

## **ENGAGING STUDENTS IN SOCIAL EMOTIONAL LEARNING: THE ROLE OF DILEMMA STORIES IN CHEMISTRY LEARNING**

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### ABSTRACT

The research aimed to engage students in social and emotional learning in chemistry learning. Dilemmas stories have been engaged students in values awareness through critical thinking and dilemma thinking. The research was conducted in Secondary schools in Jakarta. Interpretive study as a methodology provided deep engagement for both researcher and participants. The VLES (Values Learning Environment Survey), semi-structured interviews, and classroom observations were used as methods of collecting data. The VLES obtained perceptions of student engagement with the story, the teacher's supportive role, critical thinking skill development, and students' learning to listen actively and think about the chemistry learning. The results show that the students and the researcher engaged in critical reflection on their values, collaboration with others, on their roles in participating in environmental education, social issues, and in deep chemistry learning.

*Keywords: social emotional learning, dilemma story, chemistry learning, action research*

### INTRODUCTION

The aim of education is not only to enhance students' understanding, but more important is to educate young people as agents of change who understand their character and culture. Character education and culture become an important issue in the curriculum at various levels. According to Chang and Munoz (2007), the most important factor in the formation of character is how young children cope with the problems in their society. One way to educate students to understand their character, culture, including their values is through the use of dilemmas stories. The dilemmas stories relate to everyday life and current issues which have dilemmas. According to Scardamalia, Bransford, Kozma, and Quellmalz (2012) there are important skills possessed by the students when they finish school and work, for example, the ability to: 1) solve the problem, 2) make decisions, 3) work independently, 4) speak effectively and 5) work effectively with the use of technology. In this context, dilemmas stories help students to develop their critical thinking, problem solving skills, decisions making, and working with others which related to developing students' soft skills.

This innovative approach to socially responsible science education which earlier developed in Australia to address the National Framework for Values Education in Australian Schools and the National Goals for Schooling in the Twenty-First Century, as outlined in the Adelaide Declaration (1999), which argue that Australia's future depends on a solid foundation for young Australians' intellectual, physical, social, moral, spiritual and aesthetic development (Department of Education, Science & Training, 2005). Some examples of dilemmas stories that have been developed in the context of several countries (Taylor & Taylor, 2009) are: Mining dilemma, Rice fish dilemma, Nuclear power dilemma, Climate change dilemma, Dilemmas

from Pakistan, etc.

The paper is the part of the results in study of dilemma story teaching in chemistry learning. At this learning process, students act as the main character in the story, so that students felt that the story happened to them. In everyday life, students are often faced problems which associated with science issues. Problems in daily life often create conflicts that require them to make decisions. Dilemmas stories educate students to integrate their knowledge with dilemmas in everyday life which allow them to engage in deep learning.

## **THEORETICAL PERSPECTIVES**

### **Soft Skills**

Character education is one important aspect of the educational process. According to Arthur (2008), character education focuses on student basic values and behaviour. Arthur and Wilson (2010) point out that education should 'produce' workers who are professional and qualified citizens, which not only the generation who have the knowledge, but also a willingness to keep learning and personal skills and values. According to Hutcheon (1999), school plays important role in establishing the character and culture of the students, especially in facing problems within an increasingly complex society and multicultural.

According Robbles (2012) soft skills are interpersonal qualities, also known as people skills, and personal attributes that one possesses. According to Rao (2010), soft skills are all skills, personality, and behavior that help beyond technical capabilities, such as team building, leadership, motivation, time management, and emotional, social, and personality Intelligence. Soft skills attributes include shared values, motivations, behaviours, habits, character and attitude. This attribute is owned by everyone with different levels which is influenced by the habits of thinking. Soft skills is a difficult competence to be defined as it is invisible and not immediate developed, while hard skills are skills that can produce something that is tangible and immediate (visible and immediate) which can be assessed from a technical or practical test.

### **Dilemma Story**

According to Settlemaier, (2003), dilemmas stories are used for stimulating students' reflect critically on their values and beliefs through dilemma situation. The Dilemma stories can be in different forms such as summary of problematic situation, film, role-play, and stories (Settlemaier, 2003). In that study teachers had used specially prepared ethical dilemma stories to engage students in critical reflective discourse and collaborative decision-making on the ethical implications of science and its uses (Settlemaier, 2003, 2009). This approach also contributes to the recent call to 're-imagine' science education as an exciting, authentic, investigative and meaningful experience for all students (Tytler, 2007). In this respect, a good ethical dilemma teaching story – like all classic moral dilemmas - has no final solution, thus allowing for prolonged thinking, reflection and learning. Content knowledge – chemistry, biology, physics, mathematics concepts and skills - is essential in order to understand and to find solutions to the ethical dilemmas embedded in the stories. Thus dilemma story pedagogy does not aim at replacing content-based science education but rather aims to enhance its quality and relevance to modern day students by 'adding value' to their learning.

### **Values Learning Environment Survey (VLES)**

The VLES was developed with three specific goals: (a) to promote values learning: the instrument provides teachers of science (and other school subjects) with a clearly articulated framework for establishing a values learning classroom environment; (b) to assess values learning: the instrument provides teachers with a relatively simple method for assessing the quality of students' engagement in values learning; and (c) to monitor values learning: the

instrument allows teachers and researchers to trace students' long-term values learning development. the VLES was designed in order to obtain measures of students' and teachers' perceptions of 6 key factors of the classroom learning environment that our earlier research shows (Settelmaier, 2009) are conducive to values learning: critical self-reflection, empathic communication, critical social thinking, deep engagement, collaborative decision-making, teacher support. Each of these factors became initially a 7-item scale, later reduced to five. The questionnaire has two versions for measuring perceptions of the learning environment as experienced (a) by students and (b) by teachers. Previous research has established that student achievement is optimal when students perceive a close match between their preferred and actual learning environments (Fraser & Fisher, 1983). The instrument has a five-point Likert-type frequency response scale. For readability purposes on the questionnaire we re-named the scales: 'The Dilemma Story' (deep engagement); 'The Teacher' (teacher support); 'Learning to Work Together' (collaborative decision-making); 'Learning to Listen' (empathic communication); 'Learning to Think' (critical self-reflection); and 'Learning about Science' (critical social thinking). Statistical analysis revealed that the Cronbach alpha coefficients lie in the range of 0.76-0.91, indicating satisfactory internal consistency of all scales.

### **RESEARCH DESIGN**

This study implied interpretive study. Interpretive is used in real situations, rather than in contrived, experimental studies, since its primary focus is on understanding the research context. The participants in this study are students in chemistry classes from two schools in Jakarta. Multiple research methods (interviews, questionnaire (The VLES), and classroom observations) were used to provide the integrated pictures of the research. Dilemmas stories that are applied in this research was created and assessed by lecturers, teachers, and students' teachers. The criteria used to assess the stories are the dilemma in the story, a story with a chemical linkage, the truth of chemistry concepts in the story, and the story and the language used. The classroom observations were conducted during the research to provide the picture of classroom environment. Then, the VLES was used to assess students' perceptions on their classroom environment. The researchers conducted the interview with the students.

### **RESULT**

Dilemmas stories teaching has been developed in Indonesia context. Development of dilemmas stories in relation chemistry topics and problems in Indonesia develops throughout the study. The study involved three steps: 1) dilemmas stories development, 2) VLES modified in Bahasa, 3) Implementing dilemmas stories teaching in chemistry learning. Thus the results of research is divided into three main parts, namely dilemmas stories development, realibilitas VLES instruments in Bahasa, and implications of dilemmas stories.

#### **Dilemmas Stories Development**

This dilemma story development through several steps. Stories are created by the research team. Furthermore, the stories was assessed through rubric of dilemma story assessment. Description of the results of the assessment dilemma story are described in this section . There are 8 dilemmas stories has been developed in this study : 1) Hg ( Merkuri ) in skin whitening, 2) Food Preservative, 3) Sea Water, 4) Jelantah Oil, 5) Heavy Metals in Mineral Water, 6) ABS (Alkyl Benzene Sulfonate) in Detergents, 7) Carbonic Acid in soft drinks , and 8) Pesticide.

Results of the story through the assessment rubric given to 12 people consisting of experts and students. Rubric used to have indicators : dilemmas in the story, chemistry concept, benefits for students, language , and application chemistry in the story. Each question consists of five choice

likert response scale assessment: Strongly Disagree, Disagree, Agree, Strongly Agree with a score of 1, 2, 3, and 4. Assessment rubric of each story is presented below (Table 1):

Table 1. Assessment of Stories

No	Criteria	Mean of Dilemmas Stories							
		1	2	3	4	5	6	7	8
1	Dilemmas stories in relation to daily lives	3.5	3.5	3.2	3.5	3.3	3.7	3.3	3.4
2	Dilemmas stories in relation to chemistry concepts	3.3	3.3	3.0	3.1	3.0	3.0	3.1	2.8
3	Dilemmas stories motivate students and develop students' critical, creative thinking, and problem solving	3.3	3.4	3.3	3.3	3.2	3.3	3.3	3.2
4	Language and story setting are interesting	3.1	3.0	3.0	3.2	3.2	3.0	3.2	3.0
5	Dilemmas stories can be used in chemistry learning	3.5	3.3	3.0	3.1	3.1	3.3	3.3	3.3

There are some suggestions and feedback from the lecturers, teachers, and student teachers in relation for stories improvement:

*Integrated learning outcomes in the introduction of the story  
(Lecturer feedback, 23 September 2013)*

*The effect of waste and heavy metals could increasingly students awareness of the environment  
(Student teacher feedback, 24 September 2013)*

*The story climax is not really interesting, should be made more dramatic, so that students are more engaged in dilemmas stories  
(Teacher feedback, 24 September 2013)*

### **Realibility of VLES Instrument**

The questionnaire is about students' perceptions on the learning activities when we used dilemma story. There are 24 questions with 6 scales of deep engagement, teacher support, collaborative decision-making, empathic communication, critical self-reflection, and critical social thinking with five point likert scale with a response of strongly disagree, disagree, unsure, agree, strongly agree with scores of 1,2,3, 4, and 5. Results using the SPSS statistical analysis. The reliability of each scale can be seen in Table 2

**Table 1. Internal Consistency (Cronbach Alpha Coefficient), Means and Standard Deviations**

Scale	Alpha Reliability	Mean	Standard Deviation
Deep engagement	0.485	4.26	0.67
Teacher support	0.597	4.28	0.62
Collaborative decision-making	0.631	4.34	0.62
Empathic communication	0.716	4.26	0.58
Critical self-reflection	0.698	4.12	0.65
Critical social thinking	0.608	4.36	0.64

Number of students ( $N$ ) = 128

Reliability can be determined by the internal consistency of each variable using Cronbach alpha reliability coefficient (Brown , 2007; Newby & Fisher , 1997). Overall VLES instrument that has been modified and adapted in the Indonesian context , reliability has been measured at 0.866 . While each scale in Table 2 above indicates that the alpha reliability coefficient obtained ranged from 0.48 to 0.71 . This indicates that the instrument reliable , because it has an alpha value above 0.50 . However, if viewed in each scale, then the value of reliability story remains to be improved to achieve an alpha value above 0.5 , this can be done with the repair of the story, or the questionnaire itself, especially on the language used . Mean value of each category is high at over 4.12 to 4.34. From these data, it can be seen that students respond positively to dilemmas stories learning. However, based on the characteristics of the research on interpretivism paradigm , the data used is more focused on students' responses to the learning itself which can be seen in the descriptions of implications of dilemmas stories .

### **Implications of Dilemmas Stories**

The dilemmas story has been improved through the feedback from stories assessment. Then it followed by implementation of dilemmas stories teaching in 4 classes at two high schools in Jakarta. Most students are interested in dilemmas stories teaching. Students' deep engagement with dilemma stories and the dilemma learning experience is crucial for the success of this type of pedagogy (Settelmaier, 2009). The teacher's role as a facilitator, agent provocateur, or devil's advocate is vital within our values learning environment. The teacher is more of a guide than a 'dispenser of values'. Given that science teachers often find themselves in the role of the person who 'has all the knowledge', taking a step back and allowing students to engage actively in their values learning can be a challenge. Students feel the impact of learning dilemmas stories teaching are expressed through VLES questionnaire and interviews. Based on the interview, can be categorized into several implications learning stories dilemmas: 1) Deep chemistry learning , 2 ) Critical reflections on their values and beliefs, 3) Sharing and negotiating ideas, 4) Working with others, and 5) Learning from the stories. A description of each of the implications can be seen below :

### **Deep Chemistry Learning**

That students' engagement with the dilemma stories seemed positive, and most interviewees described the experience as 'fun' and as 'different' from usual science classes. The teacher's role as a facilitator, agent provocateur, or devil's advocate is vital within our values learning environment. The teacher is more of a guide than a 'dispenser of values'. Given that science teachers often find themselves in the role of the person who 'has all the knowledge', taking a step back and allowing students to engage actively in their values learning can be a challenge. Interviews and observations indicated that teachers seemed to receive mostly positive feedback

on their facilitator role, their engagement with the students, and for trying something new and different, as stated by the students bellow:

*I like dilemmas stories in learning chemistry because more connected with chemistry in daily lives and more memorable*  
( Student Interview 3, Mercury Dilemma, SMU A )

*I like it, because it becomes not a boring lesson*  
( Student Interview 4 , Sodium Benzoate Dilemma, SMU B )

*I love it , because chemistry becomes very interesting*  
( Student Interview 5 , Sodium Benzoate Dilemma, SMU B )

*I think its unique because it is a real story, it is easier to understand because the story is related to daily life*  
( Student Interview 6, Sodium Benzoate Dilemma, SMU B )

*Confuse, first , because I do not like to wear cosmetics. Second , because I do not know the chemical content in cosmetics and their functions*  
( Student Interview 7, Mercury Dilemma, SMU A )

*I agree completely of using dilemmas stories teaching , we become more understanding of chemistry. It is because we study chemistry usually only by learning theories and calculations*  
( Student Interview 1, Mercury Dilemma, SMU A )

*I agree using dilemmas stories teaching, because we know how the application of chemistry in daily lives*  
( Student Interview 2, Mercury Dilemma, SMU A )

### **Critical reflections on their values and beliefs**

When forced to make a decision students seem to engage in both critical self reflection and critical thinking (Settelmaier, 2009). Critical self reflection occurs when a student reflects on his/her own values in order to solve a problem. Critical thinking, on the other hand, is well documented in the literature as an analytic, systematic problem-solving approach that builds largely on existing knowledge, as stated by the students:

*If such challenging story, I realise, I can do improvement for my environment, thinking about hazardous metals and how its impact*  
( Student Interview 1, Mercury Dilemma, SMU A )

*Actually I'm confused, between our business and other lives*  
( Student Interview 8, Mercury Dilemma, SMU A )

*Yes , I was confused at the time of solving the problem*  
( Student Interview 4 , Sodium Benzoate Dilemma, SMU B )

*I am confused, because I had to put my position as myself. I'm confused what to do for my family and the other people*  
( Student Interview 13, Sodium Benzoate Dilemma, SMU B )

*No, I can directly answer the first question when I faced with the problem that , because I positioned it as a junior high school kid so I choose my parents  
( Student Interview 5, Sodium Benzoate Dilemma, SMU B )*

*I become aware of more careful in the use of drugs, especially cosmetics  
(Student Interview 7, Mercury Dilemma, SMU A)*

### **Sharing and negotiating ideas**

Here, the focus is on developing emotional intelligence, empathy, the ability to accept and consider other people and their ideas. Most students reported that they felt their voices were listened to and their opinions accepted as legitimate. Students seemed to appreciate the opportunity to hear about other people's thoughts and opinions, and indicated the importance of knowing what others think and feel in order to care.

*I love the discussion, because we can know other opinions as well as we can exchange ideas  
(Interview 9 Students, Sodium Benzoate Dilemma, SMU B)*

*I realized, I need to think deeply about my ideas  
(Student Interview 10, Mercury Dilemma, SMU A)*

*I love the discussion, because it combines our thinking with thoughts of friends, because sometimes we thought wrong  
(Student Interview 11, Mercury Dilemma, SMU A)*

### **Working with others**

Collaborative decision making involves student groups negotiating a decision and/or a compromise in order to solve a problem as a group. Furthermore, students draw on both their own values and increasingly on evidence provided to them through their science learning to make informed decisions. One of the key issues raised during the ethnographic inquiry was the importance of recognising difference in opinions and values and working with it. Students reported that through the group-work and the discussions they seemed to become more aware of different opinions.

*Thus, through these stories I can collaborate with friends  
(Student Interview 11, Mercury Dilemma, SMU A)*

*It is better to ask a friend if there is not yet understood, because sometimes with the teachers, I am reluctant to ask  
(Student Interview 2, Mercury Dilemma, SMU A)*

### **Learning from the stories**

Other implication of dilemmas stories teaching that students learn from the story presented. Story dilemma Mercury and Sodium Benzoate which applied to help the students learn to be aware in using cosmetic products, as well as preservatives in foods.

*More careful in the use of drugs, especially cosmetics  
( Student Interview 7, Mercury Dilemma, SMU A )*

*Food materials, plastic packaging, keep it mind every time using any chemical products. Whar are chemical ingredients in products, the dangerous. We have to understand its good or not for ourselves, others, or environment*

*( Student Interview 1, Mercury Dilemma, SMU A )*

*The problem of plastic, the plastic is almost everywhere much which contributes to pollution. We also have to be aware of any dangerous substances in food*

*( Student Interview 11, Mercury Dilemma, SMU A )*

*More careful in choosing products*

*( Student Interview 12, D Mercuryilemma, SMU A )*

*I suggest not to use sodium benzoate and sell with new innovations such as selling fruit ice using only sugar without preservatives and do not too much worry of preparation in order to keep the fruit fresh*

*( Student Interview 13, Sodium Benzoate Dilemma, SMU 30 )*

*We may eat instant noodles, but not too often, instant noodles can be substituted with eggs or other foods. Although the food more expensive than instant noodles, our health is more valuable than money*

*( Student Interview 14, Sodium Benzoate Dilemma, SMU 30 )*

There some pictures of dilemmas stories teaching. Students created the poster as the results of their reflections on dilemmas stories teaching:



*Picture 1. Teacher reads the story*



*Picture 2. Students listen the story*



*Picture 3. Students discussion in pair*



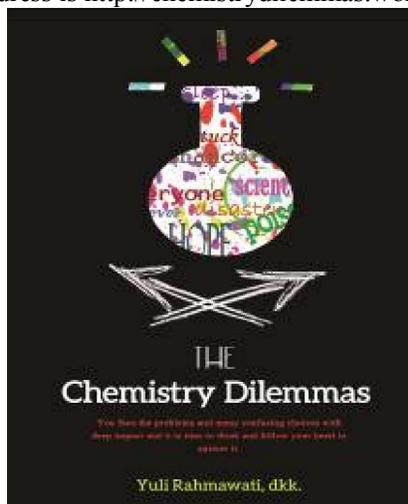
*Picture 4. Students discussion in group for solving the problems*





**Picture 8. Students completed VLES questionnaire**

The interview and pictures above show how students learn from dilemmas stories. Even some of them try to find alternative solutions to the use chemicals. This is a positive impact on student awareness for a healthier life. The results show that the students are interested and motivated to learn chemistry as it is related to daily lives. Students also learn to understand and reflect on their values. Students learn to cooperate with others share and negotiate their ideas for solving problems on dilemmas presented. Dilemmas stories from this study are represented on the booklets and dilemmas stories weblog . The front page booklet dilemmas stories can be seen in Figure 9, whereas weblog address is <http://chemistrydilemmas.wordpress.com/>



**Picture 9. Booklet of Dilemmas Stories**

This study is still continue and the quality of the story be continuously improved by integrated topics related to chemistry learning on curriculum in 2013, particularly in the character education and social emotional learning.

## **CONCLUSION**

The results of our study indicate that the students engaged positively in a social emotional learning. Research dilemmas stories on learning of chemistry has produced a collection of

stories that can be used on engaging students in chemistry learning. Instruments Values Learning Environment Survey (VLES) has been modified in Bahasa and adapted to the context of learning chemistry in Indonesia which can be used in further research. Dilemmas stories teaching has implications for chemistry learning: 1) Deep chemistry learning, 2) Critical reflections on their values and beliefs, 3) Sharing and negotiating ideas, 4) Working with others, and 5) Learning from the stories. These results are consistent with earlier research and add further evidence to the claim that a socially responsible science education based on ethical dilemma story pedagogy offers a promising means to develop critical skills with which students can engage as socially responsible citizens in informed decision-making about the appropriate use of science for addressing global issues such as climate change and environmental sustainability (Settelmaier, 2009). Stories dilemma can be used as a chemical alternative learning approaches in learning the characters in Indonesia, especially its association with Curriculum 2013 in middle schools.

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