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DEVELOPMENT OF *CHEMISTRY STUDENT WORKSHEET* ON MAIN MATERIAL ACID, BASE, AND SALT WITH SCIENCE PROCESS SKILLS ORIENTATION FOR PIONEERING INTERNATIONAL STANDARD JUNIOR HIGH SCHOOL

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Abstract : *This research is to know the feasibility of Chemistry Student Worksheet on main material of acid, base, and salt with science process skills orientation for pioneering international standard junior high school based on criteria of content, presentation, suitability with component of science process skills and language. This research develop by using Research and Development (R&D) design and only was limited until stage of development studies especially is limited trials of product. Subject of the research are a chemistry lecture, two chemistry lectures that teach English, and two science teachers of SMP Negeri 2 Bojonegoro. All respondents fill the feasibility questionnaire of chemistry student worksheet based on criteria of content, presentation, suitability with component of science process skills and language. The results showed that chemistry student worksheet with science process skills orientation is feasible based on chemistry lecturer and science teachers validation ≥ 61%. Percentages of chemistry lecture and science teachers validated based on feasibility of content criteria, presentation, suitability with component of science process skills and language are about 86.11%, 85.65%, 89.44%, dan 88.19%.*

Key words : *development research; chemistry student worksheet; science process skills; acid, base, and salt*

Abstrak : Penelitian ini bertujuan untuk mengetahui kelayakan dari *Chemistry Student Worksheet* Materi Pokok Asam, Basa, Dan Garam Berorientasi Keterampilan Proses Untuk SMP RSBI yang dinilai berdasarkan pada kriteria isi, penyajian, kesesuaian dengan komponen keterampilan proses dan kebahasaan. Penelitian ini adalah penelitian pengembangan menggunakan *Research and Developmet (R&D)* dan hanya dibatasi sampai pada tahap studi pengembangan khususnya pada uji coba produk secara terbatas. Subyek penelitian yaitu satu orang dosen kimia, dua orang dosen kimia ahli bahasa Inggris, dan dua orang guru IPA SMP Negeri 2 Bojonegoro. Semua responden mengisi daftar pertanyaan kelayakan *chemistry student worksheet* berdasarkan kriteria isi, kriteria penyajian, kriteria kesesuaian dengan komponen keterampilan proses, dan kriteria kebahasaan. Hasil penelitian menunjukkan bahwa *chemistry student worksheet* berorientasi keterampilan proses layak berdasarkan penilaian dari dosen kimia, dan guru IPA sebesar ≥ 61%. Penilaian dosen kimia dan guru IPA berdasarkan kelayakan kriteria isi, penyajian, kesesuaian dengan komponen keterampilan proses, dan kebahasaan menunjukkan persentase sebesar 86.11%, 85.65%, 89.44%, dan 88.19%.

Kata kunci : penelitian pengembangan; *chemistry student worksheet*; keterampilan proses; asam, basa, dan garam

INTRODUCTION

Development of science and technology have brought changes in almost all aspects of human life. Beside to providing benefits for human life, on the other hand these changes have also brought people into stronger era of global competition. A nation need to develop

and improve the quality of human resources to be able to participate in global competition. Education is the main capital of a nation in an effort to improve the quality of human resources. Qualified human resources will be able to manage natural resources and provide services effectively and efficiently to improve welfare of communities. Therefore, almost all nations try to improve the quality of education, including Indonesia.

Repairing the curriculum system is one of government effort to improve the quality of education in Indonesia. The curriculum should be developed regularly and continuously in line with developments of science, technology, and art. Development of science, technology, and art is one of the operational reference arranging *Kurikulum Tingkat Satuan Pendidikan (KTSP)*. The curriculum should be developed so that learners are able to compete globally and can coexist with other nations.

In this regard, the government adopted a policy as set forth in Law No. 20 of 2003 about National Education System Article 50 paragraph (3) which states that "the Government and/or local governments conduct at least one unit of education at all levels of education to be developed into an international educational unit". In *Pedoman Penjaminan Mutu Sekolah Bertaraf Internasional pada Jenjang Pendidikan Dasar dan Menengah* [1] stated that international schools are schools that have satisfied all of National Education Standards and enriched by reference to the education standard one of the members of the Organization for Economic Co-operation and Development (OECD) and/or other countries that have certain superiority in education, so it has a competitive power in international forums.

SMP Negeri 2 Bojonegoro is one of the pioneering international standard junior high school since 2008 and the learning process using bilingual (English and Indonesian). Ahmadi Khoiru [2] explains that the implementation of beginner international school must be supported by the relevant infrastructure to support bilingual learning one of them is student worksheet.

Student worksheet is sheets contains task to be done by learners. Worksheet are usually consists of instructions, the steps to complete a task. Tasks contained in the worksheet should be has clear basic competence to be achieved [3].

Depdiknas [3] states that the student worksheet will provide benefits for teachers and students. Teachers will have the materials that ready for used, while students will get experience of independent study and study to understand the written task contained in student worksheet. So, the availability of learning materials such as worksheets is also very necessary to support learning activities.

BSNP [4] explains that the good student worksheet is student worksheet who meet the feasibility criteria of content, presentation, and language. Based on the survey results on the field, the student worksheet that used in SMP Negeri 2 Bojonegoro is worksheet from MGMP not fully satisfy the feasibility criteria for student worksheet. This is supported from the interview results with science teachers of SMP Negeri 2 Bojonegoro which states that the main materials and illustrations that presented in the student worksheet is still minimal and less able to motivate students to study, so that most students have difficulty in understanding the main materials. In addition, the teacher also stated that the worksheets in English language which available in the market is still very limited and difficult to reach. The availability of English student worksheet is needed as support in the learning activities is supported from questionnaire results of pre-research that was distributed on November 7, 2011 in SMP Negeri 2 Bojonegoro, 100% of students states that English student worksheet can help them in studying the science in bilingual including chemistry because 80% of students expressed

difficulty in studying the chemistry in bilingual.

Matter acid, base, and salt is the first material for the chemical aspects of learning science at junior high school, so it should be presented as attractive as possible so that students can be motivated to study chemistry more. In addition, this material also contains concepts that are widely used in daily life. However, based on questionnaire results of pre-research in SMP Negeri 2 Bojonegoro, 84% of students stated that they had difficulty to study the acid, base, and salt material in bilingual. Standard competence of this material is understanding the classification of matters while the basic competencies which have achieved by students are classifying the properties of acid, base, and salt solutions using appropriate indicator and doing simple experiment by using materials that are obtained in daily life. Based on the standard competence and basic competencies, this material is a material that requires students to do experiments in the laboratory. This is in line with the wishes of the students that learning does not just memorize concepts and do tests but also the holding of experiments in the laboratory. To support implementation of the learning, needs chemistry student worksheet as a learning resource that can motivate students to find their own understanding so that students not only memorize the abstract concepts but rather to build his own knowledge about these concepts through experiment activities.

Based on *Permendiknas* No. 23 of 2006 about Graduate Competency Standards for Education Units of junior high schools, one of which stated that the student should be able to tell the ability to think logically, critically, creatively, and innovative. In addition, Content Standard of Education also demand learning science in the junior high school carried out scientific inquiry that emphasizes providing direct learning experience through by using and developing of process skills and scientific attitudes [4]. Inquiry skills are skills in finding out or did that include observing, measuring, classifying, asking questions, making hypotheses, planning experiments to answer questions, processing and analyzing data, applying ideas to new situations, using simple equipment and communicate information in several ways, namely by drawing, oral, writing, etc. Through process skills are developed attitudes and values that includes curiosity, honesty, patience, open, not superstitious, critical, diligent, hard working, satisfiediculous, disciplined, caring for the environment, attention to safety, and cooperate with others [5].

The essence of science includes four main elements: (1) attitude: curiosity about objects, natural phenomena, living things, and causal relations that give rise to new problems which can be solved through proper procedures, science has properties of open ended, (2) process : the procedure of problems solving through the scientific method, scientific method involves the formulating hypothesis, design of experiments, evaluation, measurement, and making conclusion, (3) product: facts, principles, theories, and laws, (4) application: the application of scientific method and the concept of science in daily life. The fourth element are characteristic of the whole of real science can not be separated from each other [5]. The tendency of science in the present study is the students only learn the science as a product, memorize the concepts, theories and laws. This situation is compounded by learning beriorientasi on tests/exams. Consequently science as a process, attitudes, and learning applications untouched in [5].

Based on the pre-research on SMP Negeri 2 Bojonegoro known that the ability of students' science process skills are still low. It is shown from the results of the science process skill test that given to students with the correct percentage for each component of the science process skills which include: observation (50%), classifying (11.5%), formulating hypotheses (7.7%),

identifying variables (0%), communicating data in tabular form (15.4%), and making conclusions (7.7%).

Studies ever conducted to train students' science process skills through the development of student worksheet show a positive response as evidenced from the increasing ability of students' process skills and students' learning outcomes. It can be used as reference to develop a *chemistry student worksheet* with process skills orientation in other materials.

Based on the background mentioned above, so the researcher need to develop a chemistry student woorksheet main material acid, base, and salt with science process skills orientation in order to facilitate students' learning invented the concept independently. Therefore, conducted research entitled "Development of Chemistry Student Worksheet Main Materials Acid, Base, and Salt with Science Process Skills Orientation for Beginner International Junior High School ".

Based on the above background, the formulation of the problem in this research are "How the feasibility Chemistry Student Worksheet On Main Material Acid, Base, and Salt With Science Process Skills Orientation for Pioneering International Standard Junior High School assessed based on criteria of content, presentation, suitability with the component of science process skills, and language?

In accordance with the above problem formulation, the objectives of this research was to determine the feasibility of this Chemistry Student Worksheet based on criteria for content, presentation, suitability with the component of science process skills, and language.

The benefits that expected of this research are: researcher have insight on the development of chemistry student worksheet so that it can be used as a reference for developing teaching materials on other material, grade, or levels of education; help provide solution to teachers in teaching the main material of acid, base, and salt for beginner international junior high school; and as a learning resource that can improve the quality of chemistry teaching, motivate students to study, and arena practice for self-study in understanding the concepts of chemistry.

RESEARCH METHOD

Type of this research is the research development i.e. development of Chemistry Student Worksheet On Main Materials Acid, Base, and Salt With Science Process Skills Orientation for Pioneering International Standard Junior High School. This research refers to Research and Development (R&D) design which consists of three stages, namely stage of introduction studies, development studies, and evaluation studies. However, in this research was limited until stage of development studies precisely is limited trials of product. Targets in this research is *Chemistry Student Worksheet* On Main Material Acid, Base, and Salt With Science Process Skills Orientation for Pioneering International Standard Junior High School which next will be assessed/validated by a lecturer of chemistry, two chemistry lecturer that teach English, and two science teacher of SMP Negeri 2 Bojonegoro to determine the feasibility of chemistry student worksheet has been developed. Analyzes is done on each of the criteria stated in the validation sheet. The percentage of the data obtained by the calculation of this questionnaire Likert scale as in Table 1.

Table 1 Likert Scale

Appraisal	Value Scale
Very Poor	0
Less	1
Enough	2
Good	3
Very Good	4

Riduwan [6]

The formula used in the calculation to obtain the percentage is:

$$Percentage = \frac{score\ amount\ of\ collecting\ data}{criteria\ score} \times 100\%$$

Criteria score obtained by calculation as follows:

$$Criteria\ Score = the\ highest\ score\ x\ amount\ aspects\ x\ amount\ respondents$$

The results of the validation sheet analysis are used to determine the feasibility of the chemistry student worksheet developed by using the interpretation of scores as follows:

Table 2 Criteria of Score Interpretation

Percentage (%)	Criteria
0 – 20	Very Poor
21 – 40	Less
41 – 60	Enough
61 – 80	Feasible
81 – 100	Very Feasible

Riduwan [6]

Research design of this c*hemistry student worksheet* development can be seen in Figure 1.

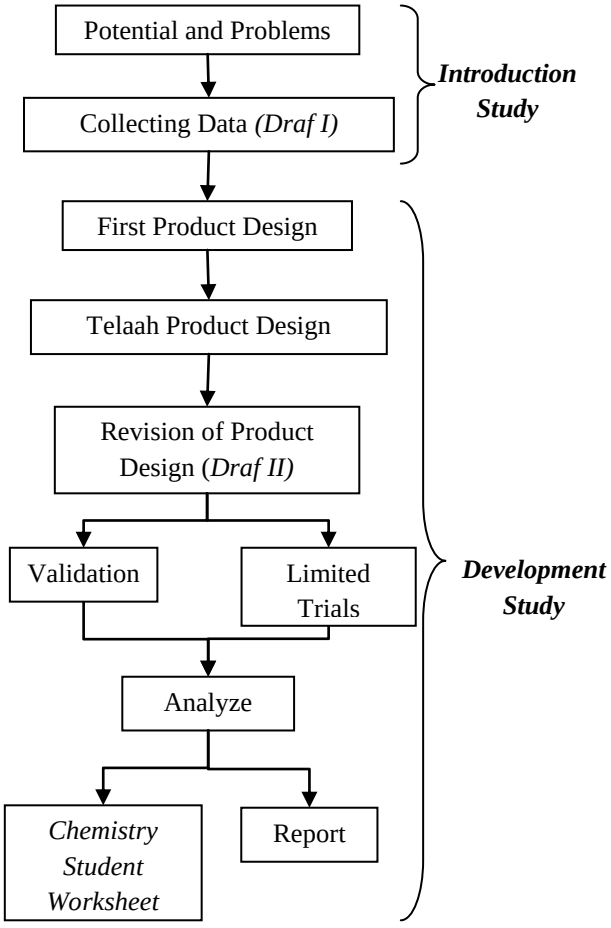

Figure 1 Design of *Chemistry Student Worksheet* Development With Science Process Skills Orientation Which Adopted

RESULTS AND DISCUSSION

Data from the *chemistry student worksheet* assessment by experts and then was analyzed descriptively and quantitatively. Validation results of design are presented in Table 3.

Chemistry student worksheet is said feasible if it has percentage of 61% - 80% and is very feasible if it has percentage of 81% -100% [6].

Validation results of the *chemistry student worksheet* based on contents criteria on *worksheet* 1, 2, and 3 respectively are 88.33%, 85.00%, and 85.00%. These results have satisfied the feasibility criteria for content that was adapted from BSNP [4] because it has been a ratings ≥ 61% [6]. Based on the criteria of score interpretation in Table 2, It can be said that the feasibility criteria for the contents of worksheet 1, 2 and 3 are very feasible.

These validation results was obtained because chemistry student worksheet has been developed to satisfy the contents criteria that described in BSNP [4] i.e. the material was presented in accordance with the standard competence and basic competencies include breadth and depth of material. Breadth of material in this case is material that presented describing the minimal substance (facts, concepts, principles, and theories). While the depth of material is description of material in accordance with the cognitive, affective, and psychomotor aspects. Based on its standard competence and basic competencies, material of acid, base, and salt requires students to conduct experiments in the laboratory so that the chemistry student worksheet was developed to provide experiments activities include cognitive aspect that is conclusion of the experimental results, affective and psychomotor aspects that must have been by students and trained for the experimental activities. Second component of the content criteria is accuracy of material covering facts, concepts and illustrations accuracy. The material presented in accordance with the truth of the facts, concepts, principles,

and theories of science and not cause a lot of interpretation. Illustrations are provided in accordance with the facts and science concepts are described by the proportional size and shape and are completed with appropriate explanations. The experimental activities that was presented in this chemistry student worksheet is also able to encourage student's curiosity about material they will learn. So from content criteria, this Chemistry Student Worksheet Main Material Acid, Base, and Salt With Science Process Skills Orientation is very feasible be used as a source of learning.

Table 3 The Validation Results of Chemistry Student Worksheet Process Skills Orientation

No	Criteria	Assessment percentage (%)			Average (%)	Criteria
		Worksheet 1	Worksheet 2	Worksheet 3		
1.	Contents	88.33	85.00	85.00	86.11	Very Feasible
2.	Presentation	88.89	81.94	86.11	85.65	Very Feasible
3.	Suitability with the component of science process skills	97.22	86.11	85.00	89.44	Very Feasible
4.	Language	89.58	85.42	89.58	88.19	Very Feasible

The validation results of the presentation criteria of chemistry student worksheet to worksheet 1, 2, and 3 respectively are 88.89%, 81.94% and 86.11%. The results stated that the chemistry student worksheet can be said feasible because it has been a ratings ≥ 61% [6]. Based on the criteria of score interpretation in Table 2, we can conclude that the feasibility of the presentation criteria for worksheet 1, 2, and 3 is very feasible.

The presentation criteria is very feasible obtained because concepts that presented in the chemistry student worksheet has been coherent, consistent, and balanced between the concepts in the worksheet 1, 2, and 3. BSNP [4] explains that the coherent concept is basic or simply concepts was presented before more complex concepts. This chemistry student worksheet consists of three worksheets are arranged from the properties introduction of acid, base, and salt; then how to identify solutions based on the properties by using synthetic and natural indicators. Consistency in the systematic *chemistry student worksheet* also has been adapted to the criteria described in BSNP [4] i.e presentation of the material has been following the writing systematic of student worksheet from *Depdiknas* [3] which includes the title, learning instructions, competencies to be achieved, supporting information, work steps, and evaluation. Balancing of substance between subs-chapters is proportional with consider the standard competence and basic competencies of acid, base, and salt material. Illustration that is presented has been suitable with the acid, base, and salt material; material that presented centered on the learner and packaged in such a way that can motivate students to learn independently through experiments activities; presentation variations is the material was presented by the inquiry satisfiedhod and was used various types of illustrations to support the material that presented and its sources; presentation and discussion of material more focus to the science process skills that is the main orientation of the chemistry student worksheet development is not only the acquisition of the final result; and there are the complete presentation such as: the introduction, contents, references, and concept map. So, in terms of presentation criteria, the Chemistry Student Worksheet On Main Material Acid, Base, and Salt With Science Process Skills

Orientation are very feasible to used in the learning process.

Chemistry student worksheet that was developed is said have satisfied the suitability with the component of science process skills criteria for all research aspects include: observing, classifying, communicating data in tabular form, formulating hypotheses, identifying variables, and making conclusions.

Validation results of the chemistry student worksheet based on suitability with the component of science process skills criteria to worksheet 1, 2, and 3 respectively are 97.22%, 86.11%, and 85.00%. Based on the validation results then the chemistry student worksheet can be said feasible because it has been a ratings ≥ 61% [6]. Based on the criteria of score interpretation in Table 2, it can be said that the suitability with the component of science process skills criteria to worksheet 1, 2, and 3 are very feasible.

Chemistry student worksheet that was developed to present some activities that can train students's science process skills which include: observing, classifying, communicating data in tabular form, formulating hypotheses, identifying variables, and making conclusions. Observation activities are presented to train students' skills in using the senses of sight to collect information about experimental results that have been done. The classifying activities in the chemistry student worksheet can train students' ability to classify certain materials based on its properties. Activities to communicate the data in tabular form can also be to train students to present data that obtained by the experimental results to be more systematic. Activities to formulate hypotheses can train students to make assumptions of the problem formulation by the phenomenon that occurs. Activities to identify variables can train students in order to control everything that could affect to experimental results. Activities to making conclusions contained in the chemistry student worksheet to train students to make statements that to be core of what learned from the experiments activities have been conducted. So based on the validation result to suitability with component of the science process skills, Chemistry Student Worksheet Main Material Acid, Base, and Salt With Science Process Skills Orientation are getting very feasible ratings and is expected can be used well as learning materials that can to train students's science process skills.

Validation results of the chemistry student worksheet based on language criteria of worksheet 1 is 89.58%, worksheet 2 is 85.42% and worksheet 3 is 89.58%. Based on the validation results so the chemistry student worksheet that developed is said feasible because it has been a ratings ≥ 61% [6]. Based on the criteria of score interpretation in Table 2, it can be said that the language criteria for worksheet 1, 2, and 3 is very feasible.

Language components adapted from BSNP [4] i.e. the syntax that used in the chemistry student worksheet to convey the message refers to the rules of English grammar accordance with good and correct English grammar. Using of English in the chemistry student worksheet has also been adapted to the development of student thinking by BSNP [4] i.e. the language is used, both to explain concepts and illustrations of concepts application describe concrete examples in daily life. English terms are used appropriately and easily understood and has been completed with the vocabulary at the end of each worksheet to new vocabularies that related to the material of acid, base, and salt. The illustrations that used in the chemistry student worksheet are relevant/have been adapted to the material to be conveyed and has been completed with a explanation for each illustration of the chemistry student worksheet. English language that used has been noticed coherent or relating between sub-chapters, paragraphs, and sentences as well as terminology and symbols used in the chemistry student worksheet are stable. So, based on the validation results

about language criteria, Chemistry Student Worksheet On Main Material Acid, Base, and Salt With Science Process Skills Orientation are getting very feasible ratings and was expected can be used well as supporting bilingual learning.

Overall validation results of the chemistry student worksheet based on criteria of content, presentation, suitability with components of science process skills, and language have percentage respectively are 86.11%, 85.65%, 89.44% and 88.19%. Based on Table 2, it can be said that the chemistry student worksheet developed very feasible to be used. In the presence of good instructional materials, it is expected the learning process that teachers and students done can achieve the Graduate Competency Standards.

CONCLUSIONS AND SUGGESTIONS

Based on data analysis and discussion of this research results, it can be concluded that the Chemistry Student Worksheet Main Material Acids, Bases, And Salts With Science Process Skills Orientation was developed feasible be used as learning material because it obtain percentage of ≥ 61% for all aspects including: feasibility criteria for contents with a percentage of 86.11% (very feasible); feasibility criteria for presentation with a percentage of 85.65% (very feasible); feasibility criteria for suitability with the the component of science process skills with a percentage of 89.44% (very feasible), and feasibility criteria of language with a percentage of 88.19% (very feasible).

Based on the above discussion and conclusions can be made several suggestions from the author, among others: during the limited trials, need to consider students' ability to speak English, so students are not wrong in understanding the material/concepts and questions whether the using of chemistry student worksheet nor do test; ability to manage time for research is needed, so the research results that obtained are as expected; research of chemistry student worksheet main material acid, base, and salt with science process skills orientation development can be carried out on students, classes or other schools which has a similar problem with the place of this research is done.

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