

The Impact of Structured Discussion on Students' Attitudes and Dispositions toward Argumentation

Khai Seng HONG, Ole C BRUDVIK, Yam San CHEE

National Institute of Education, Nanyang Technological University, Singapore
hongks@nie.edu.sg

Abstract: Argumentation skills are highly valued in both education and business. As a process, participating in argumentation helps a person to develop their meta-cognitive and higher-order thinking abilities. This paper reports on empirical results on middle-school students' changes in attitudes towards argumentation as part of an ongoing design-based research study. Past attempts by researchers to foster students' argumentation skills have met with mixed results. General Web-based discussion boards often do not provide the structures and process scaffolds to help students acquire the target skill. In this study, a web-based structured argumentation board with sentence openers as scaffolds was designed to support students' engagement with argumentation over a four week long intervention. Two questionnaires, a pre-post and a post-then-pre, were designed to measure students' attitudes towards argumentation. The two questionnaires were used to identify any treatment dependent "response-shift bias". Statistical results showed an improvement in students' attitudes toward argumentation. Qualitative analysis of student essays was also carried out and will be reported separately.

Keywords: argumentation, CSCA, student attitudes, critical thinking

1. Introduction

Argumentation is a higher-order thinking ability highly valued in both education and business problem solving circles. However, the quality of people's argumentation skills, in general, has been found to be low. Kuhn's [1] study of argument-based reasoning found that, in everyday reasoning, people readily make assertions about the causes of various social phenomena (e.g., what causes a return to crime). However, they have difficulty providing convincing reasons for the phenomena, or they are unable to provide sound evidence for reasons they provide. It thus appears that unless educators pay special attention to nurturing students' argumentation skills, the development of such skills will not occur.

Argumentation that occurs in a group context has the decided advantage of helping participants understand their position better as they begin to re-evaluate it in the broader, fleshed out information space of counterarguments, rebuttals, and alternative assessments of evidence. Thus we have the saying that "the difficult part in an argument is not to defend one's opinion but rather to know it" [2]. Argumentation that occurs in a collaborative learning context has the additional advantage of getting students to engage in the processes of collaborative meaning making and the co-construction of knowledge as teams of students engage in debate about important issues.

Ramage, Bean, & Johnson [3] have identified six types of arguments. Our analysis of these six types reveals that they can be categorized into three main categories that we call debate, causal argumentation, and problem solving. In terms of educational

usefulness, the latter two stand out. In the current study, causal argumentation was chosen as the basis of our research on students' acquisition of argumentation skills. Causal arguments try to show how one event brings about another and require close analysis of phenomena. A key purpose in exposing students to the process of causal argumentation is to help them understand the nature of scientific knowledge: that it is not simply a bundle of "discovered" or "proven" facts [4]. Rather, in education, students should be helped to understand that received knowledge involves a social process of "knowledge making" that is centrally grounded in argumentation.

In the current study, a class of middle-school students engages in causal argumentation over a period of four weeks. A combination of online and offline learning activities was designed to introduce the students to causal argumentation. In this paper we investigate the students' change in attitudes towards the causal argumentation learning activities as they engage in a web-based structured argumentation board and offline lessons. The paper proceeds with a review of relevant previous work and a description of the design of the research program and methods used for the current paper. Finally, we present the quantitative findings on the students' attitudes.

Qualitative analysis was carried out through the use of pre-post student essays, analysis of the forum messages and interviews. However, it will be reported separately and will not be discussed in this paper.

2. Previous Work

There has been considerable work in the field of CSCL (Computer Supported Collaborative Learning) that focuses on student "conversation" in electronic discussion boards. Such discussions are typically threaded, allowing students to respond using free-form text to any particular message within a thread of messages. In such discussion boards, student dialog can be extremely rich. However, due to the lack of structure (other than threading), the dialog often ends up being difficult to follow and to analyze [5].

Two broad approaches have been used to try to improve on the quality of students' electronic discourse. The first approach seeks to enhance students' articulations through the use of sentence openers and prior classification of a student's response. These features, evident in CaMILE [6] and CSILE [7] can encourage more critical and reflective thinking on the part of students despite the fact that some students will feel restricted by these features. A second approach seeks to enculturate students into a particular way of thinking by imposing "constraints" on what students can choose to do (or say) at any point in time. Belvedere [8] is an exemplar of such a system, although it is a diagrammatic representation tool rather than a textual one.

Cho & Jonassen [9] were able to use Belvedere to explore students' argumentation based on the constraints (i) hypothesis, (ii) data, (iii) principles, and (iv) other, and using the relations (i) for, (ii) against, and (iii) and. In subsequent work, Jonassen & Remidez [10] describe initial efforts in building a structured discussion board that implements arguments at four levels: (i) problem, (ii) proposal, (iii) warrant, and (iv) evidence. This scheme does not actually implement the complete Toulmin Argument Pattern which includes the elements datum, claim, qualifier, warrant, backing, and rebuttal.

Research on constraint-based approaches directed at supporting the acquisition of argumentation skills is still in its infancy. Weinberger, Fischer, & Stegmann [11], for instance, get students to use the interface that uses an incomplete form of Toulmin's Argument Pattern (like Jonassen & Remidez, [10]). The interface also does not separate ground from warrant; thereby introducing analytical difficulties when teachers (or researchers) try to determine what is the student's intended ground and what is the intended warrant. In addition, the representation is potentially confusing. While it adheres

to the forward reasoning scheme leading to a claim that Toulmin describes, this scheme does not naturally support causal argumentation which starts with claims which are then debated (unlike the legal reasoning process that ends with a claim: a declaration of guilt or otherwise).

Research to date on argumentation systems appear to suffer from at least two limitations. The first limitation relates to partial or selective implementation of the Toulmin Argument Pattern, together with sometimes confusing use of terms. Following Ramage et al. [3], a ground, strictly speaking, refers to the evidence brought to bear to support a justification for a claim, not the justification itself. The second limitations relates to the confusing way in which the elements of argumentation are often represented.

There is a third area of concern. Research findings to date have not always yielded expected results. Cho & Jonassen [9], for instance, cite a study by Tan [12] showing that students using a constraint-based argumentation tool (QuestMap™) performed significantly better in stating “grounds” in their argumentation but this had no significant effect on students’ problem solving skills. Furthermore, findings from Jonassen & Remidez [10] suggest that students were not always choosing argument elements reliably and accurately.

3. Research Objectives

Our analysis of the previous body of research led us to the belief that promoting the practice of argumentation requires the development of appropriate pedagogical strategies and materials that offer practical guidance to the teachers. Furthermore, due to the importance of engaging the students in cooperative and collaborative dialogical group argumentation we decided to develop a Web-based argumentation tool. Therefore our main research objectives are:

1. Develop understanding of and principles for classroom interventions related to fostering students development of critical thinking and argumentation skills using design-based research.
2. Develop and enhance a Web-based argumentation tool for group argumentation.
3. Investigate methods of effective student assessment using discourse-based qualitative methods.
4. Develop collaborating teachers’ abilities to design their own lesson plans for continued use of the Web-based argumentation tool.

The focus of the study reported here is, however, principally on the first area of interest. We investigate the changes in students’ attitudes towards argumentation before and after they engage in causal argumentation learning activities.

4. Theoretical Framework

In the current study the underlying argumentation framework is that of Toulmin’s Argument Pattern [13]. According to Toulmin [14], an individual argument consists of a statement or claim which can be supported by grounds or data while a warrant can be used as justification for the claim.

Toulmin also recognizes three other elements that may be present in an argument - backing, qualifier, and rebuttal. Backing provides credibility for the warrant and comes in the form of evidence and data. A qualifier indicates the degree of force or certainty that a claim possesses and is sometimes implicit in the structure of an argument by the use of the

words like “maybe” or “might”. A rebuttal represents certain conditions or exceptions under which the claim will fail [13].

Ramage et al [3] added another element called reason to link the grounds to the claim while a warrant identifies the underlying assumptions behind making the claim and/or reasons supporting it.

We adopted an instructional approach that scaffolds the learning process through the use of modeling the argumentation steps and sentence openers for students to compose their arguments. The argument is made that, over prolonged use, the scaffolds will be internalized by students as a “cognitive residue” [15] so that when the scaffolds are removed, students’ habits of thinking with respect to argumentation and its structure will remain.

Addressing the confusing use of terms, the intervention was designed to introduce these terms to students before they were used in the online structured argumentation board. This reduced chances of students selecting an inappropriate argumentative move due to their misunderstanding of the terms used. Differing from Weinberger et al [11], where grounds are combined with the warrant as one element, the online tool will represent Toulmin’s elements individually. This provides students with a clearer definition of Toulmin’s Argument Pattern and aids in clearer post-intervention analysis. For example, if grounds and warrants were combined as one entry, it might be hard to find out whether the student understood the difference between grounds and warrants through their responses using such an argumentation tool.

5. Research Design

The current study takes the form of a design experiment with two cycles. Design experiments, as a research methodology, emphasize the detailed implementation and study of interventions with evolving pedagogical goals in rich, authentic settings. It acknowledges the complexities of classroom teaching and enlightens both practitioners and researchers by leading to the development of theoretical ideas grounded in contexts of practice.

At the current stage, the study is in the first intervention which consists of a combination of classroom activities and activities using the structured argumentation board. The study follows the students’ development and the activities in the learning environment.

40 fourteen-year old students participated in the intervention which was infused into the regular English language curriculum. Before the intervention started, the students were tasked to write an essay on a causal argumentation topic. A survey that measured their self-reported attitudes towards argumentation was also administered. The essay and survey constituted the pre-intervention comparison data.

They went through a series of classroom lessons introducing them to elements of Toulmin’s argument pattern. Due to the limited curriculum time, the warrant and backing elements are planned to be introduced to the students at a later intervention cycle.

The students were given a topic to discuss about and went through tasks to (i) develop claims of their own, (ii) support their claim with reasons, (iii) provide evidence for their reasons and (iv) to develop rebuttals against another student’s claim. Throughout the classroom activities, they were exposed to the use of appropriate sentence openers for each Toulmin element through the use of structured worksheets and the teacher modeled the argumentation process. The sentence openers also appear as scaffolds in the online structured argumentation board.

After a week and a half of classroom activities, the students used the online structured argumentation board to discuss about the topic they covered in class to get

themselves familiarized with the online environment. A new discussion topic was given and the class was split into teams. A jigsaw activity structure was used. Teams were seeded with different views on the discussion topic and each team member was assigned one of five discussion forums to participate in. Teacher facilitation was faded back to allow the students to engage in argumentation without support.

After the intervention, the students were tasked to write another essay on a causal argumentation topic that was similar to the pre-intervention essay. The post self-report attitude survey was also administered to the students. A second survey was also done one day after the post survey. In this survey, the items were identical to the pre and post surveys. However, students were asked to respond twice to each item on the second survey. The first response required students to report their behavior or understanding as a result of the intervention (“after”). The second required participants to report their behavior before the program (“before” rating).

This second survey was administered due to the possibility of a “response shift bias” phenomenon [16],[17],[18]. In using self-report measures, researchers assume that a person’s standard for measurement of the scale being used will not change from pretest to posttest. If the standard of measurement were to change, however, the posttest ratings would reflect this shift in addition to the actual changes in the person’s level of functioning. For example, the students might feel at pretest that they are “average” in terms of their attitudes and understanding of argumentation. As the intervention progresses, their understanding of the skills involved in argumentation improve. Finally, at the end of the intervention they realize that their level of understanding was really below average at the pretest.

Consequently, comparisons of pretest with posttest ratings would be confounded by this distortion of the internalized scale and would encounter a lack of findings of significant differences between pre and posttest measurements.

6. Results

The statistical results of the first survey (see Table 1) showed a general increase, from pre- to post-intervention, in the means across the five items used to measure students’ attitudes towards argumentative practice. With the use of univariate ANOVA procedure, it is found that only the second item, Attitude 2, showed significant increase from pre- to post-intervention, with its F -ratio value as 6.127 and p -value as .016.

In the second set of items used to measure how much students value the skills of argumentation, none showed a significant increase from pre- to post-intervention even though all the means have increased except for the item Value 3 where the means remained constant throughout the intervention.

Next, three of the items measuring the argumentative disposition of students to provide reasons and evidence showed a general increase from pre- to post-intervention. Item Evidence 1 remained constant while item Evidence 4 decreased insignificantly over the intervention. None of the items in this category showed significant difference over the intervention, as can be seen from the F -ratio values and p -values.

Lastly, the only items measuring how much students enjoy learning the skills of argumentation that showed significant increments over the intervention are Enjoy 1 and Enjoy 2, with F -ratio values (and p -values) of 7.769 ($p = .007$) and 6.686 ($p = .012$). The other two items Enjoy 3 and Enjoy 4 also showed slight increase from pre- to post-intervention, while the last item Enjoy 5 dipped slightly.

Table 1: Statistical Results for First Survey

Item	Pre-Intervention			Post-Intervention			ANOVA	
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>
Attitude 1	36	3.81	1.009	38	4.05	.899	1.240	.269
Attitude 2	36	4.33	.828	38	4.74	.554	6.127*	.016
Attitude 3	36	4.42	.806	38	4.68	.662	2.445	.122
Attitude 4	36	4.64	.867	38	4.87	.665	1.644	.204
Attitude 5	36	5.06	.532	38	5.18	.730	.744	.391
Value 1	36	4.36	.931	38	4.37	.751	.001	.970
Value 2	36	4.72	.849	38	4.82	.766	.248	.620
Value 3	36	4.61	.903	38	4.61	.823	.001	.977
Value 4	36	3.94	.715	38	4.21	1.018	1.677	.200
Value 5	36	4.64	.762	38	4.76	.852	.436	.511
Evidence 1	36	4.89	.820	38	4.89	.649	.001	.973
Evidence 2	36	4.31	.889	38	4.39	.718	.227	.636
Evidence 3	36	4.61	.934	38	4.71	.802	.242	.624
Evidence 4	36	4.25	.806	38	4.11	.764	.629	.430
Evidence 5	36	4.22	.760	38	4.39	.916	.772	.382
Enjoy 1	36	3.81	.856	38	4.42	1.030	7.769**	.007
Enjoy 2	36	3.33	.956	38	3.92	.997	6.686*	.012
Enjoy 3	36	4.06	.826	38	4.37	1.149	1.791	.185
Enjoy 4	36	4.39	.871	38	4.47	.762	.199	.657
Enjoy 5	36	4.83	.697	38	4.76	.852	.149	.700

Note. * $p < .05$, ** $p < .01$

The statistical results of the second survey (see Table 2) showed that the students improved in their attitudes towards argumentation based on the five items used, as shown in the increase in the means. The univariate ANOVA results also showed that all five items had a significant increase.

For the scale of valuing the skills of argumentation, there was a significant increase in the rating of all but one item, Value 2. All the items measuring the argumentative disposition of students in finding reasons and evidence to support their arguments also showed a significant increase. Similarly in the next category of items measuring the extent to which students enjoy learning the skills of argumentation, the ratings before and after the project showed significant increments. Lastly, the students also rated significant increments in their attitudes towards the project, based on the three items used in this category.

Table 2: Statistical Results for Second Survey

Item	Before			After			ANOVA	
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>
Attitude1	40	3.20	1.043	40	4.30	.966	23.954**	.000
Attitude2	40	3.55	1.239	40	4.23	1.423	5.118*	.026
Attitude3	40	3.95	.932	40	4.95	.783	26.990**	.000
Attitude4R	40	3.63	1.148	40	4.65	1.167	15.688**	.000
Attitude5	40	4.08	1.185	40	5.18	.675	26.018**	.000
Value1	40	3.40	1.105	40	4.63	.705	33.778**	.000
Value2R	40	4.05	1.377	40	4.45	1.339	1.528	.220
Value3	40	3.90	.871	40	4.98	.733	33.992**	.000
Value4R	40	3.40	1.355	40	4.10	1.297	5.184*	.026
Value5	39	4.21	.978	39	5.08	.839	17.842**	.000

Evidence1	40	3.75	1.127	40	4.95	.959	26.304**	.000
Evidence2R	40	3.35	1.145	40	4.43	1.217	16.558**	.000
Evidence3	40	3.95	1.037	40	5.03	.891	24.738**	.000
Evidence4R	40	3.23	1.165	40	4.15	1.424	10.106**	.002
Evidence5	40	3.50	1.038	40	4.23	1.165	8.634**	.004
Enjoy1	39	3.72	1.099	39	4.69	1.080	15.597**	.000
Enjoy2R	40	2.98	1.230	40	4.10	1.297	17.821**	.000
Enjoy3	40	3.38	1.213	40	4.68	1.023	25.457**	.000
Enjoy4R	40	3.65	1.312	40	4.60	1.081	10.253**	.002
Enjoy5	40	3.78	1.230	40	4.98	.733	27.468**	.000
Project1	40	3.53	1.012	40	4.70	.939	28.958**	.000
Project2	40	3.18	.958	40	4.28	1.109	22.539**	.000
Project3	40	3.40	1.236	40	4.95	.959	39.245**	.000

Note. The items with an 'R' have been negatively phrased compared to the original survey.

* $p < .05$, ** $p < .01$

7. Discussion

The statistical results from the two surveys indicate a “response-shift bias” in the first survey. The first survey shows a general increase in the means on most items even though most of these items are not shown as significant in the analysis of variance. In the second survey there is also a general increase in means, however, the analysis of variance shows a stronger effect than the first survey. Response-shift bias explains this as the students have a different understanding of the meaning of the questions in the questionnaire before participating in the study as compared to after they have participated in the study.

In order to investigate further, 2 focus groups were held with a sample of 12 students, 6 students in each group. The focus group responses showed that the students valued learning the structure and process of writing a causal argumentation. They explained that learning and understanding this structure and process enabled them to better understand the process and views when they encounter argumentation in the media or other places. They also felt that learning the structure and the peculiar process of causal argumentation helped them to write better in other school work which involved a structured organization.

The students’ understood the need for evidence but experienced difficulty in using and finding evidence to support their own arguments. This was despite students being provided with a ready selection of relevant evidence. This indicates that the students do understand the importance of evidence, but find it to be a major obstacle in their writing of arguments.

The students expressed positive attitudes, values and enjoyment towards using an online structured argumentation board as compared to an offline face-to-face classroom argumentation activity like a verbal debate. They explained that they were able to concentrate better on developing a good argument in the online asynchronous environment. Noise in the classroom and the immediate “on-the-spot” responses required in a verbal debate impeded their ability to concentrate and construct better arguments. The researchers’ observations were congruent to the students’ views. When the students worked offline in the class, the noise level in the class was extremely high. However, when the class was engaged in a discussion using the online argumentation tool, the class was very quiet and the individual students were highly focused on the task.

The students also liked the ability to follow other students’ arguments online as they can see other students’ work and learn from it. The students also mentioned that the online argumentation environment provided a more comfortable environment as compared

to “face-to-face”. This could be due to the emotional tension felt when students are expressing conflicting viewpoints against each other “face-to-face”.

The students’ responses did not indicate any difficulties in using the online structured argumentation board. They found it easy to learn, taking one to five minutes to understand the interface. The sentence-openers and pre-set argumentation post selections (claim, reasons, evidence, rebuttal etc.) were also easily understood.

8. Conclusion

A four week intervention on causal argumentation with a class of middle-school students was reported. The students’ showed changes in attitude toward the process of argumentation after accounting for response shift bias. We attribute this effect to the students going through the intervention and developing a deeper sense of what argumentation is about.

Interviews with students showed that they enjoyed the web-based structured argumentation board as well as the intervention in general. Qualitative analysis of student essays is still ongoing and will be reported separately.

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