

INTEGRATION OF A SOCIO-CRITICAL AND PROBLEM-ORIENTED APPROACH IN CHEMISTRY LEARNING FOR STUDENTS' SOFT SKILLS DEVELOPMENT

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The article portrays a one-year study of the development of a socio-critical and problem-oriented approach to learning chemistry on the topics of electrolytes and non-electrolytes, reduction and oxidation, acids and bases, and colloids. The research was conducted in the academic year 2014/2015 with three classes of Year 10 and 11 students. The socio-critical and problem-oriented approach developed by Marks and Eilks (2009) aligned with the new curricula in Indonesia was used. A qualitative research approach was employed with multiple methods such as interviews, observations, and reflective journals. In classrooms with different topics, the socio-critical and problem-oriented approach was found to help students develop their soft skills of critical and reflective thinking, argumentation skills, and collaboration with others. Different classrooms were found to have different levels of students' engagement, however, the teachers developed different methods of implementing the socio-critical and problem-oriented approach, including discussions, debates, and performances to engage their students. The research study found that this approach can be implemented in the teaching of chemistry topics that are relevant to the context of social problems in Indonesia.

KEYWORDS: Socio-Critical and Problem-Oriented Approach, Soft Skills, Chemistry Learning

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INTRODUCTION

Education does not only aim to improve students' understanding, but more importantly to produce young people who have the ability to be an agent of change, character and culture. Education of character and culture have become an important issue in the curriculum at various levels. According to Chang (2009), the most important factor in the formation of a child's character is how children cope with problems in the neighbourhood. One way is to educate students to analyse the character, culture, and values that are owned by the integration issues of socio-critical learning. The implementation of the 2013 curriculum in Indonesia focuses on developing students' character, facing challenges, especially in teachers' difficulty to integrate the approaches for developing the character of the students in learning (National Directorate of Primary and Secondary Education, 2014). Integration of socio-critical research study has been conducted by Marks and Eilks (2014) which aims to increase students' interest in science and technology, finding the relevance of science to the contentious issue in the community, develop students' critical thinking skills in obtaining information and improving active learning that is relevant to the issues of social scientific controversy (Marks & Eilks, 2009). The same problems are found also by Marks and Eilks (2014) in chemistry learning activities in Germany. This research states that learning chemistry in western Germany is less attractive to students because the students found a disconnection between application of chemistry in their everyday lives.

Chemistry is related to various disciplines both in life sciences as well as social sciences. In their daily lives, students are facing with dilemmas and problems which could create conflicts that require them to make decisions. Socio-critical and other problems educate students to think critically, work together, accept and negotiate ideas, and solve problems and reflect on issues of socio-critical nature in their daily lives. Therefore, chemistry learning should not only focus on developing the knowledge, but on how to implement the knowledge of chemistry to solve problems in daily lives. Science educators have repeatedly argued for making students competent in social-scientific reasoning and for making young persons able to participate in socio-scientific controversies (Roth and Désautels, 2002; Marks, Bertram, & Eilks, 2008). Based on the success of Socio-critical and problem-oriented approach against similar problems, researchers are encouraged to conduct research with socio-critical and Problem-oriented approach in learning chemistry at school in topics of "electrolytes and non electrolytes, redox, acids-bases and colloids". The issues in these chemistry topics are expected to encourage student's critical thinking on issues presented and enable the student to argue their case. Marks, Bertram, and Eilks (2008, p. 269) state that "those which encourage personal connections between students, explicitly address the value of justifying claims and expose the importance of attending to contradictory opinions." In this study, the

researchers implemented the socio-critical and problem-oriented approach in chemistry learning for chemistry students in secondary school in Indonesia in order to develop students' soft skills in relation to new curricula.

RESEARCH METHODOLOGY

The research was conducted in secondary schools of Jakarta, Indonesia in chemistry classrooms. The methodology was implemented using a qualitative approach with interviews, classroom observations, and reflective journals as data collection instruments. In the process of research, the researchers worked with chemistry teachers from four secondary schools in chemistry classrooms with Year 10 and 11 which implemented the new curricula. The chemistry teachers implemented the socio-critical problem oriented approach in selected topics which related to the issues that are relevant in the Indonesia context. The researchers conducted classroom observations during the process and interview with chemistry students. The chemistry students also wrote their reflections on their learning experiences.

RESULTS AND DISCUSSION

This research was conducted by providing an opportunity for student to criticize the issues and social problems through various media such as articles, videos, discourse, newspapers, and other media. Each issue was presented and can be evaluated from two different point of views that will bring out the debate with the aim to motivate students to think critically and communicate clearly. Students were divided into small groups to discuss the pros and cons on the issues given. At the end, they were given the task of creating the posters that described their views on social issues. Dealing with socially relevant issues which are discussed is of importance to students lives and important for their future participation as responsible citizens (Marks and Eilks, 2014).

Meaningful Chemistry Learning Experience

Integrating socio-critical problem oriented approach has provided students with exciting and meaningful learning experiences. The students said that they were excited with interesting chemistry learning experiences which gave opportunity to learn by participating actively in different learning activities. Several questions were raised by students who showed curiosity and helped improve their critical thinking. Students' debates between pros and cons has lead to the development of enthusiasm and motivation as stated by several students such as:

"I am excited with different learning experience that have motivated me to develop my understanding in topics related with redox reactions"

(Reflective journal, 11 February 2015)

" When we conducted the debate, I was so excited to argue with my reasons on the issue"

(Reflective journal, 20 February 2015)

One of the examples of exciting learning experiences for students was when discussing the issue of anti-aging cream which is widely used in the community with their group, they conducted a debate and worked together to give their opinions:

Pros: "anti-aging cream containing fruit extracts, vegetable extracts, antioxidants, and vitamin C which are good for the skin. Therefore, anti-aging cream is not only helpful in preventing aging but also nourishes the skin to be healthier."

Cons: "But many anti-aging creams that contain harmful substances cause the woman to experience redness and severe allergic reactions on their face."

Pros: "Therefore, anti-aging creams should be assessed by BPOM (national product assessment) so it is safe. If using a cream that is not assessed by BPOM then the woman are at a risk because the product has not been passed by the quality control department"

Cons: "Sometimes, buying the product that is passed by the authorities is also not guaranteed to work well. As we know that sometimes ago BPOM registered cosmetic have been found to be dangerous because they contain mercury and dyes which are prohibited"

Pros: "Therefore, it depends on ourselves. How do we choose the best cosmetics among the many cosmetics? We still can choose, if we are good consumers, we should read the composition contained in the packaging, whether there are harmful substances or not."

In this debate, students were very enthusiastic, they learnt to state their ideas which were not happening often in their regular chemistry classroom. Each group learnt to create a powerful argumentation with evidences. They provided the argumentation in term of health issues, chemistry product awareness, including national board of product assessment which lead to their awareness and knowledge in product assessment and customer behaviour. These debates provided new knowledge for the students about the relevance of chemistry in their daily lives. The implications of meaningful learning experiences and students' motivation also lead to other learning aspects of students which were students' soft skills development as discussed in the section below.

Chemistry Students Soft Skills' Development

The results show that the integration of socio-critical and problem oriented issues has transformed students learning and their soft skills such as learning to collaborate with others through discussions on social issues and to respect each

other during the debate. Students were interested and motivated to learn chemistry through issues in articles, then they analysed and reflected on their values and learnt to solve problems together through discussion. In this paper, the researchers focused on chemistry students' soft skills development which are describe bellow:

Collaborate with Peers

The learning experiences provide opportunity for students to work together in several activities such as in discussions, poster making, debates and laboratory experiments. The classroom observations showed that several times in classroom activities in different chemistry topics of acids-bases, reduction and oxidation, and colloids, students worked closely with their friends to solve the problems and complete their tasks, as their statement below on their collaboration.

"While we conducted the debate, we tried to develop our arguments, and we could solve it together"

(Students Interview, 25 February 2015)

Another student said,

"We are happy to work together and discuss the ideas, even sometimes we don't agree with each other, but we still discuss it. We also created a poster to present our ideas"

(Students Interview, 25 February 2015)

Students showed that learning by integrating Socio-critical and problem-oriented approach they have been able to develop the collaboration between students, especially to apply the concepts of chemistry topics that they learnt into the social problems in their daily lives. This was relevant with the government policy that stated that the learning process should be organized in an interactive, inspiring, fun, challenging, and motivating manner so that students are able to actively participate and provide space for innovation, creativity, and independence in accordance with their talents, interests, and physical and psychological development (Permendikbud, 2013). Therefore, students should be given opportunities to interact with their friends so that they can develop their skills for facing the future challenges and finding new ways to express their ideas and feelings.

Empathetic Communication

Empathetic communication is required in learning chemistry with socio-critical and problem-oriented approach when in groups so that students can share their different opinions with other students with mutual respect. They learnt to appreciate differences among them, not only within the group, but also with other groups, as students' statements suggest.

"Communication is already well established and others can maintain communication to avoid misunderstanding"

(Students Interview, February 13, 2015).

"The group is communicating very well and each member gives an opinion on the material that is being presented"

(Reflective Journal, February 12, 2015).

Based on interviews and student's reflective journals we noticed that discussing and arguing with each other can be seen in such a way that students are willing to express their ideas to the group. In addition, students can learn to respect each other and respect the ideas or opinions from other students for learning by using Socio-critical and Problem-oriented approach and to solve and respond the problems that exist in the article together. In this context, socio-critical and problem-oriented approach has been able to bring out the empathetic communication between students. On the other hand, some students also had negative experiences as stated below.

" There are still some students who were not paying attention when other groups presented the results of their discussion to the class"

(Reflective Journal, February 5, 2015).

This negative experience also followed my questioning i.e. what is learning for students, as students think that learning is teacher explaining the chemistry concept, but not students expressing their ideas in different ways, especially through debate.

Critical and Reflective Thinking

Critical and reflective thinking was developed when students conducted the group discussion on the various issues and through group debates. During the debate, students also learnt to listen to others before arguing their opinions. Students began to reflect their ideas and understand their values and beliefs, before understanding others, as students' statements shown below.

"When I listen to different opinions during the debate, I was pretty upset. I prefer to be on the pro group, but my group was already chosen, thus I tried to think critically to find good arguments to support my assumptions"

(Student Interview, 25 February 2015)

"While I prefer to argue the opponent, and listen to their statements, I think critically for refuting the statement. But I still appreciate their opinion and do not show any emotions"

(Students Interview, 25 February 2015)

Most students felt they required to think more deeply to understand the article, so that students can have arguments to hold their views. However,

based on the interviews, the students faced the dilemma that sometimes they must disagree with their own values and beliefs. Thus, they become aware of their own values and beliefs. One of the main goals of learning activities through socio-critical and problem-oriented approach is the emergence of reflection on the problems and social problems in the community, to reflect on values, beliefs and attitudes through self-reflections. Students are interested in studying chemistry through problems related to daily lives and thinking to use the dangerous chemical products as statement below.

"After learning chemistry, I developed new knowledge such as knowing the chemicals contained in the drugs, the positive and negative effects of medications. This has made me aware about the use of chemical products"

(Reflective Journal, February 12, 2015)

"After learning this, I want to learn more about chemistry in the future and develop innovative ways to solve the problems in the society"

(Student Interview, February 25, 2015)

Based on interviews and students' reflective journals above statements indicate that the students had positive learning experiences as their reflections on social issues are discussed. Students became more understanding of the application of chemistry concepts their everyday life which lead them to be more motivated to learn chemistry.

Self-Confidence and Argumentation Skills

Self-confidence is one of the outcomes of students' soft skills which were developed within different learning experiences, especially when they have to express their ideas. In regular classroom, they used to be shy and felt embarrassed to speak up their ideas. Students' self-confidence is also developed when they have to argue their opinion through debates. Dialogue and argumentation took place in debates and discussions. Students develop the arguments and exchange the ideas, as students' statements suggest:

"I was confused when asked an opinion, but I tried and although I don't know if what I said was true or not, I became more confident to speak in front of the class and was motivated to learn chemistry"

(Student Interview, 20 February, 2016)

"Today groups were formed to discuss articles that have been given. I cannot wait to debate the pros and cons of the articles "

(Reflective Journal, 11 February 2015)

"Chemistry lesson was fun for me. I have deep understanding on reduction and oxidation concept"

(Students Interview, 25 February 2015)

The results show that the socio-critical learning and problem-oriented approach helped provide new experiences in the classroom so as to make the students excited to learning chemistry.

Creativity

Integration of the approach has helped students to develop their creativity, not only in finding different solutions to the problems, but also develop their creativity in presenting their ideas through posters, as students statements suggest:

*"I understand the ideas of my friends when making a poster and it enriches my idea.
I can now think of a concept that will be included in the poster"*

(Students Interview, January 28, 2015)

Although we made a poster that was not good, but we have tried to find different solutions to defend our arguments"

(Reflective journal, January 28, 2015).

Based on these observations it can be seen that students were highly engaged in developing different ways of communication in relation to presenting their ideas.

Finally, integration of socio-critical and problem oriented approach has helped the chemistry teachers in presenting different methods of teaching. These learning experiences has helped students to develop their motivation in learning and understanding the chemistry concepts. The teachers also learn to develop students' soft skills which is relevant to the new curricula.

CONCLUSIONS

Integration of socio-critical and problem-oriented approach in chemistry learning in the topics of electrolytes and non-electrolytes, reduction and oxidation, acids and bases, and colloids has positive implications on students learning. The meaningful chemistry learning experiences by creating relevant socio-critical issues in Indonesian context has developed students' awareness of their societal problems and found the solution. Students learn to stimulate their critical and creative thinking in finding the meaningful reasons for their argumentation which is based on evidence and theoretical interpretations. Using debates as new learning experiences has provide opportunity for students to develop their self-confidence and argumentation skills within an environment of mutual respect among the students. Thus, this approach has added value in chemistry learning which is not only developing students understanding on chemistry concepts, but also students' awareness for further action within the problems of the society. In addition, in relation to new curricula, development of different issues with different ways of chemistry teaching will enrich chemistry curricula and transform students learning.

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