The Science Environment Technology Society (SETS) based e-module development with project based learning model in colloidal learning

W Azura¹, A Silalahi², M Zubir², and Nurfajriani²

¹Student of Chemistry Education Departement, Graduated School of Universitas Negeri Medan, Jl. Willem Iskandar, Medan, Indonesia
²Lecturer of Chemistry Education Department, Graduated School of Universitas Negeri Medan, Jl. Willem Iskandar, Medan, Indonesia

E-mail: azurawan@mhs.unimed.ac.id

Abstract. Online learning prefers to use electronic teaching materials, one of the teaching materials used is e-modules as a learning resource that can improve students' abilities. This form of inquisition is oriented to R&D (Research & Development) with the application of the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Research for implementation of e-module based using pre-experiment design with One Group Pretest-Posttest Design. The sample selection was done by purposive sampling technique, the samples studied were students of SMA Negeri 1 Tanjungbalai as many as 32 students. The instruments used are the BSNP questionnaire and the description test High Order Thinking Skill (HOTS). The results showed that the development of SETS-based e-modules with the PjBL model on colloidal learning: (1) the average feasibility of developing e-modules for all BSNP criteria was eligible (content feasibility = 3.54, language eligibility = 3.59, presentation feasibility = 3.84 and the feasibility of graphics = 3.68, then the e-module is feasible to use, and (2) its use has an effect on increasing High Order Thinking Skill students'(HOTS) (with an N-gain of 0.44).

1. Introduction

The development of education in the Age of Revolution 4.0 has undergone a transformation of globalization into education innovation that aims to produce graduates who have skills in innovation and digital technology. Skills based innovation thinking skills to find the original idea. In addition, the use of digital technology as a source of learning to produce media with various information found so useful to facilitate the learning activities that have the life skills and career [1]. The use of technology in emergency conditions is needed. This makes it easier for teachers and students to communicate so that the delivery of learning materials remains effective and the coordination of teachers is maintained [2]. Changes in online learning activities are a challenge for the education community such as the ability to use technology, with appropriate equipment to access the information, strategies used in learning, programs that meet the learning needs for laboratory activities, and assessment process [3]. Understanding the colloid concept can be applied to people's lives, so that there are not misconceptions when receiving colloid material delivered. The colloid material delivered is problem-based so that the delivery of concepts is easy for students’ understanding [4]. Colloid chemistry is
contextual related to everyday life. Contextual phenomena in colloidal material presented in the form of a video by using interactive media [5]. Besides learning colloid can also improve science process skills, orientation chemo-entrepreneurship by creating a colloidal products [6]. The PjBL models can be applied to learning using a contextual approach (CTL), especially on colloidal material that can increase the interest in entrepreneurship and improve student learning outcomes by conducting experiments in learning activities [7]. The role of chemistry learning, especially on colloidal material as the benefits applicable to create outputs that are convenient to public. Learning colloid chemistry, especially on the material as a benefit applicable to produce products that are useful to society. Communities that have intelligence in their intellection (problem-solving skills, censorious thinking, and inventiveness) are included into Higher Order Thinking Skills (HOTS) [8]. HOTS seen from the draft to an idea in solving problems, differentiate, organize, associate, analyze the problem so as to provide the right answers through information received. Student involvement in the resolution of the existing problems is an aspect that needs to be developed to improve the HOTS owned by the students [9]. In keeping with the times, then developed a module-based technology called e-modules, development of e-learning modules as a medium capable of supporting the learning process so as to be flexible, efficient, effective, and enhance students' understanding of concepts so as to solve the problems [10]. Chemical learning process requires media contribute to learning activities by making use of technology, so that the development of e-learning modules on chemical processes be needed. Feasibility e-module suitable standards for has distinctive features animated videos attract students learning to read and watch videos that improve student literacy skills [11]. One of the innovations of instruction element in the type of modules can be developed with the application of Science Environment Technology and Society (SETS). SETS is very effective to promote students' ability to innovate to solve environmental problems and stimulate high-level thinking skills of students. SETS is an approach that connects aspects of science, technology, social and environmental, scientific literacy and technology which adds to the experience of students to conduct social interaction and launched an investigation of environmental issues [12]. SETS is an approach to scientific learning and technological literacy that is integrated with the values and ethics in the community for the solution of environmental problems [13]. During the distance learning activities distinct learning, because students and teachers must adapt to a new environment, so the impact on student learning outcomes minimum than the maximum, the teacher is the difficulty in managing the learning activities, teachers should provide materials that can be accessed online students and uploading tasks in the file different. For activities of conference only a few times because the ability of teachers and students is still limited in the use of technology. So students come to school in turn by observing health protocols. Students' needs for clean water, soap, hand sanitizer, masks and nutritional intake must be considered. The environment around the school is still relatively beautiful with various natural potentials that can be used as materials for clean water supplies, soap making, hand sanitizers and nutritious jelly for the community's immune system. The processing of these materials can be realized if there is insight of science. researchers are interested in conducting research related to the development of SETS-based e-modules with PjBL models in colloidal learning.

2. Method
This type of research is oriented towards development research. The steps used are ADDIE developed by Dick and Carey which consists of 5 stages (1) analysis; (2) designs; (3) development; (4) implementation and (5) evaluation (Sugiyono, 2010). The stages in the research are as follows:

2.1 Analysis
The analysis activity is the first stage, by analyzing the teaching materials used by the previous students when learning chemistry (Appendixes 1 and 2), looking at the chemistry learning outcomes of class XI MIA students in the previous lesson, analyzing the chemistry material for class XI on the
syllabus that is in accordance with the SETS approach and the model. PjBL, analyze KD and indicators on colloidal material to compile colloidal material, and analyze the instrument questions used by teachers in learning. After that, prepare a lesson plan on colloid subjects.

2.2 Design
The results of the analysis stage are continued at the design phase. It is by making an e-module design in the form of a cover and presenting the contents of the e-module by providing a cover model related to chemistry, determining the colloidal material developed in the e-module that is contextual in nature, compiling test instruments (objective and subjective questions) along with the key. answers and collection of images, videos, and links for e-module design.

2.3 Development
The SETS-based colloid e-module production stage is based on a description of the activities that have been carried out previously. Making e-modules using the help of online flippingbooks, making e-module products according to the SETS approach and the PjBL model, developing e-modules based on BSNP standart, validating material experts and media experts by lecturers and teachers in the field of chemistry and making revisions to e-module improvements. The standardization test based on this modified BSNP includes 4 aspects, namely: (1) content feasibility; (2) language eligibility; (3) the feasibility of presentation; and (4) the feasibility of graphics. The data obtained are in the form of a check list (√) in the score column 1 to 4, namely: (1) disagree; (2) disagree; (3) agree and (4) strongly agree. The research is in the form of qualitative research, so that data processing from each validator is carried out with a description of the percentage, namely:

\[ P = \frac{\sum q}{\sum r} \]

Information:
\( P = \) The score obtained, in this case is the percentage component of the SETS-based colloid content standard assessment component according to the BSNP.
\( \sum q = \) Number of concept with a mark (✓) in the e-module-based colloid SETS in SMA / MA class X semester.
\( \sum r = \) The number of concepts in the SETS-based colloid e-module SMA/MA class XI even semester.

2.4 Implementation
After the SETS-based colloid e-module has been categorized as feasible based on the assessment of the validators, the next step is the SETS-based e-module will be implemented in class XI MIA 5 high school students using the PjBL model to see the effectiveness of developing SETS-based e-modules on learning outcomes. Research for the implementation of e-module based using pre-experiment design with One Group Pretest-Posttest Design. The sample selection was done by purposive sampling technique, there are 32 students of SMA Negeri 1 Tanjungbalai as the sample. The instruments used are the BSNP questionnaire and the High Order Thinking Skill (HOTS) description test.

2.5 Evaluation
The researcher evaluates the SETS-based colloid e-module with the PjBL model that has been developed through the overall activities carried out, so that a SETS-based colloid e-module is produced.

3. Results and Discussion
This study aims to develop a learning module based on Science Environment Technology and Society with the PjBL model on colloidal material for high school. The learning modules developed must meet the standards set by BSNP and the composition of the material is arranged in accordance with the
Chemistry Syllabus for Class XI High School Curriculum 2013. The stages of research that have been carried out are in the stages of Analysis, Design, Development, Implementation, and Evaluation. The data described in this study include data: (1) initial analysis of teaching materials on colloidal materials used by senior high school students of class XI even semester as many as 2 publishers using instruments that have been standardized by the modified BSNP; (2) analysis of teaching materials in the form of modules developed based on the modified BSNP by 2 validators; (3) data on the acquisition of students' chemistry learning outcomes on colloidal material after apply the e-module.

3.1 Analysis of Teaching Materials on Colloidal Materials

The analyzed books are 2 books with different authors and publishers refer between books A and B. The standardization test based on this modified BSNP includes 4 aspects, namely: (1) content feasibility; (2) language eligibility; (3) the feasibility of presentation; and (4) the feasibility of graphics. The data obtained are in the form of a check list (√) in the score column 1 to 4, namely: (1) disagree; (2) disagree; (3) agree and (4) strongly agree. The feasibility level for books A and B is done by analyzing using standards. The data from this research is in the form of qualitative research, so that data processing from each validator is carried out with a description of the percentage. The data obtained by the researcher after analyzing books A and B are shown in figure 1 below:

Based on the data above, all aspects of the assessment in the form of content feasibility, language feasibility, presentation feasibility, and graphics, each got a score of 3.15; 3.33; 2.6, and 3.2 concluded that the analyzed book A is feasible to use without revision so that book A can be used. used by students in the learning process. While book B obtained data on content feasibility, language feasibility, presentation feasibility, and graphic feasibility with a score of 3.08, 3.5, 2.8 and 3.5 so it was concluded that book B was suitable for use without revision, so students can also use book B in the learning process as teaching material.

Based on the analysis of these teaching materials, researchers have an idea to develop teaching materials that students can use in a more practical form, due to the development of the era to the era of digital technology. Then based on the analysis of student needs in Appendix 2, it was found that online learning only uses printed books and additional material provided by the teacher in word form. Students have not been given learning e-modules. During online learning students never do project assignments, assignments are only test questions that are done at home. Based on the analysis of teaching materials and needs analysis, the researcher wants to develop e-modules that can be used in this digital era. Development of e-modules for class XI students on colloidal materials. The development of e-modules aims to make it easier for students to
carry out learning activities, because e-modules are practical and can be accessed freely. The development of e-modules is structured using the PjBL model and is based on SETS so that students have additional tasks in the form of project assignments that combine scientific, environmental, technological and social theories. The development of e-modules goes through several stages so that they are suitable for use as teaching materials.

3.2 Design of SETS based E-module with PjBL Model in Colloidal Learning
At this stage the researcher designs the e-module based on the feasibility of presenting and graphics that were previously done so that the e-module is feasible to use and uses technology assistance, namely an online flippingbook, so that it can be accessed freely. E-modules are arranged with the right systematic, table presentation, images have identity and references. The cover display and some of the contents of the e-module can be seen in Figure 2 below:

![Figure 2. Design of SETS based e-module with PjBL model in colloidal learning.](image)

Based on Figure 2, the graphic of the e-module is presented using A4 paper size, the design of the e-module cover and the layout of the image is adjusted to the background so that it looks harmonious. There is an e-module using a white background and additional yellow and black, while the writing color is orange and black. This is important so that the e-module becomes the center of the student’s point of view. The use of color describes chemical nuances, especially colloidal materials. In addition, the use of letters on the e-module shell and large titles uses Rockwell Extra Bold, while for the content of the material on the e-module using Times News Roman for the contents of the book with a font size of 12. For problem identification, youtube links, videos, image links, links Game and journal links are presented in colored boxes to be the center of attention.

3.3 Development of SETS based e-module with PjBL Model in Colloidal Learning
At the development stage, it is compiled based on basic competencies that must be achieved and compiled into several indicators, namely (1) Analyzing solutions, to distinguish solutions, colloids, and 1uspense, (2) Explain the types of colloids and the properties of colloids, (3) relate the colloid system and their properties, (4) Distinguish between lyophobic and hydrophobe colloids, (5) Explain the purification of colloids, the manufacture of colloids, and their role in everyday life. days and (6) Conducting experiments on the manufacture of food or other products in the form of colloids. Therefore, the scope of the material is structured as follows: (1) understanding of colloidal systems (2) types of colloids (3) properties of colloids (4) making colloids (5) the role of colloids in daily life. The
scope of the material is loaded using a concept map to make it easier for students to understand the concepts learned in colloidal material. The results of the SETS-based e-module development with the PjBL model can be seen in Figure 3:

Figure 3. Development e-module with video.  Figure 4. Development e-module with SETS.

Figure 3 and 4 shows that the e-module development is presented using the PjBL model and is based on SETS (Science, Environment, Technology, and Social). In the e-module there is a PjBL syntax that be begun with the identification of problems related to everyday life, which is presented by introducing concepts and principles to connecting between concepts by paying attention to basic competencies. In addition, it is also presented in accordance with facts in life that are relevant and up to date so as to stimulate student curiosity and develop life skills that exist in students. In addition, the developed e-module is also equipped with learning videos and youtube links to make it easier for students to access information and better understand learning accurately based on existing facts, there are educational games so that students enjoy learning activities more. At the end of the e-module there is a summary, test instrument, and a glossary.

Table 1. The relationship between the SETS approach and the PjBL model.

| SETS Approach                                      | PjBL Model                                 |
|---------------------------------------------------|--------------------------------------------|
| Introduction SETS: identify environment problems related to colloids | Syntax 1: Determination of the underlying question |
| Concept generation: students design a project to solve an environmental problem | Syntax 2: Project design |
| Analyzing: students analyze, understand the concept of problems, complete project assignments. | Syntax 3: Scheduling |
| Communicating: students report the results of project assignments they are working on | Syntax 4: Project Progress Monitoring |
| Evaluation | Syntax 5: Test results |
| Syntax 6: Experience Evaluator |                                                   |

Based on the linear relationship between the SETS approach and the PjBL model. Where approaches and learning models lead to product creation. So that students' abilities can be explored during practical activities to complete project assignments. The selection of learning approaches and models must be appropriate so that learning activities are conducive. SETS-based project activities with the PjBL model are only the initial foundation so that students are able to understand the steps to complete
project assignments, but students themselves are the ones who innovate in carrying out the process from beginning to end of creating the product.

3.3.1 The Assessment Feasibility Test of E-module based SETS with PjBL model in Colloidal Learning

The results of the assessment based on BSNP standards that have been modified by 2 expert validators include content feasibility, language feasibility, presentation feasibility, and graphic feasibility.

3.3.1.1 Content Feasibility

The evaluation of e-modules based on the content feasibility is generally available in Table 2:

| No | Indicator                                | Validator 1 | Validator 2 |
|----|------------------------------------------|-------------|-------------|
| 1  | SETS-based e-module organization         | 4           | 3.5         |
| 2  | Colloidal Matter Coverage                | 4           | 3.67        |
| 3  | Concept Truth                            | 3           | 3           |
| 4  | e-module load                            | 2.25        | 4           |
| 5  | E-module development                     | 4           | 4           |
|    | Amount                                   | 17.25       | 18.17       |
|    | Average                                  | 3.45        | 3.63        |

The results of the SETS-based e-module analysis with the PjBL model on colloidal learning by 2 expert validators using the modified BSNP standard, based on the feasibility of the content, were feasible. Feasibility of content includes organizing the e-module for validator 1 giving a score of 4, validator 2 giving a score of 3.5, the coverage of material assessed by validator 1 given a score of 4, validator 2 giving a score of 3.67, for the validity of the second concept the validator gives a score of 3, the content of the e-module validator 1 gives a score of 2.25 and validator 2 gives a score of 4, the aspects developed in the second e-module validator give a score of 4.

The preparation of colloid material in the SETS-based e-module with the PjBL model is in accordance with the basic competencies in the revised K-13, the scope of the material describes competency standards to be achieved. The concepts presented already connect science, technology and everyday life, so that students understand more easily because they are in accordance with existing facts. The material presented is quite up to date, but the validator provides suggestions for finding the latest references. In addition, the identification of the problems presented in the e-module increases students’ curiosity regarding the facts. Practical activities in the form of project assignments are presented based on SETS, thus developing students’ life skills, students better understand science concepts with phenomena that occur in the environment and take advantage of existing technology by presenting learning videos and youtube links to add information. Educational games are the main attraction for students to read the developed e-modules. The project assignments presented also motivate students to work together and take responsibility for the assigned tasks so that students interact with their classmates. In the e-module there are also instructions for using the e-module so that students can use the e-module independently, in the e-module there is also an introduction as an apperception of learning to motivate students to be interested in reading and arouse curiosity about the contents of the e-module that has been developed. At the end of the e-module also includes a summary, learning evaluation, answer key, glossary and index.
3.3.1.2 Language Eligibility

The evaluation of e-modules based on language feasibility is generally available in Table 3:

Table 3. The result of language eligibility.

| No | Indicator                                           | Validator 1 | Validator 2 |
|----|----------------------------------------------------|-------------|-------------|
| 1  | Language Eligibility                               | 3.5         | 4           |
| 2  | Suitability with the development of students       | 3.5         | 3.5         |
| 3  | Aspects of sentence clarity and level              | 3.75        | 3.5         |
| 4  | Writing Aspect                                     | 3.5         | 3.5         |
|    | Aspects of mastery of language, terms and symbols  | 3.5         | 3.5         |
|    | Amount                                             | 14.25       | 14.5        |
|    | Average                                            | 3.5625      | 3.625       |

The results of the validation of the SETS-based e-module with the PjBL model in colloidal learning developed based on the feasibility of the language obtained that the suitability of the language with the development of students gets a score of 3.5 from expert validator 1 and score 4 from validator 2, aspects of sentence clarity and readability get a score of 3.5 from the 2 expert validators, the writing aspect got a score of 3.75 and 3.5 from validators 1 and 2, the aspect of mastery of language, terms, and symbols got a score of 3.5 from the 2 validators. Based on the results of the language feasibility analysis for SETS-based e-modules with the PjBL model using the BSNP standard, it is found that the language used is in accordance with the thoughts of students, so students are easy to understand the material being read. The e-module is also communicative where there is an explanation of the illustrations provided, besides the language used is able to provide a basic picture so that it raises questions from the information read in the e-module so that the language in the e-module is interactive.

3.3.1.3 Feasibility of presentation

The evaluation of e-modules based on the feasibility of presentation is generally available in Table 4:

Table 4. The result of feasibility test on presentation aspect.

| No | Indicator                                           | Validator 1 | Validator 2 |
|----|----------------------------------------------------|-------------|-------------|
| 1  | Feasibility of presentation                        | 4           | 4           |
| 2  | E-module components                                | 3.67        | 4           |
| 3  | Cover design interest                              | 3.5         | 3.25        |
| 4  | Interest in the overall design of teaching materials| 4           | 4           |
|    | Completeness of presentation support in teaching materials | 4 | 4 |
|    | Questions lead students to draw conclusions        | 4           | 4           |
|    | Amount                                             | 19.17       | 19.25       |
|    | Average                                            | 3.834       | 3.85        |

The results of the validation of the SETS-based e-module with the PjBL model on colloidal learning developed based on the feasibility of the presentation obtained that the complete e-module component got a score of 4 from expert validator 1 and validator 2, interest in the cover design got a score of 3.67 from validator 1 and score 4 from validator 2, the overall design interest of the e-module got a score of 3.5 and 3.25 from validators 1 and 2, the completeness of supporting the presentation of the e-module got a score of 4 from the 2 validators, and the questions presented led students to easily draw conclusions and got a score of 4 from the 2 validators. Based on the results of the expert validator analysis, it was found that the consistency of the presentation, starting from the introduction to the learning evaluation, was contained in the SETS-based e-module with the PjBL module. The
presentation is also equipped with picture illustrations and there is a table that has an identity. At the end of the colloid material there is a summary or summary as the keywords of the material discussed. In addition, the presentation of the e-module uses the SETS (Science, Environment, Technology, and Science) approach which is in accordance with contextual colloidal material so that it is in accordance with the characteristics of learning. The preparation of the e-module also uses the PjBL learning model where the e-module presents project assignments on colloidal learning found in everyday life. The presentation of e-modules is also good because there is an evaluation of learning as an instrument of student learning outcomes on colloidal material. Overall the presentation of the e-module is very good.

The development of SETS-based e-modules with the PjBL model uses an online flippingbook which is accessed for free and only uses e-mail, the file or module is prepared in pdf form first and then uploaded, so that it becomes an e-module, then videos and youtube links can be added to be used as an e-module, source of student information. After that we get the e-module link without having to download flippingbook online. The development of learning media in the form of SETS-based e-modules with the PjBL model on colloidal learning is good, in the e-modules there are learning videos, youtube links, image links, and game links in the form of quizzes. This makes the developed e-module more attractive and is equipped with SETS-based experimental activities.

### 3.3.1.4 Feasibility of the graphic

The evaluation of e-modules based on the feasibility of graphics is generally available in Table 5:

| No | Indicator                        | Validator 1 | Validator 2 |
|----|----------------------------------|-------------|-------------|
| 1  | E-module size                    | 4           | 3.5         |
| 2  | E-module skin design             | 4           | 4           |
| 3  | E-module content design          | 3.25        | 3.33        |
|    | Amount                           | 11.25       | 10.83       |
|    | Average                          | 3.75        | 3.61        |

The results of the validation of the SETS-based e-module with the PjBL model on colloidal learning developed based on the feasibility of graphics, it is obtained that the size of the e-module gets a score of 4 from validator 1 and 3.5 from validator 2, the e-module skin design gets a score of 4 from validator 1 and validator 2, the content design of the e-module got a score of 3.25 and 3.33 from validator 1 and validator 2. Based on the results of the SETS-based e-module analysis with the PjBL model that the graphic feasibility was feasible because the open size was appropriate, namely A4, the material presented was in accordance with the title of the book. The cover design of the e-module is also interesting, because the colors used are bright and attractive, the color of the cover writing is also harmonious with the cover background, the layout of the text and images is also balanced. Illustration of the image on the cover with a chemical nuance that clarifies the contents of the colloidal material. In addition, the use of type and size of writing is also consistent. However, for the layout of the image content of the e-module, it needs to be more consistent so that it looks neat.

Based on the 4 aspects of the feasibility of the e-module, The summary of the assessment based on BSNP standards that have been modified by 2 expert validators include content feasibility, language feasibility, presentation feasibility, and graphic feasibility are shown in Figure 5 as follows:
Figure 5 shows that the results of the SETS-based e-module analysis with the PjBL model in colloidal learning using the modified BSNP standard, it is obtained that (1) the feasibility of the content with an average value of 3.54 means that it is suitable for use and does not need to be revised, (2) the feasibility of language with an average value an average of 3.59 means that it is suitable for use and does not need to be revised, (3) the feasibility of presentation with an average value of 3.84 means that it is suitable for use and does not need to be revised, and (4) the feasibility of graphics with an average value of 3.68 means that it is suitable for use and does not need to be revised.

### 3.4 Implementation of E-module Based SETS with PjBL Model in Colloidal Learning

The implementation of SETS-based e-modules with the PjBL model in colloidal learning has an influence on students' High Order Thinking Skills so that students' HOTS scores have increased. Based on the results of the normalized Gain value, the data in Table 4 is obtained as follows.

**Table 6. Normalized gain value.**

| Average n-gain | Classification | highest n-gain | lowest n-gain |
|----------------|----------------|----------------|--------------|
| 0.44           | Currently      | 0.69           | 0.17         |

Based on table 6, the average gain is 0.44 which means that there is an increase in student learning outcomes from the pretest and posttest scores in the moderate category after the application of the SETS-based e-module with the PjBL model in colloidal learning. The increase was influenced by students' High Order thinking Skill (HOTS), but is not in the high category gain, this is due to students who have not been able to understand the concept of colloid so that it is difficult for students to answer questions completely and in accordance with the concept of colloid material. Besides being seen from student learning outcomes based on the results of the answers to the description questions so that students are able to increase HOTS abilities based on aspects of interpretation, analysis, evaluation and providing information. In the SETS-based e-module with the PjBL model in colloidal learning, there are project assignments, where students are asked to make group reports using the SETS chart so that students' abilities can be explored during practical activities to complete project assignments. The selection of learning approaches and models must be appropriate so that learning activities are conducive. SETS-based project activities with the PjBL model are only the initial foundation so that students are able to understand the steps to complete project assignments, but students themselves are the ones who innovate in carrying out the process from beginning to end of product creation. It aims to improve students' High Order Thinking Skills, the following is a description of students' high order thinking on colloidal material, presented in Table 7 below:
Table 7. Description of students' high order thinking skills.

| High Order Thinking Skill | Description |
|---------------------------|-------------|
| C4 (Analyzing)            | Students are able to analyze the relationship between the concepts of matter and colloids, or between colloid concepts, and are able to analyze problems in the environment and relate them to the colloid concept. |
| C5 (Evaluate)             | Students are able to see the comparison of each type of colloid in a product, predict a scientific phenomenon related to colloidal properties, criticize a statement related to colloidal properties, evaluate experimental results by providing information related to the resulting product. |
| C6 (Creating)             | Students are able to design a product related to colloidal properties, or produce/utilize natural products as a product and relate the colloid concept. |

Based on the Table 7, High Order Thinking Skills experienced that students were able to analyze the relationship between chemical concepts (Material and its changes, chemical bonds, hydrocarbons and colloids) and were able to analyze problems in the environment and relate them to the colloid concept (C4), students were able to see the comparison of each type of colloid. on a product, predicts a scientific phenomenon related to colloidal properties, criticizes a statement related to colloidal properties, evaluates experimental results by providing information related to the resulting product (C5), and students are able to design a product related to colloidal properties, or produce/utilize natural products as product and linking colloid concept (C6).

3.5 Evaluation of SETS based e-module with PjBL Model in Colloidal Learning

An evaluation stage, an evaluation of the development of the e-module was carried out by concluding the results of the data from the previous stage, namely that it was obtained that the SETS-based e-module with the PjBL model in colloidal learning was feasible to use based on the feasibility of content, language feasibility, presentation feasibility, and graphic feasibility with the overall mean value of 3.66 indicates that the e-module does not need to be revised. The SETS-based e-module with the PjBL model on colloidal material is also in accordance with the competencies contained in the syllabus. E-module development using technology, namely online flippingbook. In addition, the application of e-modules in learning as teaching materials on colloidal material results in an increase in students' high or der thinking skills, practical use by students because it is an e-module and students are able to interact socially, be closer to nature, understand contextual chemistry, and utilize existing technology.

3.6 Discussion

Based on the results of the SETS-based e-module analysis with the PjBL model in colloidal learning, it was found that this e-module is needed by students in learning activities because it is based on analysis of students need, material analysis, and analysis of teaching materials that have been carried out, so it is necessary to develop a SETS-based e-module with PjBL model on colloidal learning. The development of e-module using technology is very much needed in the digital era. In the buffer solution material, e-modules are developed using technology, namely exe learning, where this e-module gets a good response so that students can learn independently [14]. Module was developed. developed based on Green Chemistry Learning (environmentally friendly chemistry) which is based on the curriculum, solutions to environmental problems, using problem solving models, and increasing student participation in science learning in the STEM field [15].

The SETS-based e-module with the PjBL model in colloidal learning has good feasibility so that this e-module can be used in learning activities in the digital era to meet the needs of teaching.
materials through flippingbook applications, online. The e-module validation uses the BSNP standard. The use of the BSNP standard for the development of PBL-oriented redox reaction modules to determine the feasibility of the developed module obtains appropriate results to be used as teaching materials [16]. The development of the SELVO e-module meets the high validity aspect because this e-module visualizes the complex and abstract voltaic cell topic. The same research related to the use of online-based modules has its own charm in STEM learning, so teachers must understand the concepts of learning and the use of computers that are applied [17].

The implementation of the SETS-based e-module with the PjBL model is effectively used in the learning process because it is structured using the SETS approach (Science, Environment, Technology, and Society) so that students are able to connect the four concepts in learning and improve their High Order Thinking Skills. The development of SETS-based teaching materials was also developed in science learning with a feasibility level of 3.4. Teaching materials were tested for 3 meetings. The implementation of SETS-based teaching materials in learning activities is very effective with a percentage of 95% of active students. In addition, the developed teaching materials can improve students’ critical thinking skills [18]. Learning with the SETS approach has an important role in the world of education and the environment. SETS-based learning is able to connect science concepts to solve environmental problems by utilizing existing technology, or creating new technologies, so that the SETS approach is able to make learning activities more meaningful because students solve problems by interacting with the community or other people. The SETS approach forms the social character of students [19]. SETS-based learning activities have an important role in building the social spirit of students, encouraging scientific attitudes based on natural phenomena or environmental problems, so that students with the SETS approach are trained in improving process skills, adding scientific insight, pedagogy, social interaction and decision making in a problem that occurs in the environment by utilizing technology [12]. Environmental problems are often encountered in everyday life which can be used as an interesting discussion to be scientific and train students’ thinking skills, one of which is appropriate learning, namely SETS-based learning [20].

In the implementation of the colloid e-module using the PjBL model where students design an activity to produce products in the form of ice cream, hand sanitizer, herbal soap, liquid soap, mayonnaise, and betel soap. This is supported by previous research that the PjBL model is able to make students more active in learning activities and improve students’ critical thinking skills because students must be able to produce products from the identification of existing problems as a solution [21]. Learning with the PjBL model has a good impact on the environment because based on existing problems so that learning is more active, students gain direct knowledge and real experience [22].

The development of SETS-based e-modules with the PjBL model on colloidal material is structured to meet the needs of students’ teaching materials in online learning, but experimental activities are carried out directly in schools, so that the implementation of e-modules can be used in blended learning. The development of e-modules is carried out in blended learning, which is based on the Lecture Program Unit (SAP), learning using e-modules has the advantage that it is easily accessible freely, has photos and videos that can be played, has interesting color variations, is easy to edit and can be used in mixed learning [23]. The implementation of e-modules is also developed with the principle of UDL (Universal Design for Learning), where the modules are easily accessible, provide constructive learning, collaboration or discussion and are able to motivate students in learning. The online UDL module also contains learning materials, articles, videos, several questions so that discussions occur between students and teachers as facilitators. The online implementation of the UDL module can create an interactive learning process and increase student learning outcomes [24]. Module development is also carried out in chromatography learning with a pedagogical approach to improve students’ abilities which are built gradually in learning. In the development of the module, starting from the selection of the appropriate chemical material so that it is focused on the separation of chemical compounds, then the chromatographic material is selected. The module contains identified problems and the sequence of experiments that must be carried out, articles or related references as literature so that students have information as a theoretical basis or comparison, videos of activities in
the laboratory related to TLC and HPLC, and is equipped with regulations when working in the laboratory, and finally an evaluation is carried out on projects/experiments that have been done. The results of the evaluation of the use of the chromatography module improve the process skills of students [25]. The development of e-modules is also applied to hydrocarbon-oriented materials to improve students’ literacy orientation so that they can improve students’ critical thinking skills. The developed e-module also has the advantage of an animated video, so that students can easily understand the concept [26]. The development of e-modules in online learning is needed in an emergency situation, so that an interactive e-module is needed in chemistry learning, the material presented is salt hydrolysis for class XI high school students which is valid based on aspects of content, pedagogic, language, and graphics [27]. The developed e-module was validated by the validator to be suitable for use based on the aspects of content, presentation, usability, and graphics. Based on the results at the evaluation stage of the hyper-content e-module on the material of atomic structure and periodic elements it is very valid to be used as a learning resource [28]. The use of e-modules in learning is needed during distance learning due to emergency situations, so a chemistry e-module was developed based on the representation of chemical triplets and the unity of science. Development of e-modules using effective multimedia to encourage students' critical thinking [29]. Development of chemistry e-module using professional flip pdf which is used in chemistry learning. The development of e-modules on carbon and silicon materials as teaching materials is very feasible based on the evaluation stages of a very feasible expert validator [30].

Development of SETS-based e-module with PjBL model on colloidal material. The selection of colloidal material based on material analysis is reading and is often found in everyday life, so colloidal material is contextual. In the e-module students are free to determine the project to be worked on based on the available materials, and articles as other references. Projects made by students include making nutritious ice, mayonnaise, natural hand sanitizer, herbal bar soap, betel soap, and liquid soap. So this increases the high order thinking skills of students. The development of problem-based colloid e-modules is able to increase students’ theoretical knowledge and understand concepts so as to produce products found in colloidal material applications [9]. Teaching materials that can be developed on colloidal materials in the form of modules with guided inquiry models are able to increase students' cognitive abilities and science process skills. The colloidal material that students understand the most after using a guided inquiry-based colloid module is the manufacture of colloid based on a hydrolysis reaction with a percentage of 100%, while the lowest understanding of the material is coagulation with a percentage of 39% [31].

Based on the results of the study, the development of SETS-based e-modules with the PjBL model in colloidal learning resulted in an increase in students’ high order thinking skills. Enhancement in high order thinking skills, as seen from the gain analysis carried out based on the pretest and posttest scores, students are able to analyze a problem, design an experiment, evaluate or criticize a statement, and create or produce products on colloidal material. The ability of these students is a high order thinking skill. High order thinking skill is the ability to think with a classification of levels C4 (analyze), C5 (evaluate), and C6 (create) in Bloom's taxonomy [32]. The questions provided must be categorized within that level so that they are categorized as high order thinking skills. Aspects of high order thinking skills include (1) analyzing aspects where students must be able to distinguish, organize and compile a problem, (2) evaluation where students must be able to examine and criticize a thing, (3) create, in this aspect students must be able to design a product or produce something. So the teacher must be able to arrange questions in the HOTS category [33]. The era of revolution requires students to have competencies so that they can compete, one of the competencies that must be possessed is high order thinking skills in solving a problem, finding facts, understanding concepts, analyzing a problem in depth, and innovating [34]. Based on the description of the research results that have been carried out and supported by previous research, it can be concluded that the SETS-based e-module with the PjBL model in colloidal learning can improve students' High Order Thinking Skills.
4. Conclusion
Based on the results of the analysis for development research, information related to the analysis of student needs is obtained in the form of e-modules for learning activities that facilitate the chemistry learning process. The appropriate material that is contextual is colloidal material based on the analysis of the chemical material contained in the syllabus. The analysis of teaching materials used by students for colloid learning is feasible but needs to be developed in the form of e-modules using technology (flipping book online), SETS approach, and PjBL models. with an average score of 3.54 (2) language eligibility with an average score of 3.59 (3) presentation feasibility with an average value of 3.84 and (4) graphic feasibility with an average score of 3.68. Then the e-module is feasible to use and does not need to be revised. The implementation of the SETS-based e-module with the PjBL model on colloidal learning affects the High Order Thinking of students so that an n-gain of 0.44 is obtained which is categorized in the "medium" category, meaning that there is an increase in students' high order thinking after using the e-module and doing project assignments. SETS based. To the other researchers can conduct other development research in other learning materials because this research only colloid, and the next research researchers should ask students' responses to the media because in this research there were not students' responses to the developed e-module. And the researcher hopes the teachers can implement SETS-based e-modules with the model PjBL on colloidal learning to see the effectiveness of e-modules on learning activities.

Acknowledgments
Thanks to all staff of the Postgraduate School and FMIPA Universitas Negeri Medan for the suggestions so that the paper can be published and thanks to all staff SMA Negeri 1 Tanjungbalai.

References
[1] Puriwat W and Tripopsakul S 2020 Int. J. of Instruction 13 89-104
[2] Azura W and Silalahi A 2020 Prosiding Seminar KSM (Medan, Universitas Negeri Medan)
[3] Holme T A 2020 J. of Chemical Education 97 1226
[4] Muflihah M, Supardi K I and Sumarmi W 2020 J. of Innovative Science Education 9 306-313
[5] Padmanaba I K G, Kirna I M and Sudria I B Ny 2018 J. Pendidikan Kimia Indonesia 2 1-10
[6] Sumarti S S, Nuswowati M and Kurniawati E 2018 J. Phenomenon, 8 175-184
[7] Mahmud, Silalahi A, Komisia F and Marpanggahtun 2021 Research Gate Publication
[8] Supendi A and Nurjanah 2020 Int.Conf. on Elementary Education. vol 2 (Bandung, Universitas Pendidikan Indonesia Edu) p 1054
[9] Anggraini N P, Budiyono and Pratiwi H 2019 J. of Physics: Conf. Series 1211 012077
[10] UZ L M Z Haryono and Wardani 2019 Innovative J. of Curriculum and Educational Technology 8 59-66
[11] Irwansyah F S, Lubab I, Farida I, and Ramdhan M A 2017 J.of Physics: Conf. Series 895 012012
[12] Bencze L, Pouliot C, Pedretti E, Simonneaux L, Simonneaux J and Zeidler D 2020 Cultural Studies of Science Education (Springer Nature)
[13] Chowdhury M A 2016 Electronic J. of Science Educat 20 20-38
[14] Agusti M, Ginting S R dan Solikhin F 2021 J. Pendidikan dan Ilmu Kimia 5 198-205
[15] Aisyah S, Sari R and Wijayanti I E 2019 J. of Chemistry Education Research 3 29-34
[16] Juniar A, Siregar J, Silalahi A, Suyanti R D and Mistryanto P 2019 Talenta Conference Series vol 2 (Medan, Talenta Publisher) p 259
[17] Zha S, Jin Y, Moore P, and Joe G 2020 J. of digital learning in Teacher Education 36 32-45
[18] Amilyana A S, Kirana T, Noer M S, and Raharjo Int. J. of Recent Educational Research 2 372-391
[19] Ilmiyati N, Maladona A, Rahmawati D. and Rahman N A 2020 International J. of scientific & Technology Research 9 1-3
[20] Asmuni, Sarwanto, and Masykuri M 2019 J. Kajian Pendidikan Sains 5 30-43
[21] Santyasa I W, Agustini K, and Pratiwi N W E 2021 Int. J. of Instruction 14 909-928
[22] Pereira M A C, Baretto M A M and Pazeti, M 2017 Production, 27(spe) e20162238
[23] Sumarmi, Bachri S, Irawan L Y and Aliman M 2021 Int. J. of Instruction 14 187-208
[24] Lee A and Griffin C C 2021 J. of Education for Teaching 47 1323-1327
[25] Xie M, Inguva P, Chen W, Prasetya N, Macey A, Dimaggio P, Shah U, and Brechtelsbauer C 2020 J. of Chemical Education 97 1001-1007
[26] Oktari B, Susilawati, and Copriady J 2020 J. of Educational Sciences 4 347-356
[27] Mazidah, Erna M, Anwar L 2020 J.of Physics: Conference Series 1655 012051
[28] Sari M P, Oktavia R, and Arif K 2021 J.of Physics: Conference Series 1940 012112
[29] Fibonacci A, Wahid A, Lathifa U, Zami M, Wibowo T, Kusuma H H, 1796 012110
[30] Rahman L, Silaban R, Nurfajriani 2021 Duconomic 1 185-191
[31] Novilia L, Iskandar S M, and Fajaroh F 2016 Int. J. of Education 9 17-23
[32] Widyaningsih S R, Yusuf I, Prasetyo Z K and Istiyono E 2021 14 51-68
[33] Setiawan J, Sudrajat A, Aman, and Kumalasari D 2021 Int. J. of Evaluation and Research in Education (IJERE) 10 545-552
[34] Harta J Rasuh N T and Seriang A 2020 Int. J. of Intruction 3 143-148