

# Development of Innovative Chemistry Textbook Class XI for Even Semester at Senior High School

**Hendra Simanjuntak**

Faculty of Teachers Training and Education,  
Universitas HKBP Nommensen Pematangsiantar, Indonesia  
Email: hendrajuntax@gmail.com

## ABSTRACT:

This research aims to: (1) find out the lecturer's response to the innovative chemistry textbooks for Class XI Semester 2 which were compiled (2) find out the effectiveness of the innovative chemistry textbooks for Class XI Semester 2 which were developed by looking at student learning outcomes taught with these books. This type of research is development research that uses the Borg and Gall product development model combined with experimental research. The research consists of two stages, Phase I is a product trial consisting of: (1) content feasibility test, (2) language feasibility test, (3) presentation feasibility test and phase II is a product effectiveness test by looking at student learning outcomes. taught using innovative chemistry textbooks. The results of this study are: (1) Respondents (lecturers, teachers, and students) gave positive responses to the innovative textbooks seen from the average respondent's assessment of the appropriateness of the content, which was 3.58, the appropriateness of the language, which was 3.68, and the feasibility of presentation, which was 3.63, which means the book Innovative chemistry teaching is feasible and does not need to be revised, (2) So it is found that teaching using chemistry textbooks can increase learning outcomes by an average of 74.25%, while teaching using student handbooks increases learning outcomes by an average of 73%.

*Keywords* : *Development of textbooks, Learning Outcomes, Chemistry Textbook*

## INTRODUCTION

Education is a conscious and systematic effort that people make entrusted with the responsibility to influence students to have and character in accordance with the ideals of education (Daryanto, 2013). A very dynamic world of education requires educators to be more active, creative and innovative in making a learning media so that students are interested in learning (Rosalina et al., 2018).

The curriculum 13 based of competency focuses on the acquisition of certain competencies by students. One of the characteristics the competency based 2013 curriculum is to utilize all learning resources. Utilization of learning resources has a very important meaning in addition to complementing, maintaining, and enriching learning resources, learning resources can also increase learning activity and creativity, which is very beneficial for both teachers and students. (Mulyasa, 2013). One of the factors that causes the low quality of learning, among others, has not been utilized optimally by both teachers and students (Mulyasa, 2013).

Teaching materials are all information in the form of text, visual, audio or video combination of the three that students need to learn, in order to achieve competence as a whole and integrated. Innovations that have been made in the world of education is to make interactive teaching materials, in which the teaching materials are teaching materials which combines two or more media such as audio, text, graphics, images or video animation (MANASIKANA, 2017). Good teaching materials are very effective in being used as learning media because they function as a communication tool to

bring accurate information from learning sources to students (Silitonga and Situmorang, 2009). Thus, teaching materials as educational media are indispensable in learning because they can explain various difficult phenomena, including abstract concepts into realistic knowledge (Edginton and Holbrook, 2010). Using good teaching materials will accelerate the achievement of competence because it functions as a good, objective, truthful and relevant teacher (Situmorang, Sinaga, Tarigan, Sitorus, and Tobing, 2011). Teaching materials that are packaged properly are very necessary in learning because they can present messages or information according to the needs, interests, and speed of students, can be studied anytime and anywhere because they are easy to carry. (Mahdjoubi, L., dan Rahman, 2012).

One of the learning tools that have a big role is student textbooks in learning. This textbook can be made by the teacher himself, lecturers, or related institutions (Sihotang & Sibuea, 2015), as well as the main teaching aids in the classroom, meaning as a source of knowledge for students (Devetak, I., and Vogrinc, 2013) and facilitate the teacher in choosing the topic of the lesson (Martínez-Gracia, Gil-Quílez, & Osada, 2006) All information such as material to the author's ideology (White, 1988) as a form of interpretation of Curriculum (Martínez-Gracia, M. V., Gil-Quílez, M. J., & Osada, 2006) can be found in it. Apart from being a tool, textbooks are a reflection of the applicable curriculum (Altbach, 1987).

Based on the results of the study, it was shown that the innovative chemistry textbooks could help students in learning to achieve competencies according to the demands of the curriculum. Textbooks as learning media can improve students' chemistry learning activities easily and efficiently so that there is a shift in learning from teacher center to student center, and at the same time improve students' good character (Situmorang et al., 2015). And based on the data generated in this study, it was found that the development of CCT-based teaching materials when viewed from the aspect of content feasibility, presentation feasibility, language assessment, multiple assessment of chemical representations assessed by several experts can be concluded that the developed teaching materials are good and feasible to use. in the field with some improvements with an average validation value of 4. In addition, a limited test was also conducted on students of teaching materials that were being developed and students responded well to these teaching materials because they could help them understand with an average score of 85 (Sukmawati et al., 2020). Based on the results of the study, Silalahi stated that Based on the results of this study; (1) the level of feasibility analysis according to expert validators for exe-learning media development at the level material is said to be valid in the media category because the overall percentage of each overall assessment of the four aspects of development is 87.20% and is in the range of 80% to 100% with a valid category, (2) Student responses to the feasibility level of ex-learning media development on the reaction rate material are said to be valid media categories because the overall average percentage of each of the four aspects of development assessment is 86.35% and is in the range of 80% to 100% with valid categories. And (3) learning outcomes using exe-learning media are higher than using power points (contextual) with an increase in learning outcomes of 80% and 66% (Silalahi, 2020).

## METHOD

This research was conducted in Toba Samosir Regency, North Sumatra, in 4 different schools that have chemistry teachers with a bachelor's qualification and have a minimum of 3 years teaching experience. The time of this research starts from November 2019 to February 2020. The sample of research is (1) UNIMED chemistry lecturers who were selected by purposive sampling, Lecturers were selected with a minimum educational criteria of S3, have a minimum of 5 years teaching experience, are actively teaching and mastered chemistry relevant to high school chemistry as many as 3 people, (2) chemistry teachers who were categorized as professional teachers with the criteria of having a minimum formal education of S1 and teaching experience of at least 3 years in 3 schools

where the research was conducted, (3) two class XI IPA each in 4 schools that will be used as research sites. The sample was selected by purposive sampling. The student sample was divided into 2 parts, namely the control class and the experimental class. Where the experimental class was given teaching treatment using innovative chemistry textbooks designed for each subject and the control class was taught without using innovative chemistry textbooks. This research is a combination of development research and experimentation.

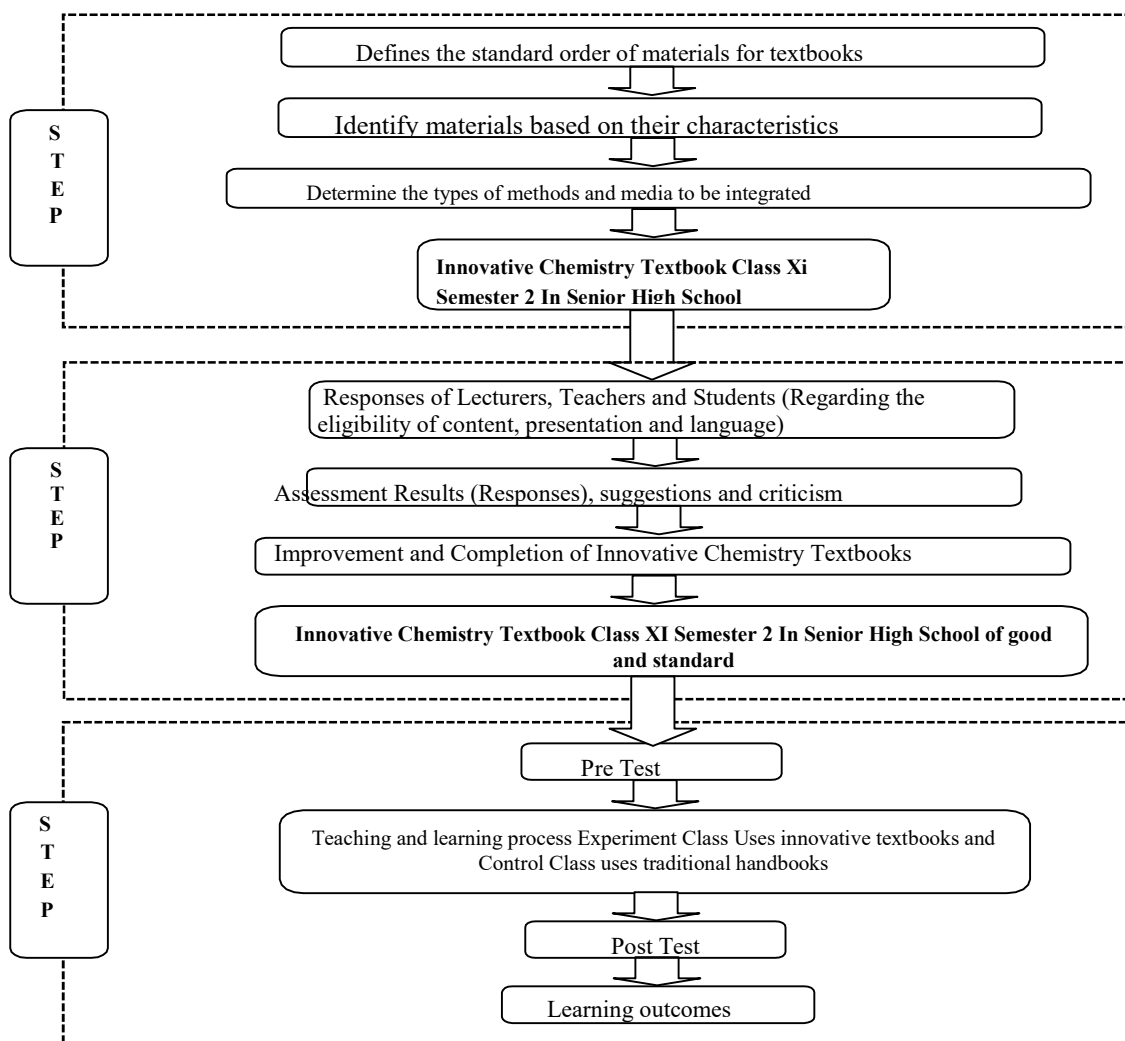
The design of this research is based on the research and development steps according to Gagne (Ngussa, 2014) using the Analysis, Design, Development, Implementation and Evaluation (ADDIE) development model approach. The ADDIE model development scheme is shown in Figure 1.



Figure 1. ADDIE Development Model

The steps taken in this research are as follows:

Figure 2. Research procedures and stages of developing innovative chemistry textbooks for class XI SMA/MA semester 2



### Data Collection Technique

The data obtained from this research are qualitative data and quantitative data. Qualitative data in the form of responses and suggestions for improvement from lecturers, teachers and students on innovative chemistry textbooks obtained from the answers to questionnaires containing the standard for assessing textbooks from BSNP. While quantitative data were obtained from the results of the book trial phase and learning innovations used by teachers. This quantitative data is in the form of data from the pretest and posttest results of students from the control group and the experimental group.

### Data Analysis Technique

The data in this study are qualitative data obtained from assessment and revision to produce a product in the form of a chemistry textbook for class XI semester 2 and quantitative data in the form of student achievement scores which were analyzed using the Microsoft Excel application program. For qualitative data in the form of assessments of chemistry lecturers, chemistry teachers, and students on the components of the feasibility of content, language, and presentation of the developed chemistry textbook. The standard instrument for assessing books according to BSNP is presented in Appendix. The answers to the research questionnaire use a Likert scale with the following categories of choice:

- a. The number 4 means very good / very valid / very interesting / very easy / very clear / very accurate / strongly agree.
- b. Number 3 means good/valid/interesting/easy/clear/correct/agree.
- c. Number 2 means less good / less valid / less interesting / less easy / less clear / less precise / less agree.
- d. The number 1 means very bad/very invalid/very unattractive/very uneasy/very unclear/highly inaccurate/strongly disagree.

To strengthen the data from the validation results, a qualification level of validity criteria was developed. This determination is based on Arikunto's opinion (Arikunto, 2009) which states that if a questionnaire consists of 3 aspects with 10 questions in each aspect, then all of these aspects contain 30 questions. If the score for each item is at least 1 and the maximum is 3, then a score for each subject will be as low as 30 and as high as 90. In this study, the rating scale that will be used is 1 to 4, where the lowest score is 1 and the highest score is 4. The determination of the range can be determined through the range of the highest score minus the range of the lowest score divided by the highest score. Based on the determination of the range obtained a range of 0.75. The criteria for the validity of the average analysis used can be seen in table 3.1. Meanwhile, quantitative data will be analyzed with the following steps: After the data was obtained, it was processed using the following data analysis techniques: (1) Calculating the average of each group, (2) Calculating the standard deviation of each group, (3) Testing the normality of the data for each group using the Lilliefors normality test. .

Table 1 Textbook Feasibility Criteria Scale Based on Respondents' Opinions Ranging from the Best to the Less Good.

Average	Validation Criteria
3,26 – 4,00	Valid and does not need revision
2,51 – 3,25	Sufficiently valid and does not need revision
1,76 – 2,50	Not valid, some of the contents of the book need to be revised
1,00 – 1,75	Invalid and needs a total revision.

Furthermore, the research hypothesis will be tested with a one - party t - test , in this case the third - party test is used . The test criteria are to accept the hypothesis if  $t_{count} > t(1-1/2\alpha)$  and reject the hypothesis if it is not met, at a significance level of 5%.

## RESULTS AND DISCUSSION

In the development of innovative chemistry textbooks, innovations were made by including picture illustrations, examples of questions and how to solve them, and integrating teaching methods in the form of lectures, discussions, demonstrations with interactive teaching media in the form of powerpoint, flash, and video that can be used using computer assistance. After the development of innovative chemistry textbooks for SMA class XI semester 2 was carried out, a standardized test of the feasibility of content, language, and presentation was carried out by distributing standardized questionnaires to lecturers, teachers, and students. Each statement on the questionnaire sheet is given a score. The numbers or scores obtained are added up and given a score, then averaged to obtain response data to the proposed material and the feasibility standard for innovative chemistry textbooks. From the results of the distributed questionnaires, it can be seen that the responses of chemistry lecturers and teachers to the feasibility test of innovative chemistry textbooks for class XI semester 2 can be seen.

The next stage is to try out the use of innovative chemistry textbooks to students to find out the improvement of student chemistry learning outcomes. The data used to determine student learning outcomes were obtained from the pretest and post-test scores by using a test instrument. The research data are presented in the analysis of research instrument data and hypothesis testing.

### 1. Standardization of Innovative Chemistry Textbooks for Class XI SMA/MA Semester 2 (Even Semester)

The chemistry textbook for class XI Semester 2 which was developed in accordance with the mandate of Competency Standards (SK) and Basic Competencies in the content standards is accompanied by additional pictures that are expected to be able to explain the meaning of the concept, so that students feel interested in learning it more deeply, as well as providing training and questions that can later be used as a measure of the achievement of graduate competencies. The developed chemistry textbooks have been tested or standardized by expert assessors, namely three (3) chemistry lecturers and eight (8) chemistry teachers plus the assessment of forty (40) students in the sample schools on the developed textbooks, so that they can be used as standard teaching materials in the teaching and learning process. The developed book will be analyzed by lecturers, teachers, and students who are the samples in this study, by providing responses according to their choice in the form of a check list mark ( $\surd$ ) on the numbers:

- 1 = Strongly disagree,
- 2 = Disagree,

3 = Agree, and

4 = Strongly agree,

which were analyzed based on the components of the chemistry textbook assessment which included the content feasibility component (has 27 assessment points), the language feasibility component (had 15 assessment points), and the presentation feasibility component (had 21 assessment items) which were in accordance with the textbook assessment standards used, by BSNP. The average eligibility of standard book contents is 3.58. In accordance with the average validity criteria, the number is in the range of 3.26 – 4.00, which means that the chemistry textbook developed is declared valid and does not need to be revised in terms of content feasibility. The improvements made were only limited to typing corrections and adding the appraiser's suggestions to the book.

The average language suitability of the developed chemistry textbooks is 3.68. In accordance with the average validity criteria, the number is in the range of 3.26 – 4.00, which means that the chemistry textbook developed is declared valid and does not need to be revised in terms of language feasibility. The average presentation feasibility of the developed chemistry textbook is 3.63. In accordance with the criteria for average validity, the figure is in the range of 3.26 – 4.00, which means that the chemistry textbook developed is valid and does not need to be revised.

## **2. Effectiveness of Innovative Chemistry Textbooks for Class XI SMA/MA Semester 2 (Even Semester)**

Innovative chemistry textbooks were used as teaching materials in the classroom on the subject of acid-base teaching, and as controls were used student handbooks set by the school.

The innovative chemistry textbook was tested on students in 4 high schools in Toba Samosir Regency. During the study, the research was carried out relatively the same. The final learning evaluation (posttest) is carried out during chemistry lesson hours, after all the material has been delivered. All data were analyzed using Microsoft Excel application program.

After the normality test and data homogeneity test were carried out, from the calculation of the pretest values of the two groups, it was found that the sample data were normally distributed and homogeneously distributed. Then the next test is to find out whether the learning outcomes of students who use innovative chemistry books are significantly different from students who are taught using textbooks set by the school, in this case an independent t-test is used. From the results of the t-test calculation, it is found that the t-count in the final learning outcomes in three (3) sample schools is greater than the t-table, and the t-count in one (1) sample school is smaller than the t-table. This shows that in the three sample schools, students who were taught using innovative chemistry textbooks had better learning outcomes than students who were taught using the student handbooks set by the school. Meanwhile, in one sample school, students who were taught using innovative chemistry textbooks did not have better learning outcomes than students who were taught using the student handbooks set by the school.

The magnitude of the increase in learning outcomes can be seen from the results of the average pretest and posttest average of the control class and experimental class in each sample school. Where the comparison of the average pretest and posttest results for the control class at school A is  $18.95 : 53.67 = 1 : 2.84$ . From this comparison, it is calculated that the increase in posttest scores is about 74%. In the experimental class the comparison of the average pretest and posttest scores was  $20.21 : 63.58 = 1 : 3.2$ . From this comparison, it was calculated that the increase in posttest scores was about 76%. The comparison of the average pretest score and the average posttest score for the control class at school B is  $25.58 : 67.52 = 1 : 2.62$ . From this comparison, it was calculated that the increase in the control class's posttest score was about 73%. While in the experimental class, the average comparison of the pretest and posttest scores is  $25.65 : 68.71 = 73\%$ . In school C, the comparison of

the average pretest and posttest scores for the control class is  $25.33 : 61.78 = 1 : 2.48$ . From this comparison, it was calculated that the post-test score increased by 71%. Meanwhile for the experimental class, the comparison of pretest and posttest scores was  $28.11 : 64.69 = 1 : 2.32$ . From this comparison, an increase in the posttest value of 70% was calculated. And in sample D schools, the comparison of the average pretest and posttest scores for the control class was  $21.13 : 63.63 = 1 : 3$ . The increase in posttest scores was 75%. As for the experimental class, the comparison of the average pretest and posttest scores is  $20.97 : 72.97 = 1 : 3.48$ . From this comparison, an increase in posttest value was calculated by 78%. From these results, it is found that teaching using innovative chemistry books can increase learning outcomes by an average of 74.25% while teaching using student handbooks increases learning outcomes by an average of 73%. These results confirm that the developed chemistry book is effective in improving student learning outcomes in acid-base teaching.

## CONCLUSIONS

Based on the results of this study, it can be concluded that:

1. Respondents (lecturers, teachers, and students) gave positive responses to the innovative textbooks seen from the average respondent's assessment of the appropriateness of the content, which was 3.58, the appropriateness of the language, which was 3.68, and the feasibility of presentation, which was 3.63, which means the book Innovative chemistry teaching is feasible and does not need to be revised.
2. Innovative chemistry textbooks are effective for improving chemistry learning outcomes for grade XI semester 2 students with the following information: a. At SMA Negeri 1 Silaen, the increase in the average posttest score for the control class was 74% and the posttest average for the experimental class increased 76%. b. At SMA Negeri 1 Siantar Narumonda, the increase in the average posttest score for the control class was 73% and an increase in the average posttest score for the control class. experimental class by 73%. c. At SMA Negeri 1 Laguboti, the increase in the average posttest score for the control class was 71% and the posttest average for the experimental class increased by 70%. d. At SMA Negeri 1 Siantar Narumonda, the increase in the average posttest score for the control class was 75% and the posttest average for the experimental class increased by 78%. So it is found that teaching using chemistry textbooks can increase learning outcomes by an average of 74.25%, while teaching using student handbooks increases learning outcomes by an average of 73%.

## SUGGESTIONS

Based on the results of the research that has been done, the researchers can suggest:

1. We recommend that textbook users pay attention to the appropriateness of the content, language, and presentation of the books used so that there is no longer use of textbooks that do not meet the eligibility standards according to BSNP
2. Teachers should be able to develop learning media that are in accordance with the contents of the books used, so that there is no difference between the learning media and the contents of the books used, this will make it easier for students to understand the material presented, and books student handles can be more functional.

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