Should we learn culture in chemistry classroom? Integration ethnochemistry in culturally responsive teaching
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Should We Learn Culture in Chemistry Classroom? 
Integration Ethnochemistry in Culturally Responsive Teaching 

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Abstract. The papers report the first year of two-year longitudinal study of ethnochemistry integration in culturally responsive teaching in chemistry classrooms. The teaching approach is focusing on exploring the culture and indigenous knowledge in Indonesia from chemistry perspectives. Ethnochemistry looks at the culture from chemistry perspectives integrated into culturally responsive teaching has developed students’ cultural identity and students’ engagement in chemistry learning. There are limited research and data in exploring Indonesia culture, which has around 300 ethics, from chemistry perspectives. Students come to the chemistry classrooms from a different background; however, their chemistry learning disconnected with their background which leads to students’ disengagement in chemistry learning. Therefore this approach focused on students’ engagement within their differences. This research was conducted with year 10 and 11 from four classrooms in two secondary schools through qualitative methodology with observation, interviews, and reflective journals as data collection. The results showed that the integration of ethnochemistry in culturally responsive teaching approach can be implemented by involving 5 principles which are content integration, facilitating knowledge construction, prejudice reduction, social justice, and academic development. The culturally responsive teaching has engaged students in their chemistry learning and developed their cultural identity and soft skills. Students found that the learning experiences has helped to develop their chemistry knowledge and understand the culture from chemistry perspectives. The students developed the ability to work together, responsibility, curiosity, social awareness, creativity, empathy communication, and self-confidence which categorized into collaboration skills, student engagement, social and cultural awareness, and high order thinking skills. The ethnochemistry has helped them to develop the critical self-reflection on their own cultural background.

INTRODUCTION

Indonesia consists of more than 17,000 islands, with around 6000 of them inhabited, and has five major islands (Java, Sumatera, Kalimantan, Sulawesi, Irian Jaya islands). Indonesia is one of the most populous countries in the world with 224 million, with 60% lives on Java, the smallest of the five major islands. Indonesia also has 300 ethnic groups that speak more than 250 dialects, with Bahasa Indonesia as the national language. These ethnic groups have different cultures which influence the way they think and behave. Currently, Indonesia students grow up with different cultures which influence the set of values and beliefs, including in their learning. The process of globalisation and cross cultural interactions among ethnic groups in Indonesia creates different cultural identities and loss their first cultural identity. Globalization is held responsible for the reigning consumptive culture in Indonesian society...[thus] the Indonesian culture, which is deeply rooted in communality bound by a frame of moralistic spirit, should serve as a filtering mesh for the upsurge of materialistic orientation inherent in the process.
of globalization (Sairin, 2004, p. 155). In chemistry learning, western knowledge dominant in every level of curriculum and students learning which lead to students disconnected to their cultural background. It leads to students’ disengagement in chemistry as culture is central to learning and motivation. Thus, in education, they develop multicultural classrooms by embrace culturally responsive teaching. They relate content to students’ cultural backgrounds and leverage their students’ cultural capital. To do this, they must build strong relationships with their students and families and develop a pedagogy that acknowledges, respects, responds to, builds on, and understands different cultures. Doing so offers full, equitable access to education for students from all cultures. Cultural competence is the ability to successfully teach students who come from cultures other than our own. It entails developing certain personal and interpersonal awareness and sensitivities, developing certain bodies of cultural knowledge, and mastering a set of skills, that, taken together, underlie effective cross-cultural teaching (Diller & Moule, 2005).

According Gay (2000) model of learning culturally responsive teaching is a culturally responsive learning model that can connect the subject matter with the cultural background of students. Culturally responsive teaching as a learning approach by using cultural knowledge, previous experience, and student performance differences for providing meaningful learning experiences. The learning outcomes of culturally responsive teaching are to ensure students achieve academic success, cultural competence in which students can build their cultural identity, and also think critically about the current cultural identity (Ladson & Billings, 1995). Development of character values using culturally responsive teaching in chemistry learning can be achieved by integrating ethnochemistry by engaging students in Indonesian cultural practices related to students’ daily lives. It will encourage students to understand their cultures from chemistry perspectives while they learn the chemistry concepts. According to Fysh and Lucas (1998), one of the main objectives of science education is students understanding in differences between indigenous view and the scientific view which will help them to understand the chemistry concepts.

Curriculum 2013 has encouraged in the learning process to be integrated with students’ own character within their differences (Kementerian Pendidikan dan Kebudayaan, 2013). One of the main aims of chemistry education in Indonesia curriculum both KTSP and Kurikulum 2013 share similar key points on is developing students’ scientific inquiry through connected, engaged, and meaningful chemistry learning in relation to National character. Scientific inquiry refers to the activities through which students develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. The 2013 curriculum is different from previous curricula, not only on curriculum structure, but also on focusing outcomes and characters. Curriculum 2013 emphasizes ethics and values learning for developing students’ character as holistic individual, not only knowledge and skills. These changes have several impacts on education in Indonesia, including students’ skills and knowledge, teacher competences, and assessment, especially chemistry education. In the context of chemistry subject is challenging for teachers to develop students’ scientific inquiry. The process of these changes have several impacts on education in Indonesia, including challenges in developing curricula structure, curricula integration, teachers and students shifting paradigm, teacher competences, teaching and learning process, assessments, and facilities. In the instructional process, teachers play important role in implementing the curricula, especially in shifting their curriculum images and paradigm to transformative and empowering teaching. Consequently, teacher education programs must prepare and empower the student teachers in transforming their teaching paradigms, in which the comprehensive approaches need to continuously be developed for developing holistic individual in facing global competitiveness.

The research is conducted in two years in secondary schools in Jakarta and Tangerang. The paper reports the first year of study which will be explored in detail in the second year. The study of the first year is focusing on the adjustment of culturally responsive teaching in chemistry learning by integrating ethnochemistry. The research involves chemistry students in secondary schools in Jakarta in year 10 and 11. The opportunities and challenges in implementing the model are explored in this paper, especially integrating culture in chemistry learning becoming challenges. The next step will be further development of the model and its implication to students’ soft skills development in relation to Indonesia curriculum policy.

**RESEARCH METHODOLOGY**

The study employs the qualitative approach with interviews, classroom observation, and reflective journal as data collection. This study embraces interpretivism paradigm which focuses on in-depth understanding of all contexts in research and participants. This study deeply explores all aspects in the development and implementation of culturally responsive teaching. This study conducted in year 10 and 11 di two secondary schools of the academic
year 2015 / 2016. The study consists of three main research phases of the preliminary phase of exploring classroom and students’ cultural background through observations and interviews. The second phase is culturally responsive teaching model development by integrating ethnochemistry. In this stage, ethnochemistry articles as a worksheet for students understanding of their cultural background from chemistry perspectives are developed. The third phase is the culturally responsive teaching implementation by understanding students’ differences and soft skills development. This paper portray the early study of third phase after implementation the ethnochemistry CRT model.

In this study, the ethnochemistry CRT model which has been developed in second phase involves 5 main steps of self-identification, cultural understanding, collaboration, critical reflective thinking, and transformative construction. In these five process, students have opportunities in developing self-understanding of their characters, learning style, and cultural identity. They also learn about others and collaborate within differences within this model bellow.

The process can be modified based the classroom learning environment. This model not only aims to equip teachers to realize, respect the culture, and differences of their students but also as the initiation for deeper chemistry knowledge.

RESULT AND DISCUSSION

The Ethnochemistry Integration in Culturally Responsive Teaching Model

Culturally Responsive Teaching is Validating, Comprehensive, Multidimensional, Empowering, Transformative, and Emancipatory (Gay, 2000). Gay (2000) defines culturally responsive teaching as using the cultural knowledge, prior experiences, and performance styles of diverse students to make learning more appropriate and effective for them; it teaches to and through the strengths of these students. Ladson and Billings (1995) explains that culturally responsive teachers develop intellectual, social, emotional, and political learning by "using cultural referents to impart knowledge, skills, and attitudes" (p. 382). Culturally responsive teachers realize not only the importance of academic achievement, but also the maintaining of cultural identity and heritage (Gay, 2000). Multidimensional culturally responsive teaching involves many things: curriculum content, learning context, classroom climate, student-teacher relationships, instructional techniques, and performance assessments. Teacher from various disciplines (language arts, science, social studies, music) may collaborate in
teaching a single cultural concept, such as protest. Students can also participate actively in their own performance evaluations (Gay, 2000). Culturally responsive teaching enables students to be better human beings and more successful learners. Empowerment can be described as academic competence, self-efficacy, and initiative. Culturally responsive teaching does not incorporate traditional educational practices with respect to students of color (Gay, 2000). The Culturally Responsive Teaching model is modified based on the Hernandez, Morales, and Shroyer (2013) model. The learning model Culturally Responsive Teaching by Hernandez, Morales, and Shroyer (2013) consists of five main categories of content integration, facilitating of knowledge construction, prejudice reduction, social justice, and academic development. The following table describes each of the main categories on which the implementation of culturally responsive teaching model in chemistry classroom in this study.

**TABLE 1. Culturally responsive teaching models implementation**

<table>
<thead>
<tr>
<th>Content Integration</th>
<th>Facilitating Knowledge Construction</th>
<th>Prejudice Reduction</th>
<th>Social Justice</th>
<th>Academic Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The determination of content from different cultures</strong></td>
<td><strong>Develop a positive relationship between teacher and student</strong></td>
<td><strong>Giving high expectations in achievement</strong></td>
<td><strong>Develop local language</strong></td>
<td><strong>The willingness of the teacher to act as an agent of change</strong></td>
</tr>
<tr>
<td>• Making learning or content material integrated with different student cultures by using ethnochemistry article as students worksheet</td>
<td>• Build positive relationships between teachers and students</td>
<td>• Delivering high expectations to all students in chemistry learning</td>
<td>• Using the local language for students</td>
<td>• Support students to be agent of change</td>
</tr>
<tr>
<td>• Giving examples in students’ everyday lives</td>
<td>• Establish a safe learning environment for students to participate in class discussions</td>
<td>• Identify the essentials approaches to help students in achieving the tar</td>
<td>• Communicate with parents using the local language</td>
<td>• By encouraging students to ask questions and to be aware of their differences</td>
</tr>
<tr>
<td><strong>Construct knowledge based on what the students know</strong></td>
<td><strong>Using the &quot;real&quot; example</strong></td>
<td><strong>Facilitate students in learning to be critical and self-reliant who are open to science</strong></td>
<td><strong>Develop a positive interaction between students and students</strong></td>
<td><strong>Encourage students to develop social awareness</strong></td>
</tr>
<tr>
<td>• Using prior knowledge of chemistry in order to help students in understanding the concepts</td>
<td>• Using &quot;real world&quot; examples while teaching new chemistry concepts</td>
<td>• Facilitate students by communicating effectively</td>
<td>• Develop positive relationships between students and students</td>
<td>• By encouraging students to ask questions and to be aware of their differences</td>
</tr>
<tr>
<td></td>
<td>• Real examples carried out for example by providing an example of a hydrolysis reaction in baking soda/sodium bicarbonate in Roti Buaya</td>
<td>• Encourage students to learn and think</td>
<td></td>
<td>• Encourage students to become good citizens</td>
</tr>
<tr>
<td><strong>Facilitating Knowledge Construction</strong></td>
<td><strong>Facilitate students in learning to be critical and self-reliant who are open to science</strong></td>
<td><strong>Prejudice Reduction</strong></td>
<td><strong>Social Justice</strong></td>
<td><strong>Academic Development</strong></td>
</tr>
<tr>
<td><strong>Construct knowledge based on what the students know</strong></td>
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<td><strong>Develop a positive interaction between students and students</strong></td>
<td><strong>Develop local language</strong></td>
<td><strong>The willingness of the teacher to act as an agent of change</strong></td>
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<td>• Support students to be agent of change</td>
</tr>
<tr>
<td></td>
<td>• Real examples carried out for example by providing an example of a hydrolysis reaction in baking soda/sodium bicarbonate in Roti Buaya</td>
<td>• Create a comfortable learning environment</td>
<td>• Communicate with parents using the local language</td>
<td>• By encouraging students to ask questions and to be aware of their differences</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Create a comfortable learning environment</td>
<td>• Encourage students to become good citizens</td>
</tr>
</tbody>
</table>
Teachers create opportunities for students to achieve academic achievement

- Implementation varied learning methods to create opportunities for students in developing students' academic achievement
- Using visual media to facilitate students in understanding the concepts.
- Using different models in approaching students difficulties

The use of instructional strategies that describe the different learning styles of students

- Using examples such as the use of citric acid in citrus crops, the structure of the compounds when introducing new or difficult materials concepts in chemistry.
- Use large collaborative groups or small groups.

In this approach, students develop their understanding of their own cultural background and differences with others. The chemistry topics are discussed in this first-year study is Hydrolysis and Electrolyte solutions with the stories of Roti Buaya, Jeruk Nipis, Cuka Bali, Dewi Sri. These stories help them to understand their culture from cultural perspectives. For example, the reaction of hydrolysis of sodium bicarbonate as baking soda in Roti Buaya, hydrolysis of fertilizer on plants making fertile rice in Dewi Sri “Dewi Kesuburan Tanah”, The use of green coconut water in Javanese culture that is in Tingkeban is useful to remove urine that avoid the urinary tract infections because the green coconut water contains electrolytes, and the Cuka Bali Alami called Tuak which contains alcohol as the result of fermentation of sugar contained in the water of Nira. The addition of lau in Tuak can accelerate the rate of alcohol formation because the lau contains enzyme-producing bacteria that play a role in the fermentation of sugar in the water of Nira. The descriptions and linking with Indonesia curricula has been explored bellow.

**TABLE 2.** Linking dilemmas stories and Indonesia curricula

<table>
<thead>
<tr>
<th>Etnochemistry Article</th>
<th>Description</th>
<th>Chemistry Topic</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roti Buaya in Betawi</td>
<td>Sodium bicarbonate is used as a baking ingredient in Roti Buaya. This compound is used to develop the dough because carbon dioxide is produced after reacting with acidic liquids.</td>
<td>Hydrolysis</td>
<td>Students understand the hydrolysis concepts</td>
</tr>
<tr>
<td>Dewi Sri “Goddess of arable land in Java”</td>
<td>Farmer in Java believe that the fertility of rice crop is due to the Dewi Sri as goddess of rice and fertility. In chemistry perspective, the occurrence the hydrolysis of fertilizer plants make the soil component becomes fertile.</td>
<td>Hydrolysis</td>
<td>Students apply the hydrolysis concept in daily lives</td>
</tr>
<tr>
<td>Natural Vinegar from Bali</td>
<td>Making of Bali vinegar from tuak, where Tuak can change due to chemical reaction. Tuak contains alcohol which is the result of fermentation of sugar from nira, catalyzed by lau (coconut fiber flake)</td>
<td>Electrolyte and Non-Electrolyte</td>
<td>Students analyse the effects of electrolyte and non electrolyte solution</td>
</tr>
<tr>
<td>Green Coconut in Javanesse Culture</td>
<td>Coconut water is a natural isotonic beverage that can help in filling the fluids and loss of natural salts released by the body for pregnant women.</td>
<td>Electrolyte and Non-Electrolyte</td>
<td>Students apply electrolyte and non-electrolyte concepts in daily lives</td>
</tr>
</tbody>
</table>

The stories have been develop in different chemistry curricula for engaging students in their culture and the chemistry concepts. One of the example stories that is given to the students is represented bellow.
Green Coconut Water in Javanese Culture

In the Javanese culture there is a myth of advice and prohibitions for a pregnant woman in doing things. One of them is strongly recommended to drink green coconut water during pregnancy. Coconut consists of various types, one of which is a green coconut that has a Latin name is cocos viridis. The people believe that the Green coconut water will accelerate labor, clear amniotic fluid and make baby's skin become pure white and nourish hair (Kasnodihardjo & Kristiana, 2013). For this study, not many studies that can prove all these myths, but the suggestion to drink coconut water for pregnant women is still applied in Javanese culture.

Coconut water is a natural isotonic beverage that can help in filling the fluids and the loss of natural salts released by the body. Young coconut water is rich in electrolyte content such as chloride, calcium, potassium, magnesium, sodium, and riboflavin. As a natural isotonic that is rich in minerals and has electrolyte properties similar to the body's electrolyte, green coconut water is very beneficial for rehydration and restore stamina, especially for pregnant women (Quantum Health Magazine, 2015).

The content of electrolytes in green coconut water acts as a natural diuretic to increase urine expenditure so as to avoid urinary tract infections that are common in pregnant women. Diuretics are drugs that can increase the rate of urine formation. The content of electrolytes and antioxidants in green coconut water can also keep the uterus clean, especially the amniotic fluid of pregnant women by removing the mucus and dirt contained in the amniotic fluid, so the amniotic fluid becomes clear.

Coconut is used in one of a series of Javanese pregnancy ceremonies called “Tingkeban”. This ceremony is usually performed at seven months of gestation in the first pregnancy with a Javanese calendar system. At the ceremony, a pair of green coconut is painted by Kamajaya and Kamaratih or Arjuna and Sembadra and entered by the prospective father through the belly of the expectant mother and accepted by the baby's grandmother. The hope of this event is that the baby who is born has a physical and nature like the puppet character.

According to the story of the name "Tingkeban" comes from the name of a mother named Niken Satingkeb, the wife of Ki Sedy. They both have nine children but the nine children always die at an early age. Various attempts have been made, but they have not produced results. Until one day they ventured to face to Kanjeng Sinuwun Jayabaya for advice. Jayabaya finally advised them to undergo some rituals. After a series of rituals suggested by King Jayabaya was done, it turned out that God granted their request. Ki Sedy and Niken Satingkeb get healthy and long-lived babies. To recall the name Niken Satingkeb, a series of rituals were imitated by the next generation up to now and named “Tingkeban”. It is on this basis that until now the “Tingkeban” ritual is held even becomes a necessity for Javanese society.

The stories was written in relation to understand the concept of electrolyte solution in chemistry curricula. According to Sartiso (2006), most the teachings consist of philosophical values giving a moral basis for Javanese people’s lives, particularly in responding many different phenomena, such as: how to position themselves in relating and communicating with God as the Creator, with other people, with other different creatures as well as with their environment”. Therefore, the Javanese tradition is mostly transferred in the family.

Implications of the Culturally Responsive Teaching Model

The implications of the culturally responsive teaching with 5 categories of content integration, facilitating knowledge construction, prejudice reduction, social justice, and academic development. The researchers worked with the teachers to integrate these for engaging the students. Students’ engagement showed in both hard and soft skills development. This study reports on four basic categories of collaboration skills, student engagement, social and cultural awareness, and high order thinking skills. These four categories are driven by the findings on work together, responsibility, curiosity, social awareness, creativity, empathy communication, and self-confidence.

Collaboration skills

The teachers implemented different cooperative teaching approach to develop students’ collaboration skills. In this approach, the teachers facilitate students to understand the chemistry concepts and solve the problems through the project which provide opportunities for the students to develop empathy communication, team working, and self-confidence. Students expressing their opinions as stated below.
We are not confused to find answers when answering a question because there are task and mutual sharing. I feel happy and comfortable working in groups by exchanging ideas and listening others.
(Student Interview, 15 January 2016)

We were responsible for completing the task and helping each other, we feel uncomfortable if we can't help each other.
(Student Reflective journals, 24 February 2016)

Through this study, I felt confidence and encouraged to perform better. We tried to give the best for our group project.
(Student Interview, 19 February 2016)

The participation of all members of the group to work together achieve the goal as a cooperative skill were developed among members. According to Pieterse (2001, p. 220), “recognition and difference are a function of the existing identities and boundaries that are available on the social and cultural maps. In addition, the students become more responsible for completing the tasks on time. The soft skills of understanding, empathy, and tolerance in order to understand others were happened in this learning environment. They started to be able to understand the thoughts and feelings of others and be able to manage their social-emotional.

In addition to the positive response, there were students who are facing the challenges because of they found the members who were not working properly. They felt that the group was not good since there were students who were not giving a contribution to the group as stated bellow.

I actually feel good when a working group, however, I did not like it because there are members of the group who were lazy and they can’t collaborate with others.
(Student Interview, 19 February 2016)

From the interview above it can be seen that some students are less able to discuss in groups. Teachers need to act decisively and give more attention to these students. The current curricula has encouraged teachers to develop their role as facilitator in developing students’ collaboration skills.

**Social and Cultural awareness**

The students started to develop social awareness during culturally responsive teaching model was implemented. The implementation of content integration with ethnochemistry has led not only developing cognitive value but also aims to develop cultural value and character of students. The social justice can be raised in a culturally responsive learning environment Teaching (CRT) is to encourage students to ask questions and/or challenge to show their status quo. In this means, students can develop an awareness to be more critical of their status in a multicultural learning environment. The teacher asked the students to learn their indigenous language, most of them used Javanese language as they came from Java, then its also related to the article of ethnochemistry about Dewi Sri. In this context, the teacher challenged the students to move from their comfort zone and understand their own cultural identity.

The attitude of being aware of other differences was developed, especially in group discussions. According to Palmer (2007), by embracing diversity, we realise connectedness with others which is empowering for transforming our lives. In embracing difference I also learnt how to be more empathetic. Empathy helps students to understand how others are feeling and why it is they behave in particular ways. They also started to develop their cultural identity in understanding their culture and others.

I have learned to communicate with friends and know each other well
(Student Interview, 11 February 2016)

I realized, we have different opinions, ethnic background, different views which put me into better understanding of these differences
(Student Reflective Journal, 24 February 2016)

Through this project, we know other cultures which can be implemented in our daily lives
Some students in the above statement are appreciating the difference between themselves and their friends. It also happened with students and teachers different cultural background. According to White as cited in Fitzpatrick (2012, p. 55), “research shows that teachers who differ from their students in terms of racial and ethnic background can nonetheless share values and assumptions that help them better relate to their students”. In this context, teachers tried to understand their students.

They realized it is important to appreciate differences and learn about Indonesia culture to keep their rich culture. It is interesting to have different perspectives in learning their culture. The integration of ethnochemistry was the new things in chemistry learning. Thus the students keep developing their curiosity by searching different cultural practices which is related to chemistry concepts. Here is the statement of the student who showed curiosity towards the material covered.

"So I would like to know how to make Roti Buaya, I want to immediately put into practice, 'is it true that the chemicals used can be shown to make Roti Buaya?. Learning about rice from Dewi Sri’s story, its interesting, is it chemistry inside the rice"

(Student Interview, February 10, 2016)

The ethnochemistry has stimulated their curiosity. Not only about the chemistry concepts, but also the tradition. Socially conscious attitude shown by the students during the learning. Attitude to be sensitive about the existence of others and interdependence is seen especially when the discussion as students following statement.

"Now I often communicate with friends who I never close with, we tried to know each other"

(Student Interview, February 11, 2016)

Based on the statements of students both from interviews or reflective journals, students indicated that their communication frequency with classmates becomes more often than usual. They stated that they become more used to talk, get to know their friends’ character which leading to be good at working together.

The implementation of content integration has committed to not only developing cognitive value, but also aims to develop cultural value and character of students. One is the value of patriotism. Statement following students show their patriotism after following integrated with the learning culture.

"Certainly, we are Indonesia, but when exploring our own cultural background, its has stimulated me to maintain my culture and share to others”

(Student Interview, March 15, 2016)

"I feel grateful that we have been given a favor all manner what so and we have to preserve our culture."

(Student Interview, March 3, 2016)

Students explained that they become more loving Indonesia culture. Their tried to understand and implement cultural and the character values of the students as a way of thinking, loyalty, care and high appreciation of language, physical environment, social, cultural, economic, politics and nations.

Student Engagement

The integration of the learning material was employed by provide learning materials associated with the daily life of students and associate culture that related to chemistry curricula. The example of articles are Roti Buaya and Dewi Sri from Betawi and Javanese culture. Students found engaging in their chemistry learning as stated bellow.

"It gave motivation to learn chemistry since its applied in everyday life"

(Reflective Journals, February 4, 2016)

Students found the relation of chemistry concepts that they learnt with their daily lives. Then when they read the articles, the students found their awareness of understanding of their culture from different perspectives. The teacher
provided task for students to asking about Dewi Sri to their parents which lead to cultural understanding from their own family.

In the content integration, teacher was fostering positive teacher-student relationships. Teachers build a comfortable learning environment and building positive relationships between teachers and students can be one of convenience for students to obtain information and integrate the contents of the subject matter. The following statement of the students related to learning they experience and their assessment of the teacher during lessons.

“The teacher is very nice and friendly. She is highly appreciated our answer”
(Reflective Journals, February 4, 2016)

Based on the results, students found the teacher developed a good relationship between teachers and students have been there so that students feel appreciated by the teacher.

The teacher was also holding high expectation by encouraging students to achieve learning objectives and motivate the students.

“Teachers must always bring the spirit of 'you can do it'. Its easy to ask questions and we enjoy the learning”
(Student Interview, March 3, 2016)

In this context, students who have not achieved the objective, have always received encouragement and expectations of teachers so that students can and understand the material being taught. Teachers must believe their students for their ability in learning and hope that students can bring valuable experience in the classroom (Hernandez, Morales, & Shroyer, 2013). This is the communication through the high expectations from teachers to students so students can achieve the learning objectives.

Based on the results of some students do not like chemistry because it is oriented towards the chemistry scoring test. They usually understand that learning for passing the exam. After implementation of culturally responsive teaching, they started new perspectives of learning chemistry. The students engaged in chemistry learning because they found it was related to their own background and everyday lives. This is consistent with the results of research Marasinghe in Papua New Guinea on ethnochemistry which influenced students' engagement (Marasinghe, 2016). The students' engagement was showed both in their understanding of chemistry concepts, their learning motivation, and most strongly improved are their soft skills. Among the soft skills, the nation's culture and character education are related to graduate competencies from Curriculum 2013.

Learning culture in chemistry was interested were encouraged me to learn more both chemistry concepts and Indonesia culture
(Student Interview, 15 January 2016)

I think the chemistry learning integrated with etnochemistry was relevant to our everyday lives
(Student Interview, 5 February 2016)

The teachers have implemented learning method that is different from the usual learning methods. The model that have been implemented by the teacher has stimulated students’ motivation and enthusiasm in chemistry learning chemistry. Even though initially they kept asking about the reasons that they have to learn culture in the chemistry classroom.

**High Order Thinking Skills**

The students usually learn from chemistry textbook and followed the teachers’ instruction. In bringing different approaches and the culture along to chemistry concepts has helped them to develop their knowledge. It has given them the new way of chemistry learning which has been developed their knowledge about traditions from various regions in Indonesia through collaboration skills. The students engaged in the process of seeing, hearing, and developing their knowledge. Hernandez, Morales and Shroyer (2013) describes the model of culturally Responsive Teaching in facilitating of knowledge construction is constructing knowledge based on students’ prior knowledge. In this context, teacher provided students the culture context in their lives.
"I read the article which helped work on the problems, not only about the chemistry, but also the culture. Its close to my lives"

(Interview Student Interview, February 11, 2016)

The statement above shows that the students understood both from the standpoint of chemistry and cultural meanings in the article. Students discussed with their friends about Betawi tradition. According to Gay (2000), learning with culturally Responsive Teaching is the use of cultural knowledge, prior to making the learning experience can be more relevant and effective for students. It can be used to introduce new concepts.

It is also important to assist students in learning to be critical, independent thinkers who are open to other ways of knowing. According to Hernandez, Morales and Shroyer (2013), CRT can help students to become critical and reflective thinkers, understand, and represent information provided. In this context, teachers communicate with the language that students understood. Teacher also appreciated students’ questions which leading to students’ self-confidence. It makes students became more confident in expressing their opinion and better in chemistry learning. Teachers act as facilitators in group discussion activities, monitor the activities of each group. Teachers also acts as a consultant and mediator for students learning.

In prejudice reduction, the teacher developed the positive student-student interactions by implemented cooperative teaching model such as Jigsaw, STAD, and Think Pair Share.

"I worked in group and conducted the project, we developed good relationships with other friends"

(Student Interview, March 3, 2016)

Students engaged in active discussions within a group. Teachers provided time for the students to interact with their peers in positive interactions. It also helped them to improve communication skills. The prejudice reduction in the classroom also performed by teachers in creating enjoyable learning environment to make students become excited in learning participation. The teachers were always willing to answer questions from students without discrimination which make students felt comfort, happy, and engaged in the lesson. Therefore, this model has helped students to start developing their higher order thinking skills of critical and creative thinking skills.

Based on the material and approaches implemented, we often being asked about our opinions or answer questions which required critical thinking.

(Student Reflective Journal, 24 February 2016)

This study is interesting because tasks have developed our creative thinking while learning about chemistry concepts

(Student Interview, 19 February 2016)

I developed understanding of new learning and knowledge within the cultures that related to chemistry and developed my curiosity in implementation of chemistry concepts in daily lives

(Student Reflective Journal, 22 January 2016)

Exploration of new knowledge will develop students initiative to their chemistry learning. In ethnochemistry articles, students were not only required to understand the article but also have to understand the chemistry concepts that were applied. In addition, students stated that they developed more interactions with other students which leading to each other which influence their learning environment.

CONCLUSION

The culturally responsive teaching which has been integrated with etnochemistry through the five main categories of content integration, facilitating knowledge construction, prejudice reduction, social justice, and academic development has been implemented enriching chemistry learning. It is not only innovations in learning chemistry differently, but also students engagement in knowledge and soft skills development. The model has developed students’ collaboration skills, responsibility, curiosity, social awareness, creativity, empathy communication, and self-confidence which categorized into collaboration skills, student engagement, social and...
cultural awareness, and high order thinking skills. The culturally responsive teaching with etnochemistry integration makes students are aware of the role of chemistry in everyday lives, in particularly in an engagement of Indonesia cultures within this globalization. This approach will be one innovative way for culture sustainability through chemistry learning.

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