemistry representations level, has not included sub-microscopic level that can help students understand the matter of reaction rate in depth. In addition the learning materials used also have not used an interesting color combination, so it has not been fully able to motivate students to understand the concepts on topic of reaction rate. Therefore, a learning material is an impportant that can enhance the students' active role in the learning process and is equipped with macroscopic, submicroscopic, and symbolic levels that are presented with attractive color combinations and easy language to understand by students so as to help students learn independently to understand concepts on topic reaction rate. One of the teaching materials that can be used is chemistry triangle oriented module using scientific step of learning.

Curriculum Analysis
The curriculum analysis was done by analyzing the curriculum and syllabus used. The curriculum used in the study of chemistry especially on the material of the reaction rate is the curriculum and syllabus 2013. Based on the analysis of curriculum 2013 it was known that the practice of learning in the curriculum 2013 using scientific learning approach system. The system of scientific learning approach guides students to learn independently and play an active role during the learning process. Learning by using scientific learning approach is a learning process that adopts scientific steps through observing, asking, collecting data, associating, and communicating activities (5M activities). Learning practice by using scientific learning approach will be done well when facilitated with appropriate learning materials. One of the learning materials that can be used is a module compiled by using scientific learning approach.

Based on the syllabus analysis of the topic reaction rate, it was known that there are four basic competence (KD) that must be mastered by students after studying the topic of reaction rate that is understanding the collision theory in chemical reaction based on the effect of temperature on the average rate of particle matter and the influence of concentration on the collision frequency (KD 3.6). Determining the reaction order and reaction rate constant based on experimental data (KD 3.7). Present ways of arranging material storage to prevent uncontrollable changes (4.6), and Designing, conducting, concluding and presenting experimental results of factors affecting reaction rate and reaction order (4.7) Based on these basic competencies can be formulated indicators of learning and objectives learning.

Students Analysis
Student analysis was done to know the characteristics of students, which include; Age, student preferences, student needs in terms of the desired teaching materials. So also with student activities in learning, and difficulties encountered students in understanding the material.

High school students, grade XI have an average age of 15-17 years and are in the formal operation phase, the main characteristic at this stage was that students begin to solve abstract problems that can be symbolically represented. Based on the results of interviews with several chemistry teachers in Padang, it was found that students who was in grade XI IPA had different academic ability, there was students who had high academic ability, moderate, and low, as well as student motivation and psychomotor depend on how students' attitude in response to the lessons given by the teacher.

Based on the results of interviews with some high school students in Padang, it was found that students prefer to study with the illustrations or images presented in learning materials related to the material and the images can be observed both in Daily life as well as observations in the lab. Students was more likely to like soft colors. In learning activities students often feel bored when the teacher explains the lesson for too long.

Based on these characteristics, the module was designed to facilitate students to be active in learning that can guide students actively construct their knowledge independently, presented with attractive colors and language that is easily understood by students, and equipped with pictures that can be observed significantly (Macroscopic images), macroscopic images are described at the submicroscopic level and supplemented by symbolic levels in order for students' understanding on topic of reaction rates.

Concept Analysis
The concept analysis aims to determine the content of the subject matter to be studied by the students and arrange it systematically according to the order of presentation. In the concept analysis is also done the identification of facts, concept, and procedural. Factual reaction rate material is the factors that influence the rate of reaction, the symbol of reaction rate, the sample fast reaction the low reaction. Conceptual rate material is the concept of reaction rate, effective collision, activation energy, reaction rate equation, reaction order and reaction rate constant. While the material of the reaction rate which is procedural is the steps to determine the equation of reaction rate, reaction order and reaction rate constant.

3.1.2 Prototyping Stage

Prototype I
Prototype I is a prototype generated from the design and realization of the preliminary research stage. Prototype I was designed using the learning stage of the scientific approach containing chemistry triangle.

At this stage a draft of teaching materials was produced in the form of chemistry triangle oriented module. The draft meant was; module's cover, module usage instructions, competencies to be achieved, student activity sheets, students' work sheet, test sheets, and test sheet locks. The cover of chemistry triangle oriented module contains the identity of module title, module name, author name, author's supervisor's name, author's agency, and target. The title and name of the module serve to inform the module user about the material discussed in the module and aspects used in the module development. The author's name, the author's supervisor's name, and the author's agency function to provide information to the module user about the module's author, the lecturer and the agency of the author.

The module cover page was designed in soft colors, with a blue background, and images related to the reaction rate material. Soft colors like blue are the most popular colors, in addition the blue color depicts trust, comfort, and also pleases the eye[11]. Images of rotted apples, rusted bridges, and fireworks show the slow, rapidly observing events of chemical reactions observable in everyday life, they are related to the rate material of the reaction.

The module usage instructions consist of instructions for teachers and instructions for students. Instructions for teachers are provided to provide teachers with information on the various activities that teachers should undertake during the lesson, while guidance for students is provided to guide students in order to learn independently. Competence to be achieved which consists of Core Competence (KI), Basic Competence (KD), Indicator and learning objectives presented aims to enable module users to know and understand the competencies that must be achieved.

The student activity sheet contains the subject matter that must be mastered by the students. The student activity sheet was designed using the learning stage of the scientific approach. Stages of the scientific approach have five stages of learning that was; stage observing, questioning, associating, gathering information, and communicating.

The worksheet was used to answer the questions or problems to be solved based on the material on the student activity sheet. The key worksheet was given to enable students to self-evaluate their work on the worksheet. A test sheet was an evaluation tool used as a measure of success or whether a goal has been achieved in the defined prototype. The test sheet key was given as a self-correcting tool to the assessment performed.

Prototype II

The prototype I that has been produced was evaluated through self evaluation. Self evaluation done with check list system aims to check the completeness of module components. Based on the results of self evaluation was know that the module did not have a list of images and a list of literature that was the components of module, in addition to the prototype I was still found a lot of deficiencies so it needs a revision. Revisions made included; 1) changing the sub-microscopic level model at the observing stage with a macroscopic model or observable phenomena in real-life daily, the macroscopic picture was related to the subject matter that the student will learn so that the student will be more motivated to learn. This is in line with that disclosed by Daryanto observing stage is the stage of cultivating students' interest to lear, because students will feel challenged, and increase students' curiosity[12], 2) add the H2O molecules and HCl molecules due to the HCl 6M solution and change the sub-microscopic level of HCl molecule into H+ and Cl- ions. The addition of H2O molecules due to the HCl 6M solution contains water molecules andHCl molecules, water molecules serve as solvents, while changing the sub-microscopic level of HCl molecules into H+ and Cl- ions based on arrhenius acid theory, HCl if dissolved in water will produce H+ ions, 3) adding the list of imges and literature on prototype I. Based on the revision made to produce prototype II.

Prototype III

Prototype III was a prototype resulted from revisions made in prototype II, at this stage formative evaluation was done in the form of one-to-one evaluation and expert review. Based on the results of interviews obtained the picture that, the existence of models in the form of images presented by involving chemistrymultirepresentation as aspects of macroscopic, sub-microscopic, and symbolic, can guide students in finding and understanding the concept on topic of reaction rate. In terms of language use in modules, the language used in the module was easy to understand. In addition, in terms of design cover and color selection, prototype II can make students interested and passion to learn it.

Assessment of this expert aims to obtain a valid prototype scientifically. Validation of chemistry triangle oriented module on topic of reaction rate was conducted by 5 validators consisting of 3 lecturers of Chemistry Department UNP and 2 high school chemistry teachers in Padang. Validation data from prototype II can be seen in Table 2.

Table 2. Assessment Data of Module Validation

No	Components	Kappa moment (k)	Category
1	Content	0,8	High
2	Construct	0,89	Very High
3	Language	0,91	Very High
4	Graphics	0,89	Very High
	Average kappa moment	0,87	Very High

Validation results from the four components assessed, showed that the generated prototype II was valid with a very high category of validity. However, there was still a need for revisions on several parts of the prototype II. Revisions made included; 1) constantly writing the phase of the substance in the equation of the reaction, before the revision phase of the substance in the equation there was a reaction that was parallel to the chemical formula and there was also written as the bottom index. The writing og the phase of the substance in the equation of the reaction according to the IUPAC rules is written as an index below or parallel to the chemical formula but in its writting tilted, 2) increase the number of solvent molecules on the sub-microscopic representations of the reaction between the Mg band and the HCl solution, that was because before the revision the number of solvent molecules was less than the number of solute molecules, based on the theory in a solution the amount of solvent is more than the solute. The revision made a valid prototype III.

Prototype IV

Prototype IV was a prototype generated from revisions made on prototype III. At this stage a formative evaluation was conducted in the form of small group trials. The prototype III practicality data on small group test can be seen in Table 3.

Table 3. Data on the results of students' practicality in small group evaluation

No	Components	Kappa moment (k)	Category
1	Ease of use	0,8	High
2	Efficiency of learning time	0,85	Very High
3	Benefits	0,78	High
	Average kappa moment	0,81	Very High

Based on the results of data analysis of practicality on small group evaluation to the prototype III, it was gotten the average kappa moment of all components of practicality is 0.81 with very high practicality category. However, although prototype III had shown very high practicality, there was still parts of the module that need to be fixed. Revisions made include; changing the sub-microscopic level of HCl 6M, before the revised HCl 6M sub-microscopic solution consisted of H^+ and Cl^- ions, and H_2O molecule, after revision, sub-microscopic level of HCl 6M solution consisted of H_3O^+ and Cl^- ions. Revisions made to produce prototypee IV. The prototype IV that has been valid and practically carried out field test to obtain the level of practicality of prototype IV.

3.1.3 Assessment Phase

Field tests were conducted for one chemistry teacher at SMA N 10 Padang, one chemistry teacher at SMA Bunda Padang, and 25 students of class XII MIA 6 SMAN 10 Padang. Practicality data of prototype IV on field test can be seen in Table 4.

Table 4. Prototype practicality data on field test

	Kappa moment (k)	Category
Teacher reponse	0,96	Very High
Student responce	0,83	Very High

Questionnaire teacher response showed that prototype IV has a very high practicality category with value of kappa moment 0,96. Questionnaire student response indicated that prototype IV has a very high practicality category with value of kappa moment 0.83. Based on practicality data given by practitioner, it can be concluded that chemistry triangle oriented module was very practical and can be used in chemistry learning process on topic of reaction rate for Senior High School level grade XI.

3.2. Discussion

3.2.1 Validity of Chemistry Triangle Oriented Module on Reaction Rate Material

Validation of the chemistry triangle oriented module on topic of reaction rate material was determined by 5 experts consisting of three chemistry lecturers FMIPA UNP and two high school chemistry teachers in Padang. This is in line with the opinion put forward by Sugiyono that to test the validity of the instrument, can be used expert opinion (judgment experts) the minimum number of three people[13].

Assessment given by the validator was analyzed by using kappa cohen formula to obtain kappa moment. The kappa moment indicates the validity of a product. Assessment done includes the assessment of component content, construction, language and graffiti.

The validity of the content of chemistry triangle oriented module on topic ofreaction rate has a kappa moment(k) was 0.80 with a high validity category which means that the material contained in the module has been in accordance with the curriculum applicable which was Curriculum 2013 and has been in accordance with the demands of Core Competence (KI) And Basic Competence (KD) which are elaborated into indicators of learning and learning objectives. As submitted by Depdiknas that to produce a meaningful module and can be easily used by learners, the module should describe the basic competencies, indicators, and learning objectives to be achieved by the students[1].In addition, the components contained in modules such as models or drawings are in accordance with the learning indicators to be achieved and can help students understand the concept and answer the questions presented in the module. This is in line with the Depdiknas opinion that the presentation of images / models in a teaching material is needed so that students can master the Basic Competence to be achieved, see the picture / model higher than the meaning of reading or listening. In addition, the questions have led the students to the achievement of predetermined indicators and learning objectives[1].

Construct validity the chemistry triangle oriented module on topic of reaction rate has a kappa moment (k) 0.89 with a very high validity category. This means that the module has been presented in a specific, systematic and clear manner ranging from titles, Core Competencies, Basic Competencies, indicators, learning objectives, models, questions, and exercises. Modules are arranged systematically, and the clarity of indicators and learning objectives to be achieved will facilitate students in learning, and students will learn in a direction. This is in accordance with opinion of Nasution that one of the advantages of learning presented clearly and specifically is the students' learning becomes directed[14]. In addition, the concepts contained in the module do not conflict with each other. This is in line with that proposed by Rochmad that the construct validation is used to check whether the components of one model are not in conflict with the other model components[15].

The validitylanguagecomponent of the chemistry triangleoriented module on topic of of reaction rate has a kappa moment(k) 0.91 with a very high validity category. This indicates that the chemistry triangle oriented module uses a clearly readable form and letter size, the instructions and information presented in the module are clear, and the language used in the module meets the Indonesian rules of good and correct, and easy to understand. In accordance with the submitted Depdiknas that to produce a good teaching material, then it is necessary to evaluate the linguistic components that include; legibility, clarity of information, conformity with good and correct Indonesian rules, and clear language utilization[1].

The validitycomponent graffiti of the chemistry triangle oriented module on topic of reaction rate has a kappa moment(k) 0.89 with a very high validity category. This means that the model presented can be clearly observed, the type of letters used can be read, regular layouts, and the colors used can attract students' attention.

Overall the average value of the validity test of the chemistry triangle oriented module on topic of reaction rate is 0.87 with the category of very high validity. This proves that the module has fulfilled the four aspects of the validity test based on the validator's assessment so that this module can be used as a teaching material in the chemistry learning process at the reaction rate topic for Senior High School students Grade XI.

3.2.2 Practicality of chemistry-oriented triangle module on reaction rate material

Practicality refers to the level of ease in use, time in the implementation, as well as the attractiveness of teaching materials to student interests in the learning process[16].The practical data of this module was analyzed by using kappa cohen formula to obtain the kappa moment value. The kappa moment indicates the product's practicability.

The result of practicability analysis toward the module produced based on questionnaire of teacher response has very high practicality category with kappa moment value 0.96 and based on questionnaire of student response on small group test result of practical analysis has very high category with kappa moment value 0,81, and result of questionnaire analysis of student response on field test has very high category with kappa moment value equal to 0,83. Therefore, assessments include assessment of easy using, efficiency of learning time, and benefits.

The results of data analysis module practicality based on teacher response questionnaire provide a very high value of practicality. The modules have been prepared based on basic competence (KD) in accordance with those listed in the curriculum subject syllabus of 2013.

In terms of ease of use, chemistry triangleoriented module is considered practical with a value 0.99. This indicates that the module already has clear and easy-to-understand usage instructions, so the teacher knows the steps to be taken in the learning process. Sudjana and Rivai states that the instruction for teachers aims to make the teacher perform the lesson efficiently[17]. In addition, modules are made practically on the ease of use aspects of the language. It is evident from the teacher's reply that the language used in the module is easy to understand. In addition, the macroscopic, submicroscopic, and symbolic representations presented in the module are easy to understand so as to help students understand the concept of reaction rate. This is in line with Chittleborough, so that students better understand the chemistry in depth then in the learning process chemistry needs to involve multi representation chemical namely; Macroscopic aspects, submicroscopic aspects, and symbolic aspects[4].

In terms of efficiency of learning time, chemistry triangle oriented module on reaction rate material has been proved to be efficient when used in learning. This is seen from the results of practicality test by teachers who claim practical with a value 0.93.

In terms of the benefits of chemistry triangle oriented module on the reaction rate material is considered practical with a value 0.98. This is indicated by the teacher's reply that the chemistry triangle oriented module on topic of reaction rate can assist or replace the teacher's role in explaining the reaction rate because the activities contained in the module are presented very clearly, systematically, and easily understood by the students, so teachers have plenty of time to monitor student learning activities.

Student module practicality test was done in three stages: one-to-one, small group, and field test. The one-to-one evaluation aims to see the real errors of the developed module. Students engaged in a one-to-one trial consisting of three look at the whole section of the module and try to answer using a small portion of the module, then assess the module that had been developed. The data collection instrument used in the one-to-one test wasan interview sheet, based on the answers given by the students, it can be concluded that the module that has been developed was interesting and can foster the spirit of the students in reading and studying the module.

Small group evaluationaim to see the practicality of modules developed. Students involved in small group evaluation are six students. Based on the analysis of the practicality results in small group evaluation obtain kappa moment 0.81 with the category of very high practicality.

Field test involves 25 students of class XII. Based on the analysis of the results of field testing practice, the kappa moment was 0.83 with very high practicality category. This practical value was the average of three aspects of the practicality test, namely ease of use, efficiency of learning time, and module benefits.

In the terms of the ease of module use, chemistry triangle was considered practical. This shows that module has a clear and easy to understand instruction, so the students know the steps that have to be done in the learning process. In addition, in the term of the ease of language use was considered practical. This was proven from the answers and the comments given by the students on the practicality questioners at the field test which states that the module was easy to understand. Thus this has addressed the obstacles often faced by students who often have difficulty in understanding the teaching materials that are presented with an elusive language.

In terms of efficiency of learning time oriented module, chemistry triangle was considered practical, this was reflected from the answers given by students. Students can learn at their own learning speed. In connection with thisNasution states that the purpose of learning with the module is to open opportunities for students to learn according to the speed of each[14]. In addition, the learning time becomes more efficient with the use of chemistry triangle oriented modules in the learning process. This is demonstrated by the answers given by the students. This is in line with the opinion of Suryosubroto states that the purpose of the use of modules in the learning process one of them is that indicators and learning objectives can be achieved efficiently and effectively[18].

In terms of the benefits, chemistry triangle oriented modules considered practical, this was illustrated by the answers given by students, which states that the module was very helpful for students to understand the concepts on the material reaction rate well, and the use of modules in the learning process can improve the spirit of students for learning, also students can learn independently and in accordance with the speed of each learning. This is in line with Suryosubroto who states that the purpose of the use of modules in the learning process one of which is that learners can understand as much as they can and conduct learning activities independently[18].

To prove the chemistry triangle oriented module on the reaction rate material has a very high practicality, it has been done an analysis of the answers of students in answering questions in the module. Based on the results of the analysis module that has been done, the result that the average percentage of student value on Student Activity Sheet is 83.44%, Student Worksheet is 94%, and on the Evaluation sheet is 85.60%. This data indicates that the module prepared can be used and understood by the students.

Overall, the results of practicality test of the triangle chemistry-oriented module are practical and can be used easily for teachers and students because the modules have been designed with scientific approach stages in accordance with the demands of the 2013 curriculum, as well as the presentation of models presented by involving all three aspects of chemical representation, that was; Macroscopic representations, sub microscopic representations, and symbolic representations that help students to understand concepts and assist teachers in teaching and learning.

4. Conclusion

Based on the result of research and development of chemistry triangle oriented module on reaction rate material for learning chemistry at Senior High School level students grade XI can be concluded that chemistry triangle oriented module on reaction rate material can be developed with Plomp development model. The final product of the developed module has a very high category of validity and a high degree of practicality.

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