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ARGUMENTATION IN PEER-GUIDED VERSUS TEACHER-GUIDED GROUP DISCUSSIONS

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ABSTRACT: This study investigated argumentation patterns resulting in teacher-guided and peer-guided group discussions on four socioscientific-issues (SSI). Two groups, each including five students from grade 7, studied on a different SSI during four weeks. Discussions within both groups were observed, videotaped, and analyzed qualitatively. After four weeks, group interviews were conducted. The results showed that teacher-guided group presented more complex argumentation patterns than peer-guided group. Both groups supported their claims with scientific and non-scientific evidence. But teacher-guided group presented the evidence deeply. The results suggested that teachers should have the related pedagogical skills to put argumentation into practice and to explore the students' skills in constructing arguments in the context of SSI. The implications for science educators and researchers were discussed.

INTRODUCTION

It is important for individuals to be competent in science content knowledge, to have argumentation skills, and to make informed decisions to be responsible citizens which are also among the key elements of scientific literacy. Scientific literacy is defined as a multidimensional construct including "being able to use scientific knowledge and ways of thinking for personal and social purposes" (AAAS, 1990, pp. xvii-xviii). It is important to be a scientifically literate person in this century which is full of scientific and technological developments. Scientifically literate individual is the one who "use appropriate scientific processes and principles in making personal decisions" and "engage intelligently in public discourse and debate about matters of scientific and technological concern" (NRC, 1996, p. 13). To sum up, scientific literacy is related to one's knowledge about science, technology, society and the relationship between them and scientifically literate person is the one who uses her/his scientific literacy in order to make decisions for complex issues which are not only scientific but also social and technological. These issues are called as socioscientific issues (SSI) and defined as intricate and open-ended having no certain answers (Sadler, 2003). They are controversial in nature and likely cause an argument. Being questionable makes SSI debatable therefore opposing ideas emerge against those issues. Dawson and Venville (2010) emphasized that school science should focus on necessary skills, knowledge, and comprehension to deal with socioscientific issues since individuals should be able to evaluate their pros and cons, ask questions, assess the information in terms of different perspectives and finally reach balanced, reasonable, and informative decisions. In light of this, this study investigates the argumentation patterns and quality of argumentation in grade seven students' small group discussions about different SSIs with and without teacher guidance. The specific research question guided this study was: What are the argumentation patterns and the quality of argumentation within teacher-guided and peer guided small group discussions?

THEORETICAL FRAMEWORK

In this study, sociocultural approach of learning was drawn on to comprehend how students grapple with different socioscientific issues. Jimenez-Aleixandre and Erduran (2007) underlined two aspects of argumentation; justification of claims and persuading audience. The former is related to the connection between reasoning process, theoretical ideas and empirical evidence to justify the claim. The latter is what you claim and advocate by evidence aim to persuade the audience for your argument. Jimenez-Aleixandre and Erduran (2007) foreground sociocultural approach as a framework laying stress on socialization for learning and thinking

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through the use of language. Argumentation is a form of discourse underlying learning in social context through the interaction of learners. Sociocultural approach basically explains the mental processes in human mind with an emphasis on the relation between these processes and the context and human communicative practices instigate these processes (Wertsch, 1991). Wertsch states that this approach works for academic discussions as well as everyday events.

LITERATURE REVIEW

Argumentation is defined as a claim furnished by corroborating justification (Kolstø & Ratcliffe, 2007). Researchers studying argumentation in teaching and learning science stated that argumentation should be integrated into science education and researchers should contribute to the progress of it (i.e. Driver, Newton, & Osborne, 2000). Driver et al. (2000) argued that science is not only observation and experimentation but also includes disagreements which contribute to the construction of scientific knowledge. These disagreements result in the engagement with claims, evidence, counter claims, rebutting claims and changing hypotheses.

The related literature shows that most of the studies in socioscientific issues focused on the argumentation as a means to resolve sociosceintific issues (Jimenez-Aleixandre, Rodriguez, & Duschl, 2000; Kortland, 1996; Patronis, Potari, & Spiliotopoulou, 1999; Zohar & Nemet, 2002). Kortland (1996) studied the argumentation patterns with the middle school students in the content of environment, specifically waste management and recycling. The results of the study guide Kortland to make the conclusion that students have the ability to create a basic argument, on the other hand he reported that the arguments generated are not clear, limited and not applicable. Patronis et al.'s (1999) study revealed opposite findings to the Kortland's study. They suggested that middle school students could develop strong arguments in the context of socioscientific issues. SSI, being controversial in nature with different scientific and social dimension, is an appropriate context to engage students in argumentation. It creates such a classroom environment in which students develop claims, counter claims including evidence to justify them. Therefore classroom practices might be useful to engage students in argumentation in the context of SSI.

METHOD

This study investigated the argumentation patterns resulting in teacher-guided and peer-guided group discussions on four SSIs (hydroelectric power plant, nuclear power plant, genetically modified food, and research conducted on animals). Participants of the study were ten Grade 7 students who worked as groups of five. They studied on a different SSI each week for a total of four weeks. Discussions within both groups were videotaped, transcribed, and analyzed qualitatively. They were also observed by researchers. After four weeks, group interviews were conducted on discussions. The nature and quality of students' argumentation patterns were analyzed through Toulmin Argumentation Pattern (TAP) (Toulmin, 1958) and the analytical framework developed by Erduran, Simon, and Osborne (2004). Table 1 gives the analytical framework used in this study.

Table 1. Analytical Framework to Assess the Quality of Argumentation

Level 1	Level 1 argumentation consists of arguments that are a simple claim versus a counter-claim or a claim versus a claim
Level 2	Level 2 argumentation has arguments consisting of a claim versus a claim with either data, warrants, or backings but do not contain any rebuttals.
Level 3	Level 3 argumentation has arguments with a series of claims or counter-claims with either data, warrants, or backings with the occasional weak rebuttal.
Level 4	Level 4 argumentation shows arguments with a claim with a clearly identifiable rebuttal. Such an argument may have several claims and counter-claims.
Level 5	Level 5 argumentation displays an extended argument with more than one rebuttal.

RESULTS

In particular, we were interested in comparing the nature of arguments generated in the small groups with and without teacher guidance on different SSIs. Transcripts of two group discussions were examined for episodes of argumentation clusters. Erduran et al. (2004) defined clusters as permutations of Toulmin Argumentation Pattern such as "claim-data-warrant" or "claim-data-rebuttal". We aimed at identifying argumentation clusters and assigning levels for both type group discussions.

Teacher-guided group discussions: These discussions were guided by the teacher. The group was informed about four SSIs with short stories including a few directions about what they were required to do. Teacher asked the driving question about each socioscientific issue during discussions and let the students discuss. He did not directly state his personal ideas and thoughts and give any specific information. Instead he asked questions to clarify and elaborate on students' ideas and encouraged them to participate in discussions. The teacher was knowledgeable about argumentation and practiced it in his classes before. Therefore he did not have difficulties in guiding students to present elements of argumentation. The most evident result in teacher-guided group discussions was that students experienced a higher level of argumentation (see Figure 1). They referred to scientific evidence to support themselves in addition to the non-scientific ones. For example they referred to water cycle in supporting their claims about hydroelectric power plant. Students' lived experiences were also found to be influential in presenting their claims and evidence. In one of the discussions, for example, one student told that his relatives were forced to abandon their home due to the construction of hydroelectric power plant by the authority because their home was in that region. This student felt upset because of this and opposed to the construction of it.

Peer-guided group discussions: This group did not receive any guidance from teacher during their discussions. The group was given the same short stories as teacher-guided group about four SSIs and they were given the same directions about what they were required to do. They negotiated on each issue with their peers. The researcher observed their discussions to ensure that they were on task and there is no off-task behavior. The group members shared their ideas. However they could not elaborate on them further. The most evident result in peer-guided group discussions was that students could not experience a higher level of argumentation as in teacher-guided group discussions (see Figure 1). Similar to other group, they referred to both scientific and non-scientific evidence to support themselves. However their scientific evidence was so superficial. For example, one student supported the construction of hydroelectric power plants due to electricity production but neither he nor other group members elaborated on this.

Table 2 presents an example for how the nature and quality of arguments differed in both groups' discussions in the context of hydroelectric power plant. It was evident that teacher-guided group experienced a more sophisticated level of argumentation than peer-guided group.

Table 2. An Example Argumentation Patterns in Teacher-Guided and Peer-Guided Discussions

	Example (Level)	
	Teacher-guided	*Peer-guided*
Hydroelectric power plant	**Student A:** I think hydroelectric power plants should not be constructed because it takes water from nature and water becomes less. **Teacher:** Do you mean the amount of water in nature reduces? **Student A:** Yes. **Student B:** I do not think that water is used up [by hydroelectric power plants] and reduced. **Teacher:** What do you mean? Do you mean that hydroelectric plants do not change the amount of water in nature or they increase it? **Student B:** I think water is not used up [by hydroelectric power plants]. Those plants collect water together and let the water turn turbines through energy transformation and produce electricity. If they used up water, the amount of it in nature would not reduce because there is water cycle in nature. ***(Level 4)***	**Student F:** Hydroelectric plants are necessary because they produce electricity. **Student G:** I think so because it is also important for economical developments. **Student H:** You may be right in your views but it damages environment and ecosystem and people protest it. **Student F:** Ok it may have some disadvantageous but electricity is vital in our lives and it is more important. Can you do your homework without electricity at home (referring to Student H)? Of course no! ***(Level 2)***

The chart in figure 1 shows the distribution of level of arguments which were obtained from two groups' discussions during four weeks. This chart shows that teacher-guided group performed better in terms of nature and quality of argumentation than peer-guided group. The students engaged in more sophisticated argumentation patterns when the teacher guided the discussion. Level 5 argumentation was not observed in both groups. Peer-guided group could reach level 3 argumentation at most.

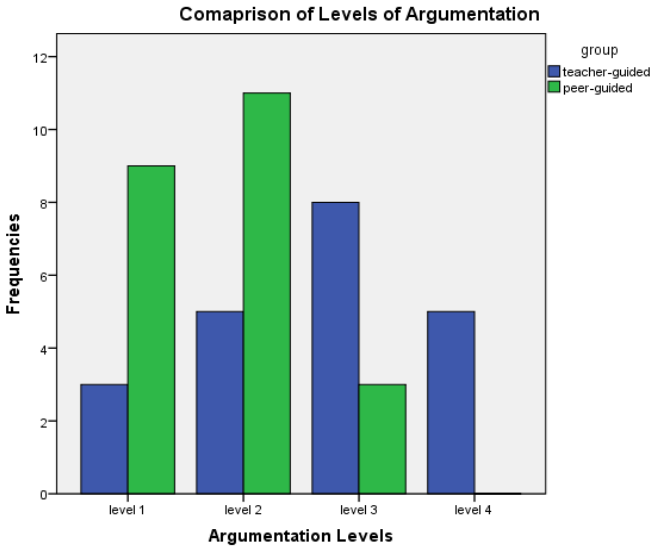

Figure 1. Comparison of Argumentation Levels for Teacher-Guided and Peer-Guided Groups

DISCUSSION

The results showed that teacher-guided group presented more complex argumentation patterns than peer-guided group (see Figure 1). Teacher-guided discussions were more informative and included high quality argumentation. Peer-guided group could not achieve complex argumentation patterns. Both groups supported their claims with scientific and non-scientific evidence. But teacher-guided group presented the evidence deeply. The teacher in this study experienced argumentation before and guided students in presenting different elements of argumentation competently. The questions he asked directed students to a more complex argumentation. In light of this, the results suggested that teachers should have the related pedagogical skills to put argumentation into practice and to explore the students' skills in constructing arguments in the context of SSI. As a result this will contribute to educating students as responsible citizens who are capable of engaging in public discussions about social issues which influences their lives.

This study will contribute to science educators and researchers' general interest in terms of argumentation and its implementation in SSI context. It will also inform them about results for teacher or peer guided group discussions.

REFERENCES

American Association for the Advancement of Science (AAAS). (1990). Science for all Americans. New York: Oxford University Press.

Dawson, V. M., & Venville, G. (2008). Teaching strategies for developing students' argumentation skills about socioscientific issues in high school genetics. *Research in Science Education*, *40*(2), 133–148.

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science education*, *84*(3), 287–312.

Erduran, S., Simon, S., & Osborne, J. (2004). TAPping into argumentation: Developments in the application of Toulmin's argument pattern for studying science discourse. *Science Education*, *88*(6), 915–933.

Jimenez-Aleixandre, M. P., Rodriguez, A. B., & Duschl, R. A. (2000). "Doing the lesson" or "doing science": Argument in high school genetics. Science Education, 84, 757 – 792.

Jiménez-Aleixandre, M. P., & Erduran, S. (2007). Argumentation in science education: An overview. In S. Erduran & M. P. Jiménez-Aleixandre (Eds.), *Argumentation in Science Education* (pp. 3–27). Springer Netherlands.

Kortland, K. (1996). An STS case study about students' decision making on the waste issue. *Science Education*, *80*(6), 673–689.

Kolstø, S. D., & Ratcliffe, M. (2007). Social aspects of argumentation. In S. Erduran & M. P. Jiménez-Aleixandre (Eds.), *Argumentation in Science Education* (pp. 117–136). Springer Netherlands.

National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press.

Patronis, T., Potari, D., & Spiliotopoulou, V. (1999). Students' argumentation in decision-making on a socioscientific issue: Implications for teaching. *International Journal of Science Education, 21*, 745 – 754.

Sadler, T. D. (2003). Informal reasoning regarding socioscientific issues: The influence of morality and content knowledge. (Doctoral dissertation, University of South Florida, 2003).

Toulmin, S. (1958). *The uses of argument*. Cambridge: Cambridge University Press.

Wertsch, J. V. (1991). *Voices of the mind: A sociocultural approach to mediatedaction*. Cambridge, Mass: Harvard University Press.

Zohar, A. & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching, 39*, 35–62.