Student-Led Argumentation: Effects on Knowledge Building

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ABSTRACT

This study investigated the effects of student-led argumentation teaching approach (SLATA) on student knowledge building in Biology at the junior high school level. It also examined if the subscales of knowledge building (general self-regulation, knowledge building, question asking low level, question asking high level, lack of regulation, cooperative learning and teacher directed classroom) have been affected by SLATA. The sample consisted of 105 students (52 in the CTA group and 53 in the SLATA group) drawn from two Grade 7 students from a public high school in Quezon City. Date were collected through pre- and post-tests. The findings showed that there is no significant difference between the two groups in terms of knowledge building. But in one of the seven subscales of the student perceptions of classroom knowledge building, the teacher directed classroom instruction was found to be statistically significant. Hence, it is recommended that teachers allot more time in exposing their students to SLATA in order to develop more students' knowledge building.

Keywords: *student-led/initiated, argumentation, knowledge building*

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INTRODUCTION

Learning science per se is fun and exciting because of its startling laboratory experiment results and eye-opening class discussions. Aside from that, science becomes an enjoyable experience for the students if this fully involves them in the learning process. But nowadays learning science is challenged because of different factors that prevent the effective learning of this core subject. One of those factors that drastically affect the learning process of science is the numerous times of teacher's dominance in the class, so the teaching learning process becomes teacher-centered. Relatively, the teacher frequently makes use of lecture method as his or her teaching strategy. Alduasis (2012) supported this claim when he said that teachers have this habit of dominating the classroom discussion. As a result, students become mere listeners and absorbers of information. They are not given ample opportunity to explore the depth of scientific knowledge on their own and students' way of thinking also becomes poor.

Al-Amoush, Markic, and Eilks (2012) also stated in their study that teacher-centered beliefs are still seen among teachers and scaffolding practices are rare (Van de Pol, Volman, & Beishuizen, 2011). This type of teaching approach has still been the practice of most science teachers both in public and private schools, most especially if they have to cover everything in their science curriculum for a particular grading period. With this, it is logical to say that the apparent teaching approach happening inside the classroom is through lecturing. Elison (2010) described lecturing as the involvement of transfer of the information from the notes of the lecturer (teacher) to the notes of the student without passing through the minds of either. Bligh (2000) also emphasized that lecture method is a relatively poor instructional approach for maintaining student attention.

This is also the reason why teachers are encouraged to design student-initiated activities so that students will become more involved in the teaching learning process.

Duckworth (2009) also asserted that teacher-centered learning actually prevents students' educational growth. This actually prohibits them to think critically and to express themselves argumentatively. In contrast, in a learner-centered classroom, students are actively learning and they have greater input into what they learn, how they learn it, and when they learn it. This means that students take responsibility of their own learning and are directly involved in the learning process.

Previous research also suggested that engaging students in knowledge building environment is an effective means to support collaborative learning activities in class settings (Hong & Scardamalia, 2008; Scardamalia, Bereiter, & Lamon, 1994; Sun, Zhang, van A., & Chan, 2007), and yields advances in literacy, in twenty-first century skills, in core content knowledge, in the ability to learn from text, and other abilities (Scardamalia & Bereiter, 2007). Hence, when teachers intend to develop students' scientific knowledge, they should do it in conjunction with forming interactive group or collaborative group work. But again, this kind of setup is rarely seen in typical science classes.

Further, teachers must consider that science education should not only be concerned with more than knowledge of scientific facts. It should also place value and emphasis on the processes of making arguments that enable students to understand science as a way of Knowing (Driver, Leach, Millar, & Scott, 1996; Driver, Newton, & Osborne, 2000; Millar & Osborne, 1998). The practice of argumentation is a cornerstone of the scientific process; students at the secondary level have few opportunities to engage in it (Bell, 2004). That is why many students still lack this argumentative skill, which usually leaves them not prepared for college and careers. It is also widely recognized that argumentation is an important skill for citizenship but also a significant objective of science teaching. Teaching this core skill of science has always been given little emphasis in the Philippine classrooms; making Filipino students intellectually challenged in terms of making sound arguments and counter-arguments.

This study focused on the student-led argumentation and its effects on the knowledge building of the students in science. The researcher sees the need for the students to hone their argumentative skills in science through forming interactive group which required them to utilize argumentation in their discourse of scientific issues. Alduasis (2012) also mentioned that giving the students a chance in the classroom to interact with each other and to argumentatively discuss what they have learned is also a good strategy which can encourage them to share their ideas with the teacher and to be self-directed learners.

Purpose of the Study

This study aimed to determine the effects of Student-led Argumentation Teaching Approach on knowledge building. Specifically, this research sought to answer the question:(1) Do students exposed to Student-led Argumentation Teaching Approach have better knowledge building in Biology than those exposed to conventional teaching approach?

Literature Review

Student-led/initiated classroom activities

Students of the 21st Century are very much different compared to students 5 to 10 years ago in terms of developing learning in and outside of the classroom. Some of them learn best when they are really the ones who perform the tasks given to them. However, most of the time teachers deprive their students to be fully responsible for own their learning due to some justifiable reasons, and of course some unacceptable reasons.

“Student initiation would mean generally the ability of both teacher and his followed methodology (strategy) inside the classroom to motivate, encourage, and stimulate the students so that they participate as much as possible inside and during the classroom” (Alduasis, 2012, p. 28). It is also described as a strategy which is actually used by learners of either a foreign or second language to express their ‘conscious and unconscious processes of learning and using language’ (Richards, Schmidt, Kendrick, & Kim, 2002).

Alduasis (2012) emphasizes that “student-initiation approach is more effective than teacher-initiation approach as it allows students to recall more information and knowledge from what they have learned and at the same time, are more independent and self-confident”(pp. 29-30). Once students initiate their learning they are actually doing the group learning. Slavin (1990) explains that group learning allows students interaction, feedback, and sharing of ideas which can help students reformulate concepts and construct new knowledge. This particular finding of Slavin has also explored by the researcher in his teaching approach. The researcher also wanted to find if small-group interaction as guided by argumentation really helps students reformulate their science concepts and construct their new knowledge upon the exchange of their ideas with their group mates.Kagwesage (2014) also concluded in his research study that student-initiated group discussion have the potential to promote knowledge construction in content subjects and affords confident students participation. Previous studies have also shown that peer-led sessions enhanced students’ performance in chemistry and their final grades also got higher (Drane, Smith, Light, Pinto, & Swarat, 2005) and in organic chemistry (Tien, Roth, & Kampmeier, 2002).

Argumentation: Its Nature and Role in Science Learning

It is human nature for a person to always speak for his or her mind. He or she usually does this in order for him or her to say what he or she believes in and probably defends his or her point. In this regard, science also uses this way of defending something but it has to be based on facts and scientific evidence. In science, this can be classified as an argumentation.

The word argumentation can form two words; the word argumentation itself and the word argument. Although both seem to have the same meaning, they are definitely different from each other. Schuetz (2012) defined argumentation as a cooperative process in which communications make inferences from various grounds and evidence, provide justifications for their conclusions or claims based on those starting points, and promote, defend, and amend positions and standpoints while argument can be defined as an individual activity through thinking and writing or as a social activity taking place within a group (Don, 2003).

Osborne et al. (2004) have also this kind of description. According to them an argument is essentially an artefact that is constructed with the intent to justify a claim whereas argumentation refers to the complex process of constructing, exchanging, critiquing and revising those artifacts. They also mentioned the importance of this skill to the students. They said that through providing students with tasks that require discussion and debate, it was envisaged (to picture something in mind) that teachers could engage students in the construction of arguments through the process of argumentation.

Research findings have demonstrated numerous benefits of argumentation in science learning which include understanding science concepts (Jimenez-Aleixandre, Rodriguez, & Duschl, 2000, Mason, 1996, Osborne, 2010, Zohar & Nemet, 2002), promote thinking and reasoning (Mercer, Dawes, Wegerit, & Sams, 2004; Simon & Maloney, 2007).This is also backed up by Osborne, Erduran, and Simon (2004b). They said that the teaching of argumentation through the use of appropriate activities and pedagogical strategies is a means of promoting epistemic, cognitive and social goals as well as enhancing students' conceptual understanding of science. Thus allowing students to engage in argumentation collaboratively is thought to help students correct incorrect ideas by building consensus (Berland & Lee, 2012) and enhance students' scientific reasoning and understanding of scientific concepts (Osborne, 2010).

Moreover, Erduran and Osborne (2004) and Lawson (1998) concluded that argumentation plays a principal role in the building of explanations, models, and theories as well as sharpens the critical thinking skills of students. When people are engaged in exchange of contradictory view points, reasons and evidence are actively sought to resolve the contradictions. A person skilled in argumentation is skilled in reasoning. If teachers want to help their students become better reasoners, they should provoke them to argue and to reflect on the adequacies/ inadequacies of their arguments.

The significant impact of argumentation on how it enhances and develops students' reasoning abilities and scientific skills is undoubtedly evident among the various studies conducted for several years. This simply reveals that the use of argumentation in science promotes total learning among the students. It makes them become critical and logical thinkers on their own way. It develops in them the ability to support their claims on something by being argumentative in synthesizing their own answers as well as the presented answers of their classmates. In this regard, students will also learn to listen as this one is the most important aspect of the argumentative process. They listen first before they make their argumentation (Erduran &

Osborne, 2004).

Knowledge Building: Its Meaning and Relevance to Science Learning

Knowledge building in science has created dramatic interest among the researchers in the field of education. They wanted to find out how knowledge develops and the processes it takes before it reaches the point of the knowledge creation.

Roscoe and Chi (2007) defined knowledge-building as a "process of metacognitively monitoring one's own knowledge and understanding, integrating new and prior knowledge, and generating new ideas throughinference and reasoning (i.e., knowledge construction)" (p. 3).Ellis, Rudnitsky, and Moriarty (2010) described the behavior of the students when they participate in a knowledge building discourse. According to them, student usually experience an interactive discourse in which they work together to expound their ideas, reformulate problems and share knowledge. By doing this, students will have a deeper level of understanding and collaborative production of new knowledge. Students' interaction helps them achieve the benefits of knowledge building discourse.

In the study conducted by Lai (2013), he found that when students are involved in knowledge building process, their understanding and knowledge of science was enhanced. It also had a positive impact on their school work. Several studies also support this claim that by immersing in knowledge building communities, students can develop the competencies and cultural practices which are needed in the knowledge society (Bielaczyc & Ow, 2010; Fong, 2010; Lee, Chan, & van Aalst, 2006; Oshima, et al; 2006, Zang, Scardamalia, Lamo, Messina, & Reeve, 2007). Bereiter (2002) also posited that by engaging learners in a knowledge-building community, teachers are actually empowering their students to work constructively and creatively with ideas; that are, treating learners as knowledge producers.

A knowledge building classroom should be a community of inquiry, with reflective thought as the guiding principle. In this regard, students should be builders rather than only users of artifacts (Papert, 1991). This claim is also supported by Chan, Burtis, and Bereiter (1997); Okada and Simon (1997). In their study they found that when students are engaged in deeper inquiry over time, moving from descriptive to explanatory question, students' level of questioning becomes an important part of their scientific inquiry. It can be noted that students ask relevant questions which help them develop more their scientific inquiry skills.

Methodology

Research Design

The study used a quasi-experimental two-group pretest-posttest design with two intact classes. One group was exposed to Student-led Argumentation Teaching Approach (SLATA) while the other group was exposed to Conventional Teaching Approach (CTA).

The two groups were assessed twice, first during the pretest, and second in the posttest. The pretest and posttest scores were compared to determine how effective SLATA is in the enhancement of knowledge building of the students.

Research participants

The participants in this study were Grade 7 students from two heterogeneous intact classes in a public high school during the School Year 2016-2017. At purposive sampling, students in sections 6 and 7 were chosen to be the participants of the study. The teacher-researcher used the random sampling in selecting the control and experimental group. One group (experimental) was exposed to Student-led Argumentation Teaching Approach (SLATA) while the second group was exposed to Conventional Teaching Approach (CTA). The study was conducted from the 4th week of August to the 1st week of November.

Instrument

The SPOCK (Student Perceptions of Classroom Knowledge Building) twenty-seven item scale developed by Shell and Husman (2008) and Shell, Husman, Turner, Cliffel, Nath, and Sweany (2005) was used in this study.The instrument measures seven aspects of students' perception of their learning in a particular science class: General Self-regulation, Knowledge Building, Question Asking Low Level, Question Asking High Level, Lack of Regulation, Cooperative Learning, and Teacher Directed Classroom. All questions or items in the SPOCK were answered on a five-point Likert scale from 1 (almost never) to 5 (almost always).

Data Collection Procedure

Before the intervention the researcher sought first the permission of the School's Division Office in Quezon City to conduct the study in the host school. The same letter was also given to the principal and the science department head. Both groups were brief in terms of their cooperation and active participation in the class. Pretest was administered to both groups. During the implementation period, the researcher first explained and modelled to the SLATA group the argumentation process and the things they should know when it comes to making arguments and counter-arguments while the CTA group were just instructed to do the usual way of doing the group discussion. Lesson plans were developed and had them evaluated by an expert. One standardized instruments was used in the study, Student Perceptions of Classroom Knowledge Building (SPOCK), with permission from the author. Both participants of the study were taught by the researcher in 8 weeks. Each week both groups were exposed to the same science activities and teaching materials. After the intervention, posttest was given to both groups.

The Treatment

In the SLATA class, a question or a laboratory activity about the topic was given to the students before the start of the lesson. These were presented through visuals such as video clips and PowerPoint presentation. After the presentation, the teacher assessed what the students learned about the topic. Then, students were grouped heterogeneously to form the interactive group. The interactive group was composed of seven to eight members.

The teacher discussed first how the interaction in the group should be done with emphasis on the argumentation. Then, the teacher explainedto the students the difference between argument and argumentation, and how they do this in their interactive groups. This was done to make students become familiar with the argumentation process. Modelling of the argumentation process done by the teacher was followed.

The teacher used the Toulmin's Argument Pattern (TAP) to evaluate if students construct valid arguments and make counter-arguments. For this research study, the data, claims, and warrants were used to qualify to be a valid argument. The group interaction was videotaped. The teacher used the videotaped material to assess if students were able to make their arguments and counter-arguments.

During the student-led argumentation process, each member shared his or her ideas through making his or her argument about the given topic. As students listened to one another, they also constructed their counter-arguments based on the claims given.At this point, as students shared his or her own ideas, nothing can be taken yet as definitively concluded answers, as every assertion is always subjected to analysis of all the members until such time the group decides to come up with one conclusion. As students finished the tasks, discussion of the results followed. Then the interactive group was still given the chance to revisit their answers and finalize everything. Once everything was done, the interactive group was asked to present their answers through reporting, panel discussion, or debate. After the presentation,students were also asked to reflect on the discussion they did. Students would particularly reflect on the interaction process and just wrote it in their journal notebook. Reflection was done to ensure that their comments and feedbacks were noted.

On the other hand, the ***Conventional Teaching Approach (CTA)*** class, same lesson about the topic were presented. The teacher presented to the class the problem they have to solve and also presented this through visuals or asking questions as a motivation about the lesson proper. Then, there was a discussion of the lesson. Students formed an interactive group which was also composed of seven to eight members.

However, there was no discussion of the difference between argument and argumentation, and what the group should do during the phase of interaction. Each group just simply met, talked, and discussed the given problem. If students have queries, the teacher just guided them and didnot entertain questions related to the activity. After the interaction, each group presented to the class their output.

Data Analysis

The data were analyzed using Microsoft Excel and the SPSS 21 for the following analyses: 1)t-test for independent samples was applied to the pretest mean scores on the Student Perceptions of Classroom Knowledge Building of SLATA and CTA groups. It was also utilized to determine if the difference in the posttest mean scores between the SLATA group and the CTA group was significant, and 2)t-test for paired samples was used to determine whether the differences in the pretest and posttest mean scores of the Student Perceptions of Classroom Knowledge Building between the SLATA group and CTA group were significant.

RESULTS AND DISCUSSION

The presentation of the results is divided into three parts: 1) comparison of pretest scores of SLATA group and CTA group on Student Perceptions of Classroom Knowledge Building, 2) comparison of posttest scores of SLATA group and CTA group on Students Perceptions of Classroom Knowledge Building), and 3) comparison of pre and posttest scores of SLATA group andCTA group on Student Perceptions of Classroom Knowledge Building (subscales).

Knowledge Building

Prior to the start of the intervention, the pretest mean scores in the Student Perceptions of Classroom Knowledge Building of the SLATA and CTA groups were compared using two-tailed t-test for independent samples. There was no significant difference (p = .198) in the pretest mean total score between the SLATA group (M= 3.41, SD = .580) and the CTA group (M = 3.57, SD = .544). The results establish that the SLATA and CTA groups were initially comparable in terms of student perceptions of classroom knowledge building.

To compare the posttest mean scores in the Student Perceptions of Classroom Knowledge Building of the two groups, one tailed t-test for independent samples was used. There was no significant difference at the 0.151 level in the mean total scores of the SLATA group (M = 3.46, SD = .544) and the CTA group (M = 3.34, SD = .562). Table 1 shows the mean scores, standard deviations, and the computed t-value of the mean posttest scores in SPOCK.

TABLE 1 INDEPENDENT SAMPLES T-TEST ON THE STUDENT PERCEPTIONS OF CLASSROOM KNOWLEDGE BUILDING POSTTEST

Group	Mean	Standard Deviation	t	df	Sig. (1-tailed)
SLATA	3.46	.544	1.04	93	0.151
CTA	3.34	.562			

One observed reason why it generated such result is the large number of students per group (mostly 7 students). This finding contradicts with the study of Creemers (1994), in his experimental research; he found that small-sized groupings (4-6 children) had positive effects on co-operative, collaborative, and mastery learning. Given that large number of students per group, it might have affected the learning process and knowledge development of each student. It could also affect the exchanging of their ideas and critiquing of one's ideas because of so many students sharing and throwing ideas to one another. Blatchford, Baines, Kutnick and Martin (2001) and Kutnick, Blatchford, and Baines (in press) in their study on size and groupings have also found that group size is an important factor at primary school and have implications for the features of the learning tasks of the students.

Scholars such as Carbonaro (2005) and Ansalone (2000) also argued that the achievement disparity stems directly from the effort given by each student in the group. It could be another possible reason that each student did not give so much effort during the group interaction. One observed factor why students gave less effort during group activity was their class schedule. Since the experimental group had their science class in the middle part of the afternoon. Students were already tired and their attention span had already declined. This claim is supported by the findings of the study of Rana, Rishi, and Sinha (1996). They concluded that "the decline in vigilance (alertness or attentiveness) performance is greatest in the afternoon, followed by the evening" (p. 398). Another research study conducted by Nope (2016) also stated that students' productivity in a class is higher in the morning than the afternoon. The results of those studies and this research study simply mean that students' academic performance particularly their being motivated and participative is affected by their time schedule.

Todetermine if there was animprovement in the knowledge building in biology of the SLATA and CTA groups, the two-tailed t-test for related samples was used. There was no significant difference at the .598 level in pretest (*M* = 3.41, *SD* = .580) and posttest (*M*= 3.46, *SD* = .544) mean total scores of the SLATA group and there was a significant difference at the .011 level in pretest (M = 3.57, SD = .544) and posttest (*M* = 3.44, *SD* = .562) mean total scores of the CTA group in the Student Perceptions of Classroom Knowledge Building. Table 2 presents the paired samples t-test on student perceptions of classroom knowledge building.

TABLE 2 PAIRED SAMPLES T-TEST ON STUDENT PERCEPTIONS OF CLASSROOM KNOWLEDGE BUILDING

		Paired Difference					
		Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-talied)
SLATA	post-pre	0.43	.556	.082	.530	45	.598
CTA	post-pre	-.217	.554	.082	-2.66	45	.011*

* *p*< .05

One of the possible reasons why the CTA group had an improvement in their knowledge building is their verbal exchange of ideas with each other. Though the teacher did not ask them to do the argumentation process, they still did the conversation and the way they did it pushed them to share their ideas and elaborated more the things they know about the presented problem or issue. In this way, it became a must for each member of the group to have a say or to speak up for himself or herself. By doing this thing, it really helped students develop or build their knowledge on a certain science concept. In fact this kind of observation is also seen in the study conducted by Linden and Wittrock (1998), and Nausbum (2008). They found out that verbal elaboration during group argumentation is a key element in developing content knowledge.

It is also important to mention that both CTA and SLATA groups were given the same sets of activities. In this regard, CTA group, though was not asked to argue with each other, but was also allowed to work on the given problems as a group. This claim was also supported by Hong, Chang, and Chai (2014) in their research study. These researchers found that when students are allowed to work on problems of their own interest and when the learning environment is more open and creative, it is more likely to foster idea generation. This can really help students become more participative and willing to involve themselves in the teaching-learning process.

Subscales of Student Perceptions of Classroom Knowledge Building

The seven components of knowledge building used in the present study were adopted from Shell and Husman (2008). The seven components of student perceptions of classroom knowledge building areasfollows: General Self-Regulation, Knowledge Building, Question Asking Low Level, Question Asking High Level, Lack of Regulation, Cooperative Learning, and Teacher-Directed Classroom. Table4showsthemeanposttestscoresofthe SLATA and CTA groups in the Student Perceptions of Classroom Knowledge Building.

As shown in Table 3, there was no significant difference between the two groups in terms of the following subscales of student perceptions of classroom knowledge building: General Self-Regulation, $t(93) = .86$, $p = .195$; Knowledge Building, $t(93) = .57$, $p = .285$; Question Asking Low Level, $t(93) = -.410$, $p = .342$; Question Asking High Level, $t(93) = .92$, $p = .312$; Lack of Regulation, $t(93) = -1.48$, $p = .071$; and Cooperative Learning, $t(93) = -.099$, $p = .461$. However, among these subscales, only the Teacher Directed Classroom subscale, $t(93) = 3.03$, $p = .002$, had a p value less than the set significance level which is .05. In this case, it indicates that there was a significant difference between the two groups in terms of the Teacher Directed Classroom subscale in the student perceptions of classroom knowledge building.

TABLE 3 INDEPENDENT SAMPLES T-TEST ON THE SUBSCALES OF STUDENT PERCEPTIONS OF CLASSROOM KNOWLEDGE BUILDING (SPOCK)

Subscales of SPOCK	Group	Mean	Standard Deviation	t	df	Sig. (1-tailed)
General Self Regulation	SLATA	3.48	.68	.86	93	.195
	CTA	3.36	.64			
Knowledge Building	SLATA	3.50	.51	.57	93	.285
	CTA	3.43	.74			
Question Asking						
Low Level	SLATA	3.21	.82	-.410	93	.342
	CTA	3.28	.80			
High Level	SLATA	3.33	.72	.92	93	.312
	CTA	3.26	.82			
Lack of Regulation	SLATA	3.15	.71	-1.48	93	.071
	CTA	3.36	.71			
Cooperative Learning	SLATA	3.71	.62	-.099	93	.461
	CTA	3.72	.85			
Teacher Directed Classroom	SLATA	4.31	.80	3.03	393	.002*
	CTA	3.79	.88			

* $p < .05$

The presence of the teacher in the student-led argumentation teaching approach was not about the dominance of the teacher in the class but rather the guidance and being the facilitator of learning in the classroom. The result supports the findings of van Aalst (2012) where they mentioned that the teacher's main role was to guide the overall process, provide encouragements, and be helpful to students as needed. In his study, he also found out that students who were guided by their teachers as to helping students grasp their role inside the classroom; they were able to learn fully. Bereiter, Scardamalia, Cassells, and Hewitt (1997) also supported this claim when they emphasized that teacher should guide their students for it will help them make greater contributions to the discourse. This often involved encouraging students to go beyond sharing knowledge and focus on refining and transforming knowledge.

Another important role of the teacher in student-led argumentation teaching approach is the explanation part after the group discussion is carried out. Greeno (2006) supported this finding when he emphasized that teachers have to scaffold, share, redirect, and otherwise influence student collaborative discourse. By doing this, students were able to grasp more the contents of the lesson and saw the relevance of their ideas. NRC report (NRC, 2012) How People Learn: aside from drawing out and building on students' existing understanding; teachers also need to teach content in depth, so that students see how important concepts work in multiple situations, and help students learn metacognitive skills and knowledge together with specific subject matter (Bransford, Brown, & Cocking, 1999).

The analysis on the effects on students' knowledge building was subjected to another statistical test which is the Paired Samples *t*-test. A one-tailed sample *t*-test was conducted to measure the difference in the mean gain of the pretest and posttest scores for each subscale of student perceptions of classroom knowledge building. As shown in Table 4, the test found to be statistically significant in the two subscales of SPOCK namely: Knowledge Building, for pretest (M = 3.33) and posttest (M = 3.52) with $t(45) = 1.77$, p = .042 and Teacher Directed Classroom, for pretest (M = 4.09) and posttest (M = 4.37) with $t(45) = 2.30$, $p = .013$. It can be noted that SLATA group had gained positive mean in Knowledge Building, Question Asking Low Level, Cooperative Learning, and Teacher Directed Classroom. These results suggest that SLATA did have a statistically significant effect on the knowledge building of the students specifically on the Knowledge building and Teacher directed classroom subscales of SPOCK.

TABLE 4 PAIRED SAMPLES T-TEST ON THE SUBSCALES OF STUDENT PERCEPTIONS OF CLASSROOM KNOWLEDGE BUILDING (SLATA GROUP)

Subscales of SPOCK		Mean	Paired Difference					
			Mean	Deviation	Error Mean	Std. *t*	df	Std.Sig. (1-tailed)
General Self-Regulation	Pre	3.54	-.087	.590	.087	-1.00	45	.161
	Post	3.46						
Knowledge Building	Pre	3.33	.196	.749	.110	1.77	45	.042*
	Post	3.52						
Question Asking								
Low Level	Pre	3.28	-0.43	.893	.132	-.330	45	.371
	Post	3.24						
High Level	Pre	3.33	.043	.815	.120	.362	45	.360
	Post	3.37						

Lack of Regulation	Pre	3.15	-.022	.830	.122	-.178	45	.430	
	Post	3.13							
Cooperative Learning	Pre	3.57	.130	.778		.115	1.14	45	.130
	Post	3.70							
Teacher-Directed Classroom	Pre	4.09	.283.834		.123	2.30	45	.013*	
	Post	4.37							

* $p< .05$

Students' conversation and exchange of ideas are the main factor why the knowledge building subscale was statistically significant. . This particular result of SLATA group is supported by the research study of Jonassen and Known (2001) and Tutty and Klein (2008). They stated that knowledge building can be developed better when students discuss the information with other members of the group. The information being talked about here is the sharing of ideas of each member of the group.

When students do the group discussion even without teacher's intervention, their argumentation skills would be improved (Lubben, Sadeck, Scholtz, & Braund, 2009). This what happened to SLATA group. Though teacher's supervision was minimal, it did still help students understand and build more their knowledge about the lesson. van Aalst (2012) also proved that through collaborative work on the community ideas, the knowledge building skill of the students will be enhanced.

In like manner, the role of the teacher in SLATA group was to facilitate learning inside the classroom. Findings of Walsh and Vandiver (2007) supported this claim. The result of their study indicated that "students performed better academically because they had a say in what they learned, and the teachers only acted as facilitators in order to allow the students to learn actively" (p. 25). Aside from that, it is also important to note that the teacher in SLATA group showed support to what students do in their interactive group. Bake and Morlock (2008), O'Connor, Dearing and Collins (2011), and Silver, Measelle, Armstrong, and Essex (2005) stated that teachers' support in the learning environment can positively impact students' social and academic outcomes, which is important for the long-term trajectory of school.

CONCLUSION AND RECOMMENDATION

After the detailed analysis done with the data, the following conclusions were drawn :(1). It was found in this study that using student-led argumentation as a science teaching approach is not effective in enhancing students' knowledge. Though, SLATA had no significant effects on students' knowledge building, this kind of teaching approach can still help students express their ideas on a given scientific issue for as long as they are given the chance to talk and be heard by their groupmates and (2)Teacher's presence and guidance is also found to be significantly important and effective element of this teaching approach because students became more participative and involve in the teaching-learning process during group interaction session.

For further studies, it is recommended: (1) to implement the intervention for a longer period of time; perhaps two grading periods or the whole school year. Some researches mentioned that the development of the "argumentative skills" of the students really takes time. Kuhn et al. (1997) and Lao and Kuhn (2002) studies have shown that extended engagement in argumentive discourse, in the absence of any additional instruction, is a sufficient condition for enhancement of the quality of arguments produced by individuals following discourse, (2) to use SLATA in other science subjects such as Physics and Chemistry to see more holistic perspective on the effects of SLATA in knowledge building of the students, (3)toallotlongertimeinstudyingtheeffects of SLATA in other lessons in biology for more thorough results, (4) to lessen the numbers of students per group to invite more the creation of arguments and counter-arguments among the students, (5) to use the SLATA to higher grade levels since this kind of teaching approach requires higher level of thinking which grades 9, 10, 11, or 12 students have somehow already developed.

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