Character values-loaded chemistry module development in redox reaction and compound nomenclature materials to improve learning outcome of high school students

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Abstract. Several values came from learning sources are needed to support character-based learning. This research aims to produce character values-loaded chemistry module in redox reaction and compound nomenclature materials. The module contains various values: religious, intellectual, education, moral-ethics, economic (practical), and social-politics. This research adapted R&D with Borg & Gall model. Trial product was implemented for 30 grade X students of State Senior High School Banda Aceh. Data were collected using questionnaire, written test, and documentation. Analysis of needs showed that modules are limited which supported character-based learning. The results indicated that the module is very feasible to be tested for learning as shown as expertise assessment with 84.94%. In addition, the percentage is also supported by limited trial on MGMP chemistry teacher with 85.29% for module feasibility. After applied for learning, the learning outcomes of redox reaction and compound nomenclature were improved based on moderate score level of N-gain with 0.63. The students’ perception indicated their acceptance for developing module with various categories percentages, 39.51% strongly agree, 51.36% agree, 7.16% doubtful, 1.85% disagree, and 0.12% strongly disagree. Therefore, the character values-loaded module is feasible to be tested and used for learning because it successfully improved students learning outcome.

1. Introduction
National character building has become a major issue of education for international community, especially in developing countries, and Indonesia is part of them [1][2]. Character-based education can be developed through 2013 curriculum application and has nationally become education program. The decline in morale and national characters of society and students is a basic reason why the 2013 curriculum should be implemented [3]. This was intended to prevent and overcome the nation's moral and character issues [4]. By 21st century, educational institution of various countries would be challenged for their effort to prepare students’ character. Teacher competence in this 21st century contributes positively to the growth and development of student character [5]. Therefore, teachers are recommended to provide character values for every school activities, both intra curricular (curriculum development, learning and evaluation), curricular, and extracurricular [6].

Educational institutions play an important role in developing students character values. Based on Kohlberg’s moral development theory, teacher has the major responsibilities which include planting,
developing, and shaping characters as building the moral identity of students [7]. Teachers are determinant of successfulness for goals of education [8]. To achieve goals of education, teachers develop the quality of human resources which trusted in a sustainable manner in terms of integrating character values [9]. In order to cultivate character values in learning process, teachers integrate the values inside teaching materials, activities, and school culture [10]. Integrating character education into subjects can be done by developing syllabi, preparing lesson plans, and loading character values into teaching materials. The integration lead students to character values introduction cognitively. Then, they are experiencing effectively and doing civilizing process. The interview results show that character education has not been comprehensive, because the design and implementation of integrated character education in the curriculum is still ineffective because teachers have not been able to integrate character values inside learning activities and teaching materials [11]. One obstacle in integrating character values is of inadequate teacher competencies [12].

Based on analysis result of real condition at senior high school, it found that learning module used by students has not supported character learning yet. They used chemistry textbook integrated by 2013 curriculum which has lack of character values inside teaching materials. Thus, the students are difficult to bring up real action for their environment. Another problem found is students are lazy to read and repeat learning material that has been learned in class. Therefore, they got learning outcome which is still relatively low. Other findings stated that the development of teaching materials inside modules can be used as an alternative to improve the quality of education, because it proved that module is able to effectively improve student learning outcomes [13]. If students have poor character, it can be rehabilitated by instilling and practicing good habits through planning for character-based learning. According to analysis of students’ needs, they positively show their acceptance for character values-loaded module as literacy learning to be more interactive and varied make them to be more interest in reading and repeating learning materials.

According to UU Sisdiknas, character-based learning can be provided by loading values derived from teaching material. Therefore, to achieve the goals of character-based learning, this research chose a solution by providing character values-loaded modules according to the level of student thinking. This module also provides examples of cases in life, event exercises and self-evaluation to familiarize student for well behavior. The previous study indicates that for the textbooks development based on character values, a very good level of validity is obtained to be employed as a learning resource for students and a reference for teachers in order to develop character values, and is also effective in improving student learning outcomes [14]. In addition, previous study shows that the development of integrated handout which is integrated with character values increased student interest in learning from 60.48% to 69.59% [15]. The use of value-integrating technique in learning has resulted in that the students posses the ability and freedom to choose values that are considered important to practice in their real life based on appropriate moral judgment [16].

2. Method
This research is research and development (R&D) with Borg & Gall model which adjusted with researchers necessary to produce module as research product [17]. Test feasibility for module was done by experts of values education, materials and language. The research used questionnaire for feasibility test and student’s perception, and chemistry question-based test which has been validated before it used. Trials test was done for chemistry teachers from ten different state high schools throughout the City of Banda Aceh as well as ten students. The trial test is provided to understand students’ perception for developing module. After that, the research is continued by implementing and disseminating the module on 30 grade X students of state senior high school majoring in natural science. The school was chosen as sample based on its vision of realizing character learning to shape students who excellent in achievement, faith, taqwa and noble character. The result of implementation and dissemination is measured through pretest and posttest using multiple choice question test and questionnaire of students’ perception.
3. Result and Discussion

3.1. Analysis of Needs

The development of character values-loaded module begins with analysis of needs at SMAN 12 Banda Aceh. This step was done by observing learning process in class, analyzing character values which loaded inside chemistry textbook, and conducting discussion with several teachers. It is important to do analysis of needs on teaching materials development and its feasibility which is preliminary lead by irrelevant learning problem of students necessary, learning environment, infrastructure, and their characteristics [18]. The researcher finds the lack of character values from the teaching material contained in the chemistry textbook. Besides that, the textbook that usually used for learning in school has not been able to give a good message of moral values related to learning materials. Thus, the usual learning has not been able to grow moral awareness and shape good behavior of students. After doing discussion with teachers, we found that many students were less enthusiasm to read and repeat learning materials using textbook or lack enthusiasm to follow learning in the classroom. Based on these findings, it can be stated that character values-loaded module is very needed. In analyzing the need, a survey by questionnaire was also conducted, resulting in six priority characters needed in the context in Aceh, which are: religious, honest, curious, responsible, and hard working.

3.2. Raw Draft Module for Planning and Development

The activity of this step begins by planning character values that will be contained inside module based on information founded during analysis of needs on previous step. At this stage the researcher planned the character values to be included in the chemistry module for the redox reaction and compound nomenclature material. The textbook containing values sourced from the teaching materials has a positive influence on the attempts of building and strengthening the student characters [19]. Before doing development for module, we prepare learning tools such as syllabi, lesson plan, assessment instrumentation and guidelines book for module production. The module was developed using guidelines which have been arranged by Direktorat Tenaga Kependidikan [20]. Each sub-indicator contained materials related to character values of teaching and learning as presented by phrases like “let us remember”, “let us stimulate the brain”, “let use know scientist”, “let us find out”, “let us read”, “let us contemplate”, and “let us doing an action”. Besides that, the module has column for “pre-introduction of learning” which contains religious values such as greeting and praying before doing a lesson. After that, it also has “learning reflection”, worksheet of project methods, and self-assessment. The character values loaded inside redox reaction and compound nomenclature materials are shown in Table 1.

| Learning values | Integration into redox reaction and compound nomenclature materials |
|-----------------|---------------------------------------------------------------------|
| Religious (Spiritual) | a. Redox reaction concept for respiratory system and photosynthesis is used to teach students to be more grateful.  
  b. Concept of electron gain and release during NaCl formation teach students for making alms.  
  c. Total oxidation number equality principle makes students to have equal behaviour and fairness in life.  
  d. Compound nomenclature is used to teach the importance of name in Islamic religion. |
| Intellectual    | a. By using redox reaction principle for respiratory system, we can identify oxidizing agent and reducing agents and understand their roles. |
Learning values | Integration into redox reaction and compound nomenclature materials
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b. | Paper production on how to clean up the rust and prevent rust on iron, making resume article about the causes and preventive actions for browning reaction of vegetables and fruits, making report about strength and weakness of redox reaction, providing task about chemistry formula determination and changing trivial name of compounds into IUPAC name.
c. | Redox reaction principle in flying rocket; redox reaction process for wastewater treatment; and the role of antioxidant compounds in inhibiting redox reaction.
d. | Making experiment report related to observation to iron rust through project method.

Educational a. | Redox reaction mechanism can keep up the equality of CO₂ and O₂ inside body. It teaches us about the beauty of sharing to create the balance between life and nature.
b. | By using compound nomenclature, we can distinguish one compound among others.
c. | Based on compound nomenclature concept, the students are trained to put awareness on name through their interaction.

Moral-Ethics a. | To balance oxygen and carbon dioxide supply on earth, the human planting trees.
b. | Ethics concept is done by preventing and minimalizing metal degradation or iron rust that caused by redox reaction.

Aesthetics a. | Gilding activity, cleaning the rust, painting and inhibiting the redox reaction are used to renew outlook.
b. | Redox reaction inside the fire produces beautiful colours and Allah loves the beauty.

economic (practical) c. | The advantage of commercial oxygen production for medical and industry sectors.
d. | By using redox concept in during electrolysis process, people are capable to produce alkaline water.
e. | Silica gel absorbs the humid, thus it can be used for inhibiting metal rust.
f. | Processing iron rust can make a higher selling value.

Social-politic a. | To improve the metal endurance, the metal was covered by other metal. The same phenomena for human who need mutual care and help to increase the strength of solidarity.
b. | By implementing the redox principle for corrosion preventive action, we can maintain the stability in social environment.

3.3. Result of Module Feasibility Test

The results of module's feasibility test were obtained from the assessments of an expert in the fields of values, materials, and languages education. The result of the test is presented by both percentages using assessment scale and comments. It aims to get inputs for module refinement before carrying out major field trials, operational field, and implementation. The overall average score of assessment provided by four experts is 84.94% which means the character values-loaded module is very feasible to be used. This finding is supported by previous research where the average score is 86%. Therefore, it can be concluded that the character values-loaded module that can be developed [21].

The expert of values education mostly comments on graphical aspects such as: the cover is less interesting, the presented figure size is not proportional, and the presentation of chemical formula and phase is not consistent. On materials and content aspects, it is suggested to insert cases of study related to daily life. Then, for character values aspect, overall comments are good, however it is suggested to explore and examine certain subtopics that strongly related to character values. Besides that, perspective of character values loaded inside the module can enrich the student’ literacy. Another comment come
from expert of language, it is suggested to refine various aspects such as diction, spelling and word form. All comments that come from experts were considered for revision before the implementation.

3.4. Teacher Perception of Major Field Trials
After doing analysis of needs, planning, development and validation test, the module is used for major field test on chemistry teacher whom selected from ten state high schools City of Banda Aceh. This test aims to obtain relevant advices and reviews for module development. Overall, the average percentage of teacher perception to module is 85.29%. the result showed that teachers support the module development. They stated that developing module has been loaded by character values which easily help to build and strengthen character of students. On presentation aspect, teachers suggested to separate mind map between two topics which are redox reaction and compound nomenclature. In addition, they also command to use national examination question integrated to higher order thinking skills (HOTS). For several advices, the researchers did refinement before the module is used for operational field test. Then, for application aspect, teachers stated that module has been contained good character values which help them in teaching. The module is also assessed to be easier to understand by students and it can be used to drive their imagination in critical and creative thinking. The previous study explained that character values help students engaged to interest and social behavior [12].

3.5. Student Perception of Operational Field Test
Good student perceptions were obtained from ten students in class X of SMAN 4 Banda Aceh, and showed the percentages of 61.48 for strongly agree, 33.70 for agree, 3.70 for doubtful, 0.74 for disagree, and 0.37 for strongly disagree. On presentation aspect, they suggested to design better and interesting cover with figures. Based on previous research, the final product of developing module was designed in full colors and supplemented by illustration that loaded by character values [22].

3.6. Student Learning Outcome
Learning outcome is obtained from result during implementation and dissemination. The test used 25 multiple choice questions referred to 2013 curriculum for pretest and posttest to evaluate the influence of module that contained character values in learning redox reaction and compound nomenclature. Then, its result was analyzed using N-gain test to investigate learning improvement and make a conclusion. Overall average score is presented in Table 2.

| Table 2. Overall Learning Outcome |
|-----------------------------------|
|                                   | Pretest | Posttest |
| Maximum values                   | 56.0    | 92.0     |
| Minimum values                   | 36.0    | 60.0     |
| Average values                   | 41.06   | 78.40    |
| Deviation Standard               | 5.03    | 6.61     |
| N-gain                           | 0.63    |          |
| Improvement criteria             | Moderate|          |

Table 2 illustrated that the learning outcome has been increased after using module as shown as N-gain test with score of 0.63. This can be interpreted that the use of communicative language in the module about the concept of redox reactions, oxidation number, and nomenclature of compounds is easily understood by students. By use this module, students are able to give examples of redox applications in life, become more proficient to calculate oxidation number and the determination of redox reactions based on oxidation number changes and more advanced in making nomenclature for compounds. The similar finding also explained that student learning outcomes using integrated character education modules reached values above the minimum completeness criteria (KKM) that is higher than 89% and the N-gain test reached a high category with score of 0.76 [23].
3.7. Student Perception on Module

The perception indicated their acceptance for developing module with various categories percentages, 39.51% strongly agree, 51.36% agree, 7.16% doubtful, 1.85% disagree, and 0.12% strongly disagree. It is also supported by previous study which stated that chemistry learning by using modules contained character values through the provision of perception questionnaire aims to measure student character, and it reached very good category with average score of 85% [21]. Among 27 statements, it contains 7 statements related to impact of module usage: (1) I have learned that chemistry is very close to Islam. The example is electron transfer which is standing for alms principle. The students gave 75% positive answers; (2) I have understood that chemical reaction with electron transfer is identical to alms principle, thus chemistry teaches us to do charity. The students gave 90% positive answers; (3) I have learned to develop chemistry-based business. The students gave 90% positive answers; (4) I have got that iron is deliberately painted to protect from corrosion and make it to be more beautiful. In line with Islamic principle, the beauty is one of nature of God, because He loves the beauty. The students gave 100% positive answers; (5) I have been learned to be more aware in examining chemical reaction accurately. The student gave 83.33% positive answers; (6) I have learned that chemistry plays the important role to overcome environment problem such as: preventing corrosion in iron pipes, wastewater treatment, and so on. The students gave 96.66% positive answers; and (7) I have learned that the rules in naming chemical compounds correctly are important in learning chemistry. According to Islamic principle, name also has crucial role, thus it is suggested to give name with good meaning. Students gave 100% positive answers.

4. Conclusion

Based on result of research and module development, it reached average score of 84.94% for validation test with very feasible category, 85.29% for strongly category of teacher perception in major filed test. Besides that, student perception also presented by their positive responses to character values-loaded module. Their acceptance is shown by percentages of 39.51 for very agree category and 51.36 for agree category. The learning outcome has been improved after using the module based on N-gain test of 0.63 with moderate category. Therefore, it can be concluded that character values-loaded is feasible to use in chemistry learning for special topics of redox reaction and compound nomenclature.

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