The Study of Used Socio-Scientific issues (SSI) in Biology

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Abstract
Using socio-scientific issues (SSI) in science lesson especially biology is an approach for students to understand and empower the science concept. Students are given the opportunity to argue the issues and will improve the process of reasoning. Using this approach indirectly can create awareness of ethics and problem solving to students. From the literature review hopefully can develop reasoning skills model based on SSI. Structural Equation Model (SEM) approach is used for measure and identify the variables that contribute students’ reasoning skills. From trends of literature reviews, three independents variables were identified, Content Acquisition, Epistemology Science Belief, Adhered values and ethics towards Reasoning Skills as a dependent variable. Hoped this study will help to improve the empowering of science concepts and Higher Order Thinking Skills (HOTS). In another hand, it also can produce a holistic students and increase creative and critical thinking skill while using the model of reasoning as a guideline.

Keywords: Socio-Scientific Issues (SSI), Content Acquisition, Epistemology Science Belief, Adherence to the values and ethics, Reasoning Skills

Introduction
21st century education requires students to compete globally, especially students who embrace science, technology, engineering and mathematics (STEM). Science aims to make the association of ideas and understanding of natural phenomena. While the technology used to produce tools to solve the problem. Conception students to the phenomenon of science is based on observation and experience a day (Lewis & Leach, 2006). Thus the characteristics of students who are able to reasoning, problem solvers, argue, communicate, creative, critical and collaboration by anyone is an aspect that should be emphasized as well as the priority of the school (Böttcher & Meisert, 2013). One effective strategy and recognized by previous studies is the SSI approach in teaching and learning, particularly in biology. SSI is a scientific issue that is happening around the students such as environmental issues, medical, nutritional, and genetic engineering. This issue is more sensitive and controversial when it was first being debated in social media after causing negative effects and harm to society although there are some issues
that are beneficial to human life (D. L. Zeidler, Florida, & Nichols, 2009). The scientific issues are not only able to test students cognitive level, but can also measure students spiritual and emotional perception (Sadler, 2004).

SSI that touch on the subject of biology can improve their students to master concepts that are taught in a more clear (Reiss, 2006). Case studies conducted by (Reis, 2009) through observation and interviews found the approach to social issues in biology able to increase students' motivation, however, the effectiveness of this approach is dependent on the expertise of teachers in implementing it. In the study Klosterman, Sadler, & Brown, (2012), states that one of the ways to learn science is to introduce approach scientific issues because of very significant problems and issues especially related to natural phenomena. Indirectly, these activities have been revealed to the students how to start a good practice before they face the real people in the community in the future.

In Malaysia, according to (Husin, Hamidah Abd Hamid, & Siti Hajar Abdul, 2006), before that, discussion of current issues related to socio-scientific issues only occurs in the electronic media. From the using internet, people talked about the issue and found no evidence any of their submissions whether they like it or not. It is better to be exposed to these skills as students in the classroom and Indirectly, this will improve skills such as reasoning level students (Chung, Yoo, Kim, Lee, & Zeidler, 2014).

In this research, researchers need to conduct an investigation and refer to theory and previous findings for the findings of this research are more meaningful and have a high validity and reliability. In this study, the purpose of the model is to assist policy makers, especially the Ministry of Education in order to provide a clear picture of the level of reasoning of scientific students and the issue of declining student achievement Malaysia in tests Trends in Mathematics and Science Studies (TIMSS) and the Programmed for International Student assessment (PISA), which measures the subject of science

**Literature Review**

**SSI and Reasoning**

Reasoning skills is synonymous with well-planned strategy in the classroom (Pegg, 2006). Reasoning skills based on SSI often used to ensure that the teaching and learning of science went perfectly and can motivate students (Zeidler et al., 2009). Apart from learning strategies that are run, the plans made by the teacher plays an important role in achieving the learning objectives through the existing curriculum. Accordingly, in Malaysia, there are a variety of teaching strategies that have been introduced in the education system to help to meet the needs of the curriculum in schools, especially in the subject of biology. Among the strategies used in the classroom is a learning strategy that is students centered, as a problem-based learning and project-based learning. To diversify strategies for teachers, and meet TIMSS and PISA domain question, the strategy of scientific issues must be implemented.
In the meantime, the socio-scientific issues in caring, teaching and learning in the classroom is basically to help students develop the skills to understand scientific terms, make a decision, make an assessment, give evidence and conclude issue’s discussions involving science concepts (Yoon, 2008). With the attention and concentration of students on subject content will continue to increase and facilitate teachers in conveying information. Thus, this strategy can help teachers when they tried to emphasize science concepts (Sampson, Simon, Amos, & Evagorou, 2011). (Tal & Kedmi, 2006) has listed the characteristics of the socio-scientific issues that need to be brought into the teaching of biology is as follows:

- Has to do with the biology curriculum standard
- Supported by current data
- The real issue
- Contemporary issues relevant to the subject
- Be controversial
- Natural character and have the scientific process
- Need to discuss moral and ethical

**SSI Review**

To facilitate researchers across the gap in the case studies, systematic literature review were used to analyze the results of previous studies related to the issues of socio-scientific. The table 1 shows the studies that have been done.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Purpose of studies</th>
<th>Variables</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Zeidler, Sadler, Applebaum, &amp; Callahan, 2009)</td>
<td>To investigate the effects of SSI on student reflective</td>
<td>Reflective judgments</td>
<td>SSI can increase the reflective student of science concepts</td>
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<td>(Sadler &amp; Zeidler, 2005)</td>
<td>To identify the significance of scientific reasoning and motivation</td>
<td>Knowledge Content Scientific Reasoning</td>
<td>Positive significant and increasing student motivation</td>
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<td>(Zeidler, Sadler, Simmons, &amp; Howes, 2005)</td>
<td>Identify literacy in science and belief in science</td>
<td>Epistemology science belief</td>
<td>Attitude and epistemology of science</td>
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<tr>
<td>(Mueller &amp; Zeidler, 2010)</td>
<td>Associate morals and ethics of science</td>
<td>Moral and ethical</td>
<td>Using moral and ethics during the discussion</td>
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<tr>
<td>(Albe, 2008)</td>
<td>Theory and practice of SSI</td>
<td>Epistemology of science</td>
<td>Raising awareness during discussions</td>
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<td>(Sadler &amp; Donnelly, 2006)</td>
<td>Debate on the SSI</td>
<td>Acquisition content, Moral and ethical</td>
<td>Has a relationship during the process of debate towards moral</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Issue Description</td>
<td>Key Issues</td>
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<td>(D. L. Zeidler &amp; Keefer, 2003)</td>
<td>The role of the moral of the SSI</td>
<td>Students are able to perform moral reasoning while arguing</td>
<td></td>
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<td>(Acar, Turkmen, &amp; Roychoudhury, 2010)</td>
<td>Using debate to identify problem towards SSI</td>
<td>Students can create a framework for decision-making through debate</td>
<td></td>
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<tr>
<td>(Klosterman, Sadler, &amp; Brown, 2012)</td>
<td>Assessing the impact of the SSI in the curriculum content knowledge using mass media</td>
<td>Multi-level assessment of scientific content knowledge gains associated with SSI based instruction</td>
<td></td>
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<td>(Siew Fong Yap, 2014)</td>
<td>Review of the SSI elements of science</td>
<td>SSI plays an important role in the social and political dimensions</td>
<td></td>
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<tr>
<td>(Gerber, Cavallo, &amp; Marek, 2001)</td>
<td>Relationships among informal learning environments, teaching procedures and scientific reasoning ability</td>
<td>Scientific reasoning</td>
<td></td>
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<tr>
<td>(Chung et al., 2014)</td>
<td>Enhancing Students’ Communication Skills in the Science Classroom Through SSI</td>
<td>SSI instruction could bring about a moderately large impact on students’ ability to understand.</td>
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</table>
The proposed framework under review

Figure 1 shows the overall framework involving SSI strategy when applied in teaching and learning.
This framework then makes a recommendation to study after identifying the variables to be tested. Here are the proposed objectives in this study.

a) Develop and validate the measurement model of reasoning skills, content acquisition, epistemological scientific beliefs and adhered values-ethics based on socio-scientific issues.

b) Identifying the effect content acquisition, epistemological scientific beliefs, adhered values and ethics towards reasoning skills.

c) Propose a model of reasoning skills is significant and positively to the study data.

Conclusion
After conducting systematic literature review, the gap is obtained for the development of Structural Equation Modeling based on SSI through four variables; analysis of content knowledge (content acquisition), epistemology science belief, adhered values and ethics towards reasoning skills. By using Analysis of Moments Structural (AMOS), hopefully the selection of four variables have high factor loading and can identify which variables to contribute students’ scientific reasoning. SSI issues should be a part of the science curriculum because students deserve the opportunity to explore important issues that challenge their understanding of science concepts. SSI also helps educators to further understand how students learn science and what factors are influence on their reasoning skills. It is directly can produce students with a holistic and fulfilling the philosophy of education.

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