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# PROCEEDING

# THE INTERNATIONAL CONFERENCE ON MATHEMATICS, SCIENCE, EDUCATION AND TECHNOLOGY

## ICOMSET 2015

*Education, Mathematics, Science and Technology for Human and Natural Resources*

**October 22, 2015**

Inna Muara Hotel and Convention Center
Padang, Indonesia

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# The International Conference on Mathematics, Science, Education and Technology

# (ICOMSET 2015)

## *Education, Mathematics, Science and Technology for Human and Natural Resources*

## October 22, 2015

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## Padang, Indonesia

**Organized by**

**Faculty of Mathematics and Science**
**State University of Padang**
**Padang, Indonesia**

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**Mathematics**



**Physics Education**

# Message

*from the*

## Rector of State University of Padang

Ladies and Gentlemen,

It give me great happiness to extend my sincere and warm welcome to the participants of the International Conference on Mathematics, Science, Education and Technology (ICOMSET 2015). On behalf of Universitas Negeri Padang, let me welcome all of you to the conference in Padang, West Sumatra Province, Indonesia.

We believe that from this scientific meeting, all participants will have time to discuss and exchange ideas, findings, creating new networking as well as strengthen the existing collaboration in the respective fields of expertise. In the century in which the information is spreading in a tremendous speed and globalization ia a trend. Universitas Negeri Padang must prepare for the hard competition that lay a head. One way to succeed is by initiating and developing collaborative work with many partners from all over the world. Through the collaboration in this conference we can improve the quality of our researches as well as teaching and learning process in mathematics, science and technology.

I would like to express my sincere appreciation to FMIPA UNP and organizing committee who have organized this event. This is a great opportunity for us to be involved in an international community. I would also like to extend my appreciation and gratitude to keynote speakers and participants of this conference for their contribution to this event.

Finally, I wish all participants get a lot of benefits at the conference. I also wish all participants can enjoy the atmosphere of the city of Padang, West Sumatra.

Thank you very much

Prof. Dr. Phil. Yanuar Kiram
Rector

# Message

*from the*

## Dean of Faculty of Mathematics and Science
## State University of Padang

Rector of State University of Padang
Vice-Dean of Faculty, Mathematics and Science
Head of Department in Faculty of Mathematics and Science
Distinguished Keynote Speakers
Organizers of this conference
Dear participants
Ladies and gentlemen

I am delighted and honored to have this opportunity to welcome you to ICOMSET 2015 - the International Conference on Mathematics, Science, Education and Technology, which is hosted by Faculty of Mathematics and Science, State University of Padang.

As the Dean of Faculty of Mathematics and Science, I wish to extend a warm welcome to colleagues from the various countries and provinces. We are especially honored this year by the presence of the eminent speaker, who has graciously accepted our invitation to be here as the Keynote Speaker. To all speakers and participants, I am greatly honored and pleased to welcome you to Padang. We are indeed honored to have you here with us.

The ICOMSET organization committee and also the scientific committee have done a great work preparing our first international conference and I would like to thank them for their energy, competence and professionalism during the organization process. For sure, the success I anticipate to this conference will certainly be the result of the effective collaboration between all those committees involved.

This conference is certainly a special occasion for those who work in education, mathematics, science, technology, and other related fields. It will be an occasion to meet, to listen, to discuss, to share information and to plan for the future. Indeed, a conference is an opportunity to provide an international platform for researchers, academicians as well as industrial professionals from all over the world to present their research results. This conference also provides opportunities for the delegates to exchange new ideas and application experiences, to establish research relations and to find partners for future collaboration. Hopefully, this conference will contribute for Human and Natural Resources.

I would like to take this opportunity to express my gratitude to all delegates and sponsors for their full support, cooperation and contribution to the ICOMSET 2015. I also wish to express my gratitude to the Organizing Committee and the Scientific Committee for their diligence. The various sponsors are also thanked for their kind support.

In closing, I realize that you are fully dedicated to the sessions that will follow, but I do hope you will also take time to enjoy fascinating Padang, with its tropical setting, friendly people and multi-cultural cuisine.

I wish the participants a very fruitful and productive meeting and with that. Finally, we respectfully request the Rector of State University of Padang to open the ICOMSET 2015 officially.

Thank you,

Faculty of Mathematics and Science
Prof. Dr. Lufri, M.S.

# THE DEVELOPMENT OF DISCOVERY LEARNING – BASED MODULE IN BUFFER SOLUTION TOPIC FOR SENIOR HIGH SCHOOL INSTRUCTION

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**ABSTRACT**

Developing discovery learning- based module appears to be one of many attempts that teachers can do to fulfill the demand of the new curriculum implemented, Curriculum 2013. This research aimed to develop valid and practical module in topic of Buffer Solution for Senior High School instruction. This research belongs to Research and Development (R&D), a study that consists of four stages namely (1) defining, (2) designing, (3) developing, and (4) disseminating. This study was done until developing stage. The instruments used in this research were validity and practicality questionnaires. Validators of the product were four chemistry lecturers and three chemistry teachers. Both teachers and students in Public School 1 Lubuk Alung responded to practicality questionnaires. Data analyzed with kappa moment showed that discovery learning- based module had high degree of validity (mean score of kappa moment was 0.74), high degree of practicality from teachers' perspective (mean score of kappa moment was 0.74), and very high degree of practicality from students' perspective (mean score of kappa moment was 0.83). It can be concluded that discovery learning – based module was valid, practical and justifiable for high school chemistry instruction.

*Index Terms— Buffer solution, discovery learning, module, scientific approach, 4-D Models*

## 1. INTRODUCTION

Buffer solution is a chemistry topic taught in semester 2, Grade X, Senior High School (SMA). According to Curriculum 2013, the topic has two basic Basic Competencies (Kompetensi Dasar, KD). They are analyzing the role of buffer solution in organism (KD 3.13) and designing, doing, concluding and reporting experiment result on buffer solution properties (KD 4.13)[1]. The two KDs are rarely accomplished in teaching and learning process because some important concepts of the topic are difficult to understand. For example, students in public Senior High School (SMAN) 1 Pemalang were reported to experience difficulty on comprehending concepts in Buffer Solution topic[2]. The percentages of difficulty were 35.52% for definition of buffer solution, 26.03% for the calculation of pH and pOH of buffer solution using equilibrium principle, 48.83% for determination of pH of buffer solution with the addition of small amount of acid or base solution, and 68.26% for the role of buffer solution in organism and daily lives. Some factors that contributed to this difficulties were that students did not pay attention during teaching and learning process; students were not prepared for new concepts; teacher did not give ample prerequisite knowledge; teacher neither emphasized the concept in depth nor they gave various types of worked-out examples; and teacher did not use approriate learning strategies.

Anoter case was found in SMAN 1 Sukasada where students had misconception on all concepts of buffer solution. The distribution were 52.44% for buffer solution, 24.50% for acid buffer, 18.62% for base buffer, and 23.10 for pH of buffer solution. The misconception were derived from students, teachers, and learning materials such as worksheet[3]. To solve the problem, learning material that ease students to learn and understand the concepts in Buffer Solution topic is an obligation. Appropriate learning materials will help teachers during teaching and learning process. The materials may include printed-out materials such as *Hand Out*, text book, module, worksheet, brochure, *Wallchart*, and other forms like video/film,VCD, radio, cassette, *audio* CD, photo, picture, computer or Internet- based interactive CD[4].

Module is a printed-out learning material that can be used by students and teachers at anytime and anywhere they want. A module is a comprehensive unit consisting series of emperical learning activities to produce effective learning result in order to achieve the clear and specific goals determined[5]. According to Indonesian Dictionary, a module is a teaching and learning program that allow students to learn the materials with little assistance from teacher, lecturer or instructor[6]. The benefits of module include (1) module creates more efficient, effective and relevant instruction than does conventional learning (2) module gives teacher more time to assist students who need more guide and this in turn helps teachers to know the students' understanding[5].

Based on the background discussed above, module for Buffer Solution topic was thought to be worth developing for senior high shcool instruction.



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The integration of scientific approach in learning instrument such as lesson plan, *Hand Out*, and module was aimed to support learning process in addition to enhance teachers' understanding towards scientific approach as described in Curriculum 2013. Previous research reported that scientific approached-based lesson plan used in problem based learning motivated students and built their internal character[7]. Scientific approached-based module was reliable in Natures' Diversity subject[8]. Scientific approached-based physics module increased students' critical thinking[9].

The integration of scientific approach in learning process and instrument must be accordance with learning model that is suitable with the characteristics of the lesson. Discovery learning model is suitable with materials that contain factual, conceptual and abstract knowledge [10]. Discovery learning is a model that implements active learning through mental processing in inquiring concepts or principles. This model is a type of students' centered learning [11].

It was found that the implementation of discovery learning with scientific approach increased critical thinking skills of high school students in Electrolyte and Non electrolyte Solution topic as much as 28.23% with 0.78 effect size value [12]. Discovery learning model could also increase students' learning activity and cognitive, affective and psychomotor achievement in topic of Buffer Solution [13]. Therefore, this study was aimed to develop a valid and practical discovery learning – based module in Buffer Solution topic for senior high school chemistry instruction.

## 2. METHODOLOGY

This research belongs to *Research and Development* (*R&D*), a study done to produce certain product and test the effectiveness of the product [14]. The product in this research was discovery learning – based module in Buffer Solution topic for senior high school instruction. 4-D model that consists of defining, designing, developing and disseminating stages [15] was used in this research. This model has several advantages including (1) it is appropriate as a base to develop learning instrument; (2) the developing stage is complete and systematic; (3) experts are always involved in developing stage, thus before tested in practice, the instrument should be revised according to score and suggestion given by the expert [15]. Due to the time constraint and limited resource, this research was done until developing stage.

In defining stage, five analyses namely beginning-end analysis, students analysis, assignment analysis, concept analysis and learning goals analysis were done. Beginning-end analysis was done to emerge and determine the main problems faced by both teachers and students in chemistry learning especially in Buffer Solution topic. Students analysis aimed to identify the students as learning target. Assignment analysis aimed to identify and analyze competencies (either of basic competencies or of materials) , as determined in Curriculum 2013[1], that students have to accomplish.

In order to fulfill basic competencies, concept analysis is an a must-doing step to fulfill the principle of concept building on materials taught [16]. Learning goals analysis is the alteration of assignment and concept analysis into learning goals. This analysis was used to construct discovery learning – based module in Buffer Solution topic.

In designing stage, discovery learning based module was designed into several components including title, competencies to achieve, manual of use, concept map, activities sheets, worksheets, evaluation sheet, and answer key of activities sheet and evaluation sheet[6]. The arrangement of module was suited to sintax of discovery learning model comprising (1) stimulation, (2) problem statement, (3) data collection, (4) Data processing, (5) verification, and (6) generalization [10].

The last stage in this research was developing stage. This stage aimed to produce valid and practical discovery learning - based module for senior high school chemistry instruction. Validation was done by four lecturers of Chemistry Department and two chemistry teachers in SMAN 1 Lubuk Alung. Critics, input and suggestion were used to revise the product. In accordance to Sugiyono[14] at least three judgement experts must be involved in testing the validity of the product. Data obtained were then analyzed with Kappa moment as described in formula 1 and decision category in Table 1 below.

$$\text{Kappa moment(k)} = \frac{\text{P}-\text{Pe}}{1-\text{Pe}} \quad \text{.....(1)}$$

Keterangan:

$k$ = Kappa moment describing validity of the product.

P = Realized proportion; counted by summing the score given by validators and then divided it by maximum total score.

Pe = Unrealized proportion; counted by substracting the maximum total score with the sum of total score given by validator, which then divided by the maximum total score

Table 1. The category of decision based on Kappa moment (k) [17].

| 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 |

Test and trial of the product was done to limited number of students in SMAN 1 Lubuk Alung. This



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was aimed to determine practicality of discovery learning - based module integrated with scientific approach. Practicality test was done to get information about the advantages, the ease of use, efficiency of the product during instruction. This test was done by distributing practicality questionnaire to chemistry teachers and students.

## 3. RESULT AND DISCUSSION

### 3.1. Defining Stage

Below are the results of analyses done in this stage.

#### *3.1.1. Beginning-end analysis*

The problems faced by teachers and students in chemistry learning were (a) students had difficulty in understanding buffer solution concepts[2], (b) students had misconceptions in almost all of the concepts in Buffer Solution topic[3], (c) teachers had difficulty in implementing scientific approach in teaching and learning process, (d) Curriculum 2013-books published by ministry of education were not available in school, (e) books used in instruction did not follow scientific approach-based ones, (f) teachers did not have module that could help them implement scientific approach. Regardless of the problems, scientific approach should be integrated into learning instrument such as module by using one of learning model suggested by Curriculum 2013, in this case discovery learning.

*Discovery learning* is a model that directs students to inquire concepts, definition and relation among concepts through intuitive process to get conclusion [10]. This model directs students to actively involve in learning (active learning) and emphasizes more on learning process rather than learning outcome. This model leads pupils to be independent, reflective, enthusiastic, curious, and communicative students [11]. Thus, this model is suitable with the characteristics of chemistry learning including buffer solution topic.

#### 3.1.2. *Students* analysis

Students in grade XI were 17 years old on average, a time of adolescence period[18]. Qualitatively, adolescence period is the last stage of cognitive development where students can make analogy on the concept with abstract things, for example, by using symbols, ideas, abstraction and generalization. Jean Piaget stated that every individual including kids has the ability to construct their own knowledge. Self-obtained knowledge will become meaningful knowledge. On the other hand information told to individual will less likely to become meaningful knowledge. Instead this information lasts shortly and soon be forgetten[19].

Some strategies to implment Piaget theory in learning include (1) use constructive approach; (2) facilitate students to learn; (3) consider knowledge and students' developmental stage; (4) execute continuing evaluation; (5) improve students' intellectual ability; and (6) create class as a space for exploration and discovery [19]. It was hoped that interesting learning instruments made, those that use colourful pictures, tables and exercise problems, tailored to senior high school students' ability would help students to independently construct concepts of buffer solution. Discovery learning that leads students to actively and directly involve in learning will help students to construct their own knowledge and create a meaningful learning.

#### 3.1.3. *Assignment* analysis

Assignment analysis was aimed to identify and analyze competencies that students need to accomplish after learning. The analysis was done by analyzing the content presented in teaching unit as demanded by Curriculum 2013. Derived from KDs analysis (KD 3.13 and KD 4.13), learning indicators[1] were formulated as described below:

a) analyze the definition of buffer solution,
b) determine type of buffer solution
c) calculate the ph and poh of buffer solution
d) provide the example of buffer solution in daily lives
e) determine the properties of buffer solution.

These indicators were used to design learning activities so that the intended competencies could be achieved.

#### 3.1.4. *Concept* analysis

Based on the indicators discussed above, concepts taught or learned in Buffer Solution topic were: definition of buffer solution, types of buffer solution, calculation on buffer solution, and the role of buffer solution[16]. This analysis was then used to design concept map and content of the module.

#### 3.1.5. *Learning* goals analysis

Learning goals of buffer solution topic are:

a) with the use of illustration on the change of pH of buffer solution, students can differentiate buffer solution from non buffer solution.
b) students can explain the characteristics of buffer solution.
c) students can calculate pH of buffer solution.
d) students can give example of the role of buffer solution in daily lives.
e) students can differentiate buffer solution from non buffer solution based on the addition of acid and/or base solution.
f) students can prepare buffer solution in an experimental work.

#### 3.1.6. *Designing* Stage

Module was created with *Microsoft word 2007* using *Times New Roman* font style size 12 and *Papyrus* font style size 14. Blue was chosen as the background of module's cover while white became



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background of the remaining pages of the module. Module contained buffer solution materials referencing some university text books and reliable and relevant senior high school books.

Discovery learning – based module consisted of cover, learning goals, manual of use, students' activities sheet, worksheet, answer key of worksheet, evaluation sheet, and answer key of evaluation sheet [12].

3.1.7. *Developing* Stage

This stage yielded two types of data namely validity and practicality of discovery learning – based module as described below.

a. Validity test of buffer solution module

Validity of module was considered based upon four componenets. They were content validity, language validity, presentation (arrangement & appearance) validity, graphics validity. Table 2 summarizes the score of module's validity on the four components given by six validator.

Table 2. Scores of validaty of the module on four components given by validator.

| Aspect of assessment | k(I) | k(II) | k(III) | k(IV) | k(V) | k(VI) | k(VII) | $\bar{X}$ |
|---|---|---|---|---|---|---|---|---|
| Content | 0,89 | 0,67 | 0,89 | 0,67 | 0,67 | 0,67 | 0,89 | 0,76 |
| Linguistics | 0,78 | 0,71 | 0,71 | 0,67 | 0,71 | 0,67 | 0,95 | 0,74 |
| Presentation | 0,70 | 0,67 | 0,83 | 0,85 | 0,74 | 0,67 | 0,86 | 0,76 |
| Graph | 0,87 | 0,87 | 0,73 | 0,67 | 0,27 | 0,27 | 1 | 0,67 |
| $\bar{X}$ | 0,81 | 0,73 | 0,79 | 0,715 | 0,60 | 0,57 | 0,92 | 0,74 |

k(I), k (II), k (III), k(IV), k (V), k (VI), and k (VII) are mean kappa moment of validator I to VII and $\bar{X}$ is mean score of kappa moment.

It can be seen that the mean score of kappa moment for each component ranged from 0.61–0.80, showing high degree of validity. It can be concluded that (1) content of discovery learning–based module fulfilled the demand of core competencies and basic competencies; (2) language used in module of buffer solution was clear, communicative, interactive and appropriate for the stage of students' development[20]. Due to clear and concise language, students did not get confused when learning the materials; (3) module was designed in proper arrangement and procedure/ steps. The steps meant were scientific ones consisting of observing, asking question, gathering information, associating, and concluding steps[21]. These steps are also used in *discovery learning*; (4) graphically module was complete because it had module detail, cover design, and content design[20]. The font style and size used in module were also clear and appropriate, which made the module capable of attracting students attention and motivating them to study.

To sum up, the discovery learning-based module was valid because it fulfilled the appropriateness of content and construct [22]. The next step was to test practicality of the prodct.

b. Practicality test of the module

Data of practicality was obtained from questionnaire distributed to 25 - grade XII senior high school students (students questionnaire) and 3 chemistry teachers (teacher questionnaire). The data is presented in Table 3.

Table 3. Data of practicality of module gobtained from students and teachers questionnaires.

| Subject | Teacher | Student |
|---|---|---|
| Mean kappa moment | 0,72 | 0,83 |

As shown in Table 3, module had high degree of practicality. The module was attractive. It could assist students to understand the materials as well as assisting them to independently study the concepts. The font style used was easy to read and clear. More over, pictures displayed on the module, experiment manual and directing questions in worksheet gave more advantages for students to understand the lesson.

The practicality of the module can also be inferred from data on students' responses to questions in the module (Table 4). On average, the percentage of correct response on some module components was 81.63% leading the module to be justifiable for use. The main factor that contibuted to this fact was the use of scientific approach integrated into discovery learning model employed in the module. Scientific approaches were also used in research activities including data collection (observing and asking), data analysis (associating), and concluding process(communicating).

Table 4. Analysis on students responses on each component of the module

| No | Module component answered correctly by students | Percentage (%) |
|---|---|---|
| 1. | Hypothesis | 84 |
| 2. | Worksheer | 75.5 |
| 3. | Hypothesis proving | 81 |
| 4. | Conclusion | 86 |
| Mean percentage (%) | | 81.63 |

The five steps of scientific approach were included in all activities sheet in the module. Observing, asking, and doing were included in activities sheets in the module. For example, in activities sheet 1, students were asked to observe pictures of a months-age palatable pinneaple and a days-age leaky one. Associating and communicating were also included in worksheet.


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## 4. CONCLUSION

Conclusions of the research are:

1. Discovery learning-based module in Buffer Solution topic for senior high school instruction was successfully produced.
2. The discovery learning-based module in Buffer Solution topic for senior high school instruction module had high degree of validity, high degree of practicality from teachers' perspective, and very high from students' perspective.

Although we recommend practitioner to use this discovery learning-based module, a test of its effectiveness is indeed needed beforehand.

## 5. ACKNOWLEDGEMENTS

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## 6. REFERENCES

[1] Silabus Mata Pelajaran Kimia SMA Kurikulum 2013.

[2] Marsita, R. A., Priatmoko, S. & Kusuma E. 2010. Analisis Kesulitan Belajar Kimia Siswa Kelas XI SMA Negeri 1 Pemalang dalam Memahami Materi Larutan Penyangga dengan Menggunakan Two-Tier Multiple Choise Diagnostik Instrumen. *Inovasi Pendidikan Kimia*, Vol.4, No.1, hal 512-520

[3] Mentari, L., I Nyoman S, dan I Wayan S. 2014. Analisis Miskonsepsi Siswa SMA pada Pembelajaran Kimia untuk Materi Larutan Penyangga. *e-Journal Kimia Visvitalis Universitas Pendidikan Ganesha*. Jurusan Pendidikan Kimia. Volume 2 Nomor 1. Hal: 76-87.

[4] Sholahuddin, A. 2011. Pengembangan Buku Ajar Kimia Kelas X Berbasis Reduksi Didaktik: Uji Kelayakan di SMA N Kota Banjarmasin. *Jurnal Pendidikan Kebudayaan*. ISSN: 1412-565X. Vol. 17. No. 2. Hal: 166-177.

[5] Nasution. 2008. *Berbagai Pendekatan dalam Proses Belajar Mengajar*. Edisi pertama cetakan ke sebelas. Jakarta: Bumi Aksara.

[6] Prastowo, A. 2011. *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: DIVA press.

[7] Fauziah, R., dkk. 2013. Pembelajaran Saintifik Elektronika Dasar Berorientasi Pembelajaran Berbasis Masalah. *Jurnal Pendidikan Teknik Elektronika*. *Invotec.* Vol. IX. No.2. Hal: 165-178.

[8] Sawitri, DW. 2014. "Pengembangan Modul Keanekaragaman Hayati Berbasis Pendekatan Saintifik untuk Kelas X SMA". *Jurnal Penelitian* Vol 3 No.3 FMIPA: Universitas Negeri Surabaya.

[9] Puspitasari, YD., Suparmi., dan Nonoh, SA. 2014. Pengembangan Modul Fisika Berbasis Scientific pada Materi Fluida Statis untuk Meningkatkan Keterampilan Berpikir Kritis. *jurnal.fkip.uns.ac.id/index.php/psdsains/article/.../345*

[10] Permendikbud Tahun 2014 Nomor 59. 2014. *Tentang Kurikulum 2013 Sekolah Menengah Atas/Madrasah Aliyah.*

[11] Sintawati, R. 2014. Implementasi Pendekatan Saintifik Model Discovery Learning dalam Pembelajaran Pendidikan Agama Islam di SMA Negeri 1 Jetis Bantul. *Skripsi*. Yogyakarta: UIN Sunan Kalijaga.

[12] Fitri, AP., Hairida, dan Rahmat R. 2014. Pengaruh Penggunaan Model Discovery Learning dengan Pendekatan Saintifik terhadap Keterampilan Berpikir Kritis Siswa SMA. *Artikel Penelitian*. Pontianak: Universitas Tanjungpura.

[13] Galuh, AI., Agung NCS., dan Sukardjo J.S. 2015. Penerapan Model Pembelajaran *Discovery Learning* untuk Meningkatkan Aktivitas dan Prestasi Belajar Pokok Bahasan Larutan Penyangga pada Siswa Kelas XI IPA Semester II SMA Negeri 1 Ngemplak Tahun Pelajaran 2013/2014. *Jurnal Pendidikan Kimia (JPK)*. Vol. 4 No. 2. Program Studi Pendidikan Kimia. Universitas Sebelas Maret. Hal. 65-73.

[14] Sugiono. 2012. *Metode Penelitian Pendidikan*. Bandung: Penerbit Alfabeta.

[15] Trianto. 2014. *Model Pembelajaran Terpadu*. Jakarta: Bumi Aksara.

[16] Oxtoby, D. 2001. *Prinsip-prinsip Kimia Modern (terjemahan).* Jakarta: Erlangga.

[17] Boslaugh, S dan Paul AW. 2008. *Statistics in a Nutshell, a desktop quick reference*. Beijing, Cambridge, Famham, Köln, Sebastopol, Taipei,Tokyo: O'reilly.

[18] Santrock, JW. 201). *Psikologi Pendidikan*. Edisi Kedua. Terjemahan. Jakarta: Kencana

[19] Sanjaya, W. 2006. *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana.

[20] Badan Standar Nasional Pendidikan (BNSP). 2006. Standar Penilaian Bahan Ajar.

[21] Permendikbud Tahun 2013 Nomor 81A. 2013. *Tentang Implementasi Kurikulum.*

[22] Arikunto, S. 2013. *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara.



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