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THE DEVELOPMENT OF CHEMISTRY HANDOUT BASED ON UNITY OF SCIENCES PRINCIPLES FOR THE CHAPTER OF ACID AND BASE MATERIALS

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Abstract

This research aims to produce a handout of chemitry based on the principle of unity of sciences to the material of acid and base. Unity of sciences is a paradihm that all sciences is united from Allah the Almighty. The subject of this research was students of XI MAN MAN Kendal, a school which supposes to have more concern of religion than regular school. This research used research and development approach. The handout was stated as very valid with the average validator score of 90%, readability test of 94% which means it does not need revision, and good responses of 80.41%. In conclusion, this handout is proper to enough to use in the learning process.

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INTRODUCTION

In the formulation of national education goals in the Article 3 Law Number 20 Year 2003 regarding National Education System, it is stated that "The goal of national education is developing students' potential to become a faithful and obedience to God the Almighty, being noble, healthy, knowledgeable, competent, creative, independent, and democratic as well as responsible".

Curriculum of education which is implemented in Indonesia always be updated every time to achieve the goals. Recently, curriculum of education in Indonesia is 2013 Curriculum. 2013 Curriculum has the Core Competence consisting of four notations, including: 1) Core Competence 1 (KI-1) for the core competence of spiritual; 2) Core Competence 2 (KI-2) for social aspect; 3) Core Competence 3 (KI-3) for cognitive aspect; dan 4) Core Competence 4 (KI-4) for psychomotor aspect.

The four core competences of 2013 curriculum contain the principal paradigm of unity of sciences. Simply, unity of science is a paradigm of science which deems that all sciences are united. In Islam, this paradigm is the anthitesis of dichotomy between religion and science (or general science) which until now is applied in the society (Hidayat, 2014).

This paradigm appears as the solution to remove the dichotomy. Unity of sciences idealize the integration between religion and general science under the belief that all sciences came from Allah SWT (Fanani, 2015). With this foundation, general sciences cannot be separated one to another. Both of them should be united because of the dichotomy only remove the potential of mutual symbiosis between them. The development of science through *kauniyah* verses (verses of science) which needs comprehensive understanding with Islamic understanding as its foundation. Therefore, the development of rational sciences is not contradicting religion; it will strengthen it instead (Laila, 2016).

In deeper understanding, rather than the dichotomy paradigm of science, unity of science is more relevant to national education goals. In the journal of education, curriculum of middle schools should strengthen the subjects of religion, language, mathematics, natural science, and social science (Soeprapto, 2013). In short, the goals of national education are building Indonesian society which put forward spirituality and science harmoniously and comprehensively. Thus, unity of science needs to be applied in the holding of national education in Indonesia.

From the explanation, education's curriculum of 2013 curriculum has four competences which are relevant to unity of sciences. It is reflected in KI-1 which focuses on spiritual aspect consistent to the strategy of spiritualization of modern science. Then, KI-2 focuses with social apsects, which is relevant to the humanization of Islamic science. Then, local wisdom in KI-3 is in line with the enhancement of cognitive and psychomotor aspects. However, the suitability of the curriculum with unity of science has never been actualized completely in schools and higher educations in Indonesia. It is proven with the initial research in MAN Kendal.

From the pre-research, some teachers of the school have ever related chemistry to other materials, religion, which percentage was only 14.2% and in mathematics which was 9%. The small percentage can be defined as ever being related, but very rare, even, it can be deemed as never being done.

The explanation above needs development of learning with *unity of sciences*. Related to the source of learning, teachers in MAN Kendal only use guide book and students' worksheet which is supported by the government in teaching and learning process. The quantity and time of books' distributed by the government is uncertain. It creates problems that the students in one class have books from different publishers. Therefore, teachers experience difficulty to equalize the concepts and perceptions between students in certain subject. Since, the guide book from a publisher with other publisher have different emphasis.

To equalize the concept, the solution is creating a handout. According to Ramdani (2012), handout has important role in the effort of making students understand concept, develop procedures, and discovering principles. Besides, there should be an arrangement of handout which can be used by all students for their independent learning. Handout is an ideal source of learning for students to learn independently, since in handout, there are some helpful components which can help students to understand the material comprehensively. It is also strengthened with the research of Izzati (2013) which shows that handout can help students to achieve learning quality which

influences learning outcome. The needs of this handout is supported by the statement of Juni Purwanti, S.Pd, a teacher in MAN Kendal, that majority of XI grade students learn independently out of school hours. From all of those students, 17% of them admitted to private course out of the school.

Based on the background, the researcher developed the handout of chemistry to the material of acid and base based on the paradigm of unity of sciences. The researcher chose the material of acid and base due to these reasons: 1) Based on the interview of Juni Purwanti, majority of students (71.4%) considered that acid and base is a difficult material to understand with many mathematical operation; 2) acid and base is the requirement to the next material of buffer solution and hydrolysis; 3) the material of acid and base is the material with easy application in daily life; and 4) acid and base is easily related to the material of other discipline of sciences, like religion, physics, biology, and social.

Unity of sciences will be integrated to the material of acid and base which is related to other discipline of knowledge, like physics, biology, religion, and social. The reason why researcher did not only relate chemistry with religion is because the learning process in MAN Kendal have never experienced that. This strategy is used by the students to understand the science of chemistry which is strongly related to other useful science. This statement is supported by Muhayya (2014) that th unification of science widens to different general science, including psychology and social sciences.

The statement above explains the importance of handout of acid and base with the basis of unity of sciences. Thereby, this research is intended to produce a handout of chemistry with the basis of unity of sciences to the chapter of acid and base. The result of this research is correlated to the main mission of UIN Walisongo to establish education and teaching of Science and Technology with unity of sciences to produce professional and noble graduates.

METHODS

This research used research and development approach (R and D). The method of RnD used by the scheme of Sugiyono (2013). The scheme can be seen in Figure 1.

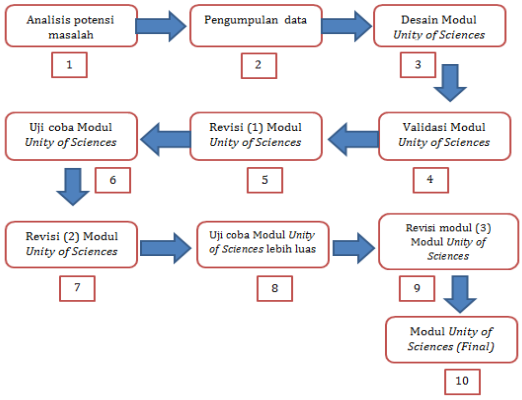

Figure 1. Scheme of R and D research based on Sugiyono (2013)

There are 10 steps of Sugiyono's research. There are the trials of the handout and revision of handout (3). However, the researcher did not try the handout in wider scope, and there is no any revision of the handout (3); thereby, the researcher did 7 steps starting from the first to the seventh step of the research, until the revision (2) of the handout.

The subjects of the experiment include the: (1) experts of the material and media, (2) experts of unity of sciences, (3) the chemistry teacher of MAN Kendal. The subject of the experiment consists of 9 students, each of the students took 3 students from the group of participant which had low, medium, and high ability. The types of obtained data were quantitative and qualitative data. The data were obtained from the questionnaires given to experts of materials and media along with the teachers of chemistry and students. The evaluation test asssessd the properness of the handout starting from its content, language, presentation, and graphic. The validity of the handout was assessed based on the criteria shown in Table 1 as follows.

Table 1. Criteria of Handout's Validity (Akbar, 2013)

Criteria of Validity	Level of Validity
85.01%-100%	Very Valid, or can be used without revision
70.01%-85%	Valid Enough, or can be used with minimum revision
50.01%-70%	Fairly Valid, improper to use with many revision
1%-50%	Invalid or cannot be used

The consideration of criteria of students' questionnaire can be seen in Table 2.

Table 2. Scoring Guidance (Muhidin, 2007)

Range of Score	Categories
86-100%	Very Good
76-86%	Good
56-75%	Fair
55-59%	Poor
0-54%	Very Poor

There is a readability test to the students. It can be seen in Table 3.

Table 3. The Scoring of Short Essay Test (Syarofah, 2012)

Scoring Categories	Note
≥60%	Do not need revision
41-60%	Revised
≤40%	Revised

Pretest and Posttest aim to compare the achievement of indicator before and after the use of the handout to the students.

RESULTS AND DISCUSSION

This research produced unity of science-based handout to the material of acid and base. The handout has come over some steps of development:

1. The Analysis of Potential Problems

This step includes the analysis of learning source in MAN Kendal, and whether it is suited to 2013 curriculum based on the strategy of unity of sciences. By applying the basis of unity of science, the researcher chose the materials which can be related to natural, social, and cultural sciences. Therefore, the chosen material was acid and base. In the other hand, 71.4% students faced difficulty caused by improper learning sources. To create learning sources, the teacher should know the learning style of the students. 83% of the students had their own learning style. In independent learning, the handout was very appropriate to use for learning process, whether in school or at home.

2. Data Collection

The collection of data was used by distributing questionnaire of needs analysis to the students. The result of the questionnaire of needs analysis can be seen in Table 4.

Table 4. The Analysis of Students' Needs

No	Aspects	Percentage
1.	The Expected Content	
	a. Pictures	78%
	b. Graphic/ Table	54%
	c. Exercises	48%
	d. Guides of Practicum	40%
	e. Miscellaneous	22%
2.	Size of the Handout	
	a. A4 paper	10%
	b. Half-A4	23%
	c. Folio paper	5%
	d. Half-folio	28%
	e. B5	47%
3.	Materials which is related to chemistry	
	a. Physics	-
	b. Biology	-
	c. Religion	14.2%
	d. Economy	-
	e. History	-
	f. Culture	-
	g. Language	-
	h. Mathematics	9%

The obtained data resulted the conclusion that the students wanted complete content in the handout. The size of the paper chosen by the students was B5 because it was simple and able to be brought everywhere. The material which has ever being related to chemistry were mathematics and religion. Therefore, the handout was made by relating the material of acid and base.

3. Design of the Handout

The initial designing steps of the handout were:

a. Determining the objective of the learning process following the syllabus of revised 2013 curriculum. The chosen basic

competences were KD 3.10, 3.11, 4.10, and 4.11.

b. Finding the literatures which were related to unity of science. In addition, the material was added with the interview with the expert of unity of sciences, Dr. H. Abdul Muhaya, M.A.

c. Designing the handout of chemistry with unity of science basis.

After the creation of the handout, the validity of it was tested by the experts.

4. Validation of Handout

Validators of this handout were R. Arizal Firmansyah, M.Si as validator 1 (content and media), Juni Purwanti K, S.Pd as validator 3 (teacher of chemistry education validating the content, media, and unity of science), and Dr. Abdul Muhaya, M.A as validator 3 (expert of unity of sciences).

In this step, the content and media of the handout scored 61.42% (fairly valid) and 97% (very valid) respectively. Meanwhile, the strategy of unity of science in the handout obtained the percentage of 73% (valid enough). Beside quantitative score, validator also gave qualitative impression, where there were some revisions needed in certain parts.

5. Revision of Handout (1)

The revision of handout was done to certain part, including:

a. Aperception of the less connection between acis and base.

b. Minimize constructivism, since the used curriculum is 2013 curriculum.

c. In the column of unity of sciences relating to acid and base, the provided verse of Al Quran has not reached the goal of unity of sciences or embracing Allah the Almighty

After the revision, the handout obtained the score of 83% (valid) from validator 1, while validator 2 valued it with 97% (very valid). Meanwhile, the strategy of unity of sciences obtained the score of 93% and stated very valid with no revision.

6. Trials of the Handout

Field trials is the following step of revision. The trial was done to small group with 9 students. The learning process to small group was done in 6 meetings. During this experiment, the handout was assessed using a questionnaire of students' responses, readability, pretest, and posttest.

a. Questionnaire of Students' Responses. According to Muhidin (2007), in overall measurement, the percentage of the students reached 80.41 % (good). The responses of the students can be seen in Figure 2.

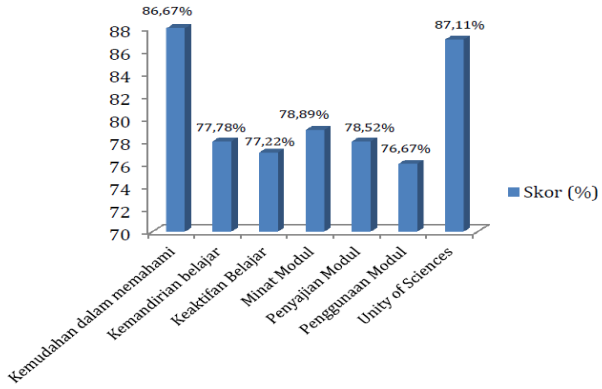

Figure 2. Students' Responses

b. The test of readability was done using Kloss technique, that the students were asked to complete blank statements. This test obtained the average percentage of 94% (no revision). The percentage which did not pass 100% was due to students unable to read the handout comprehensively.

c. The pretest and posttest were done to measure the achievement of students' indicator. Table 5 shows the result of small group students' pretest and posttest.

Table 5 provides students' pretest and posttest score. The score increased from the average of 50.55 in the pretest to 75.56 in the posttest. The increase was in 50%. The increase was due to students' serious effort in doing the exercises despite there are many exercises in the end of the subchapter and the chapter.

7. Revision of the Handout (2)

After the trial in the small-scaled class was cancelled due to students good and very good result, revision was done to the handout. The handout of chemistry was delivered by stimulating the students to learn. The content of the handout also contains the column of unity of sciences consisting of the relation of chemistry to other disciplines of sciences which can enrich students' knowledge. In this handout, there is an invitation to students to do the knowledge test in every subchapter. Based on Mardiyan (2012), students' activeness in the learning process can influence their understanding to the material. Therefore, the students will understand the material deeper and be more active in the

learning process. Among the superiorities above, the handout also has lackness that it is specifically targeted to Islamic Senior High School students who are Muslims.

Tabel 5. Pretest and Posttest Scores

Respondents	Pretest Score	Posttest Score
UK.1	75	90
UK.2	65	80
UK.3	55	75
UK.4	40	80
UK.5	30	65
UK.6	70	85
UK.7	40	70
UK.8	45	70
UK.9	35	65
Total	455	680
Mean	50.55	75.56

CONCLUSION

Based on the result of the research, a handout of chemistry was experimented in MAN Kendal. The properness of the handout was based on unity of sciences on the material of acid and base. The handout was assessed by expert judgment (validators), readability of the handout, and questionnaire of responses to the handout. Through the proper test 1 and 2, the handout obtained the score of 90% which is included as very valid. The result of the test scored 94% which means there should be no revision in the delivery of the materials. The result of students' questionnaire was 80.41% which was included in good category. Based on the result of handout quality based on unity of sciences, this handout can be considered as proper with good quality and can be tested to bigger scale of class.

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