Examining the Effect of Teacher Guidance on Collaborative Argumentation in Middle Level Classrooms

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Abstract

The purpose of this study was to investigate the effect of teacher guidance on the quality of collaborative argumentation in middle level classrooms. Each of six science classes was randomly assigned to either the intervention (teacher guidance) or control condition (minimal teacher guidance). The verbal collaborative argumentation that occurred was recorded and transcribed. The researchers conducted an independent-samples t test to analyze the difference of the depth measure of quality between groups and found a significant difference between the means in the depth measure. The findings reveal that using argumentative scripts for teacher guidance led to more in-depth argumentation.

Keywords: collaborative argumentation, middle level students, teacher guidance

Introduction

It is important for middle level students to build sound argumentation skills in all academic areas so they can be successful in school and participate in civic life. Early adolescence is a critical stage during which argumentation skills develop (Belland, Glazewski, & Richardson, 2011; Felton & Kuhn, 2001; Kuhn, 2010). In theory, young adolescents are able to comprehend and construct argumentation. However, students usually provide insufficient or inconclusive evidence to support their argumentation (Walton, 1996) or have difficulty distinguishing evidence from explanation when they support a claim (Kuhn, Goh, Iordanou, & Shaenfield, 2008). Additionally, they often demonstrate an inability to provide counterargument. When asked to generate argumentation for or against their own positions, students typically provide more reasons to support

their own positions and fail to identify points of conflict to rebut others' argumentation (Crowell & Kuhn, 2014).

A possible explanation for the poor performance of middle level students in the area of argumentation might be the different rates at which young adolescents progress through the stages of cognitive development (Piaget, 1972). Students at the formal optional stage who can comprehend abstract relationships and concepts may be better equipped to learn argumentation than their peers who remain at the concrete operational stage. The students who have not yet reached the formal operational stage may not be able to handle the cognitive tasks associated with argumentation. Thus, it is worth examining how teachers provide scaffolding for students at different levels of cognitive development to learn argumentation.

Researchers have explored the role of teachers in promoting students' collaborative argumentation (Asterhan, Schwarz, & Gil, 2012; Chin & Osborne, 2010; Gillies & Boyle, 2010; Webb, 2009). For example, some studies (Gillies, Nichols, Burgh, & Haynes, 2012; Van Drie & Dekker, 2013) indicated that when teachers focused on providing direct instruction (e.g., providing the correct or incorrect answers) students showed less elaboration or explanation and raised fewer questions for their peers. In contrast, when the teacher probed the students' thinking process, students demonstrated more reasoning or explanation and raised more questions for their peers.

In the aforementioned studies, the researchers focused their measures on individual students rather than the collaborative argumentation process in a large group setting. The purpose of this study was to investigate the effect of teacher guidance on the quality of the collaborative argumentation process in a large-group middle level setting. Specifically, this study focused on the depth of the quality of the collaborative argumentation that occurred. The research question was: Is there a difference in the depth feature of the quality of collaborative argumentation between classes with a high level of teacher guidance and classes with minimal teacher guidance? Our goal was to better understand whether, and how, teacher guidance is effective in promoting students' collaborative argumentation (Webb, 2009; White & Dinos, 2010).

Literature Review

Argumentation with Peers

Researchers have implemented curricula to help middle level students develop argumentation skills through collaborative argumentation with peers (Evagorou & Obsorne, 2013; Iordanou, 2010; Kuhn, et al., 2008; Kuhn, Wang, & Li, 2010). For example, Kuhn and Udell (2003) investigated whether peer dialogue was effective in developing argumentation skills in 34 13- to 14-year-olds who were academically atrisk. The students in the peer dialogue group showed increased frequency of use of powerful argumentation skills and improved quality of individual argumentation as compared to the control group. In their qualitative case study, Evagorou and Obsorne (2013) examined two different pairs from a class of 12- to 13-year-old students who participated in the argumentation activity for a socio-scientific issue (e.g., global warming). The findings suggested that one of the pairs was engaged more with the topic, which led to better written argumentation.

Teacher Guidance in Supporting Argumentation

In this study, we considered teacher guidance to be a form of scaffolding for students' cognitive development within the zone of proximal development (Vygotsky, 1978). Researchers who have studied different types of teacher guidance in facilitating argumentation in classrooms have examined different approaches for improving the effectiveness of collaborative argumentation (Asterhan, 2011; Van de Pol, Volman, Oort, & Beishuizen, 2013; Warwick, Mercer, Kershner, & Staarman, 2010). One type of teacher guidance focuses on argumentative elements of the discussion. In guiding collaborative argumentation, teachers specify the different components (e.g., position, reason, evidence, counterargument, rebuttal) of either an individual argumentation or the collaborative argumentation. By focusing on different aspects of argumentation, teachers might be able to help students present each aspect of argumentation clearly. Weinberger, Stegmann, and Fischer (2010) used the term "argumentative scripts" to refer to this type of teacher guidance. Research indicated that, compared to the control (unguided) group, each type of teacher guidance improved different aspects of collaborative argumentation. The use of argumentative scripts improved the development of argumentation skills but did not improve the extent of participation and interactivity (Kulatunga, Moog, & Lewis, 2013; Tawfik & Jonassen, 2013).

In the present study, the middle level students learned argumentation skills via collaborative argumentation in their science classrooms. Because the concept of argumentation was new to them, we employed argumentative scripts as a teaching technique. Additionally, the goal of this study was to involve students in learning argumentation in the form of large group discussion. We expected that argumentative scripts might improve the quality of the collaborative argumentation process.

Collaborative Argumentation

Collaborative argumentation is a technique for arriving at an agreed-upon position among members of a group (Andriessen, 2006). Andriessen distinguished between debate and collaborative argumentation. In debate, students learn how to prevail over an opponent, which is emphasized in certain domains, such as law. In contrast, collaborative argumentation is emphasized in the scientific domain and is practiced when scientists build on and refute one another's theories and empirical research to arrive at scientific conclusions.

We viewed collaborative argumentation as a key way in which students could learn critical thinking, reasoning, and problem solving (Cho & Jonassen, 2003; Jonassen & Kim, 2010). Kim, Anderson, Nguyen-Jahiel, and Archodidou (2007) examined collaborative argumentation among 10 groups of fourth and fifth graders in a text-based online system. Analysis of their argumentation showed that eight argumentation schemes were used by most groups of children. One example of an argumentation scheme was to manage participation of classmates by saying, "What do you think, NAME?" Once an argumentation scheme emerged, it tended to spread to other children and to last for the whole argumentation period. The spreading effects resulted in promoting children's learning of reasoning strategies and thinking skills.

We also viewed collaborative argumentation as a key way in which students could develop individual argumentation skills. For example, Kuhn and Udell (2003) found that a peer dialogue group showed increased frequency of use of powerful argumentation skills and improved quality of individual argumentation compared to a non-peer dialogue group of 13- to 14-year-olds). In another study, Crowell (2011) examined whether middle level students' engagement in a three-year argumentation curriculum on social issues promoted development of argumentation skills, specifically the use of direct counterargument. Analysis of their essays and argumentation indicated that performance of the experimental group exceeded the control group. The students in the experimental group demonstrated more sustained direct counterargument sequences than students in the control group at the final assessment. Jonassen and Cho (2013) integrated collaborative argumentation strategies to help college level engineering students develop argumentation schemas. They found that collaborative argumentation groups generated more argumentation, more counterarguments, and more rebuttals. When engaged in collaborative argumentation, the students were able to develop and transfer argumentation schemas to new contexts. In sum, researchers have shown that collaborative argumentation leads to a broadening and deepening of argumentation by stimulating cognitive processes like elaboration, self-explaining, and rethinking concepts and is an effective strategy for learning argumentation skills (Belland, et al., 2011; Felton & Kuhn, 2001; Kuhn, et al., 2008; Kuhn, Wang, & Li, 2010).

Elements of Argumentation

Researchers (Kuhn, 1993; Toulmin, 1958; Walton, 1996) have defined the essential elements of argumentation: position, reason, evidence, counterargument, and rebuttal. A *position* refers to an opinion or conclusion on the main question that is supported by *reason*. *Evidence* is a separate idea or example that supports reason (or counterargument/ rebuttal). *Counterargument* refers to a claim that refutes another position or gives an opposing reason. A *rebuttal* is a claim that refutes a counterargument by demonstrating that the counterargument is invalid, lacks as much force or correctness as the original argumentation, or is based on a false assumption.

Method

Research Design and Participants

We conducted this quasi-experimental study (Creswell, 2013) with six classes of seventh grade students ($N = 126$) in a suburban Chicago school. The same science teacher taught all six classes. Approximately half of the students were from middle-class Caucasian families, 25% were from middle-class Asian American families, and the remaining 25% were from middle-class African American or Hispanic American families. Fifty-six percent of the students were male and 44% were female.

We randomly assigned each class to either the intervention or the control condition (see Table 1).

Table 1
Number of Students in Each Class

Class	Number of Female Students	Number of Male Students	Total Number	Intervention or Control Condition
1	4	10	14	Intervention
2	13	13	26	Control
3	10	15	25	Intervention
4	12	11	23	Control
5	9	10	19	Intervention
6	8	11	19	Control

In the intervention classes, the students engaged in whole-class verbal collaborative argumentation with teacher guidance (discussed in next section). The classes we assigned to the control condition participated in whole-class verbal collaborative argumentation with minimal teacher guidance. We expected the students to be engaged in collaborative argumentation about science topics. However, because the concept of collaborative argumentation was new to the students, the first and the second authors decided to engage the students in argumentation about a social topic (to be discussed later) with which they were familiar while they learned how to engage in collaborative argumentation.

Design of Teacher Guidance

As we described in the literature review, an argumentative script is one type of teacher guidance that focuses on student acquisition of the argumentation components. Because our study focused on how students learn to argue, we integrated characteristics of argumentative scripts into teacher guidance in the intervention condition. Table 2 shows a complete 10-question teacher script for the intervention group. In the control condition, the teacher asked only the first and last question. The teacher used these exact questions in each intervention section and in the control sections of the class.

Table 2
Teacher Script for the Intervention Condition

Teacher Script	Characteristics of Argumentative Scripts
1. Do you think that cell phones should be banned in school?	
2. If yes, what reasons do you think that cell phones should be banned in school?	Position
3. What evidence do you have to support the reasons?	Evidence
4. What might somebody else say to show that your position is wrong?	Counterargument
5. What could you tell him/her to show he/she is wrong?	Rebuttal
6. If no, what reasons do you think that cell phone should not be banned in school?	Position
7. What evidence do you have to support the reasons?	Evidence
8. What might somebody else say to show that your position is wrong?	Counterargument
9. What could you tell him/her to showhe/she is wrong?	Rebuttal
10. Is there a compromise or creative solution?	

Procedures and Data Collection

On day one, the teacher provided an introduction of the components of good argumentation and collaborative argumentation to the students in the intervention and control conditions. In this study, the students were at the beginning stage of developing their argumentation skills. For practice purposes, we allowed them to select a social issue through which they engaged in a collaborative argumentation process. The students proposed a number of authentic and ill-structured issues, such as whether they should wear uniforms to school. According to Jonassen and Kim (2010), to successfully develop students' argumentation skills, it is essential to create an open-ended learning environment, such as authentic or ill-structured learning environment in which legitimate alternatives that require argumentation exist. The issue they voted to be the focus of the collaborative argumentation activity was, "Do you think that cell phones should be banned in school?"

On day two, the classes in both conditions were engaged in the whole-class collaborative argumentation activity. The teacher defined the ground rules with all of the classes. To avoid several students talking at the same time, the teacher provided a foam ball and whoever had the ball could speak. The teacher directed the students to toss the foam ball from student to student in the order in which they raised their hands. The researchers recorded the verbal collaborative argumentation in the classroom with a digital camcorder.

Analysis of Quality of Verbal Collaborative Argumentation Data

We transcribed the verbal collaborative argumentation for students in the intervention and control conditions and used Chinn and Anderson's (1998) argumentation framework to construct an argumentation diagram to represent all groups' collaborative argumentation processes. We constructed a total of six argument diagrams.

According to Chinn and Anderson (1998), the core units of an argumentation among children are a claim (C), a datum (D), and a warrant (W). Claim (C) is the conclusion of the argumentation and is supported by a datum (D). The datum is linked to the claim by a warrant (W). Warrant refers to a statement that would make the valid inference from the datum to the claim. The warrants are optional elements of the argumentation framework and are presented as either explicit or entailed. An explicit warrant uses language connectives such as because. In argumentation that

lacks an explicit warrant and have the form *p so q* or *q because p*, the first and the third researchers treated the rule *if p, then q* as an entailed warrant, which is contained in the meaning of connectives such as so, since, and *because*.

In argumentation networks, the units of ideas are expressed in nodes and links in an intricate web of argumentation and sub-argumentation. In the present study, the first researcher and the third researcher first identified the idea units in argumentative discussions. The first researcher and the third researcher began looking for idea units by examining sentences in the transcriptions. A sentence may contain more than one idea unit, and it is likely that a learner may need to use two or more sentences to covey a claim. The first researcher and the third researcher generated the first diagram independently. The interrater reliability was 70%. The first researcher and the third researcher discussed the discrepancies. The discrepancies came from the distinction between reason and evidence and the identification of the number of idea units in long statements. After the discussion, the first researcher and the third researcher came to consensus and developed one diagram. The first researcher and the third researcher continued to generate the second diagram and repeated the same procedure for six diagrams.

As indicated in Appendix A, the students in class 2 took three positions, represented as statements enclosed in a rectangle. In each rectangle, there are multiple numbers in parentheses, which indicates that multiple students shared the same position. The number in a parenthesis indicates the line number from the transcriptions that helped us identify who said what statements. For demonstration purposes, Figure 1 shows the farthest left part in the diagram. Within the rectangle in the farthest left, the number 3 indicates line 3 in the transcriptions and shows Grace's position. Grace agreed that cell phones should be banned in school. She supported her position with the datum *It is a distraction to kids*, represented as a statement enclosed in a textbox. Because this statement serves as the purpose of reason, there is an r in a parenthesis in a textbox. The other numbers in parentheses in the same textbox indicate that multiple students provided the same reason. There is an explicit warrant because connecting the claim *Cell phones should be banned* with the datum *It's a distraction to kids.* Explicit warrants are labeled with a connective because on the link. Grace offered the data *I've heard through the year already 5 cell phones going off during the class* and *It is funny. When you hear the ring tone, it disrupts your*
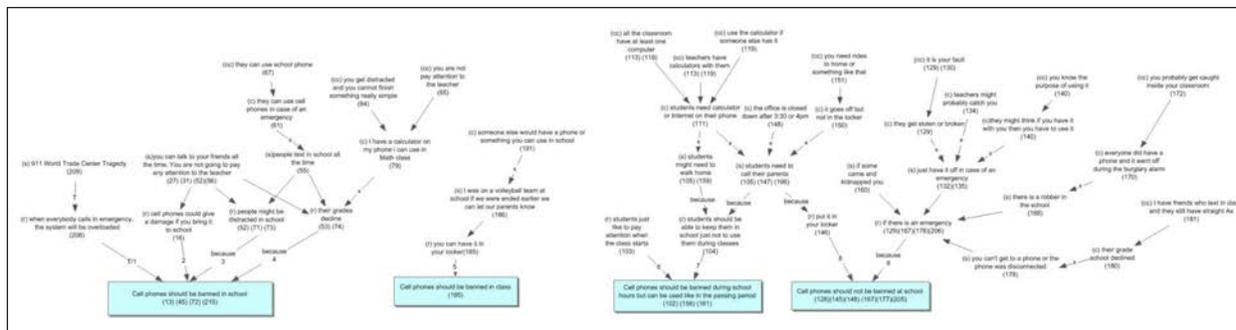
Figure 1. Most left part of argumentation diagram of collaborative argumentation in class 2 (control condition).

Figure 2. Upper part of argumentation diagram of collaborative argumentation in class 2 (control condition).

Figure 3. Argumentation diagram of collaborative argumentation in class 1 (intervention condition).

learning. As both statements serve as evidence, there is an s in a parenthesis in a textbox. The number on the link represents the order in which the different argumentations were developed. The students in class 2 developed eight lines of argumentation as shown in Appendix A.

When statements served as the purpose of counter-argument or rebuttal, there is a c or cc in a parenthesis in a textbox. In the upper part of Figure 2, Jeremy (line number 113) provided evidence *Mr. Reynolds lets you call your mom in homebase. Most people text friends.* Mike (line number 129) provided the counterargument *There is a way to stop them. You could find a way to track who is calling and where the texts are being made* represented as statements enclosed in a textbox. Because Mike's statement serves as the purpose of the counterargument, we placed a c in a parenthesis in a textbox. Andy (line number 135) provided a rebuttal *It could cost a lot of money* represented as a statement enclosed in a textbox. We indicated that this statement served the purpose of a rebuttal by placing a cc in parenthesis in a textbox.

Figure 3 indicates an argumentation diagram of collaborative argumentation in class 1 assigned to the intervention condition. The first researcher and the third researcher identified the quality of the collaborative argumentation based on a number of features: size, breadth, depth, types of rhetorical moves, and co-construction of argumentation (Chinn & Anderson, 1998, Chinn, O'Donnell, & Jinks, 2000; Sampson & Clark, 2008). The first researcher and the third researcher identified each feature from a number of quantitative measures. Table 3 indicates the values of these measures.

Size. The quantitative measure of argumentation size is the total number of nodes (e.g., textboxes) in the final diagrams. For example, in Figure 3, there are 42 nodes.

Breadth. Breadth refers to the extensiveness of the discussion, including the number of different positions considered and the number of distinct argumentation advanced for and against these positions. We determined lines of argumentation by counting clusters of links and nodes that were mainly separated from each other and emanated from a single position. For example, Figure 3 contains nine lines of argumentation for four positions because there are nine distinct clusters of argumentation with each cluster linked to a single position.

Depth. Depth refers to how extensively the students elaborated individual argumentation. Some argumentations were not developed at all and consisted of just one or two nodes. Other argumentations were developed in great depth with elaborate justifications, challenges, and counterchallenges. One indicator of depth was the number of argumentation with five or fewer nodes.

Table 3
Quantitative Measures of Quality of Argumentation

Argumentation Feature	Quantitative Measure
Size	Nodes
Breadth	Positions
	Lines of argumentation
Depth	Argumentation with 5 or fewer nodes
Types of rhetorical moves	Reasons
	Evidence
	Counterargument
	Rebuttal
Co-construction of argumentation	Argumentation constructed by 2 or more students

Rhetorical moves. We identified the following rhetorical moves in the data: reason and evidence, counterargument, and rebuttal. We indicated whether the students provided reasons to support their claims by placing the letter r in parentheses next to the beginning of each statement in the argumentation network. Evidence for a reason included all the statements that provided positive evidence for the reason together with the statements that supported other supporting statements. We indicated supporting evidentiary statements using the letter s in parentheses next to the beginning of each statement in the argumentation network. Counterarguments consisted of all those statements that collectively challenged the reason and support. We indicated counterarguments with the letter c in parentheses next to each statement in the argumentation network. Rebuttals consisted of all the nodes and links that attempted to rebut a challenge. We indicated rebuttals with the letters cc in parentheses next to the beginning of each statement in the argumentation network.

Collaborative construction of argumentation. We were interested in examining if students constructed individual argumentation collaboratively or if a single student constructed each individual argumentation with different students constructing each different individual argumentation. The first researcher and the third researcher measured the number of argumentations constructed by two or more students. In Figure 3, we depict eight lines of argumentation constructed collaboratively.

As discussed in the introduction section, this study focused on the depth of quality of the collaborative argumentation. The first researcher and the third researcher conducted an independent-samples *t* test to analyze the difference of the depth measure between the intervention and control groups.

Findings and Discussion

The research question investigated whether the intervention group differed from the control group on the depth feature of the quality of collaborative argumentation. This study indicated a significant difference between the means in the depth feature (i.e., argumentation with 5 or fewer nodes) of the two groups ($t(4) = -2.817, p < .05$), with a large effect size of $d = 2.3$. The mean of the intervention group was significantly lower ($m = 7, sd = 1.73$) than the mean of the control group ($m = 14.33, sd = 4.16$). This study showed teacher guidance that integrated characteristics of argumentative scripts could augment the depth of collaborative argumentation in a large group setting

(Nussbaum, 2011), specifically in the quantitative measure of "argumentation with 5 or fewer nodes."

The findings indicated that the intervention groups developed a combination of more elaborated reason, evidence, counterargument, or rebuttals in the collaborative argumentation process than the control groups. Previous research (Kulatunga, Moog, & Lewis, 2013; Tawfik & Jonassen, 2013) indicated that teacher guidance of argumentative scripts could result in the development of argumentation skills. Additionally, this study showed that such teacher guidance led to more in-depth argumentation in the collaborative argumentation process. Previous studies (Evagorou & Obsorne, 2013; Iordanou, 2010; Kuhn, et al., 2008; Kuhn, Wang, & Li, 2010) focused on developing argumentation skills by involving students in collaborative argumentation in pairs. This study showed that when engaging students in a large-group setting, teachers could provide guidance to enhance the depth of argumentation in the collaborative argumentation process.

In this study, teacher guidance in the intervention classrooms was a form of scaffolding (Vygotsky, 1978). In the intervention condition, each teacher had a script of 10 questions and support was more extensive than in the control condition. The seventh graders might have been at different cognitive development stages—some might have been in the concrete operational stage and some might have progressed to the formal operational stage (Piaget, 1972). In this study, the extended form of teacher guidance (Asterhan, 2011; Van de Pol, et al., 2013; Warwick, et al., 2010) was shown to be effective in enhancing middle level students who are in different cognitive development stages in the high level of a cognitive task, the depth feature of the quality of collaborative argumentation.

Conclusion

In conclusion, the teacher guidance proposed in this research is effective for enhancing the depth of collaborative argumentation in a large-class setting. The researchers suggest that middle level teachers should use extended teacher guidance rather than minimal teacher guidance to lead students in high level cognitive tasks in a large-class setting. This study focused on the depth feature of the quality of collaborative argumentation. The researchers suggest future research is needed to study the impact of extended teacher guidance and minimal teacher guidance on other aspects of quality of argumentation in the collaborative argumentation process.

Acknowledgments

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Appendix A
Argumentation Diagram of Collaborative Argumentation in Class 2 (Control Condition)