

AN EDUCATIONAL PROGRAM USING A DEBATE SUPPORT SYSTEM FOR CULTIVATING CRITICAL THINKING DISPOSITION

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Abstract

Debate learning is effective for fostering critical thinking disposition that is a very important educational goal. In this study, a critical thinking program is proposed, which includes debate learning by an internet-based debate support system, and it was conducted in practice in a high school. As the result, it was statistically confirmed that their critical thinking disposition of objectivity and good-faith was improved.

Keywords - critical thinking disposition, debate, ICT.

1 INTRODUCTION

Fostering critical thinking ability of students is one of the most important educational goals in high school education. Critical thinking, which was defined as “reasonable, reflective thinking that is focused on deciding what to believe or do” by Ennis[1], is very useful way of thinking in daily life, academic context, or business. Japanese government introduced “integrated study” to elementary school, junior high school[2] in 2002, and a study say that fostering critical thinking ability can contribute purposes of integrated study[3].

According to some studies about critical thinking[1][4], critical thinking ability consists of (a)cognitive elements, such as skill or knowledge of critical thinking, and (b)emotional elements, which are typified by disposition of critical thinking. In particular, cultivating critical thinking disposition is an essential because it is necessary for proactive or autonomous critical thinking.

Debate learning is often introduced as an effective program for cultivating critical thinking ability. Debate is defined as “a communication form which speakers of two teams are divided into the pros side and the cons side of a theme, discuss the theme based on objective evidence in order to make their own assertion’s advantage understood by listener”[5]. Because debate requires logical persuasion to participants, debate have been regarded as useful for cultivating logical thinking or debating skills, and practiced in educational contexts as debate learning. This characteristic of debate is also useful for cultivating critical thinking.

It is, however, difficult to introduce the debate learning into actual high school classes because it needs much time for all the students to participate in the debate. Moreover, it would be seen that some Japanese students have difficulty in criticizing other side’s position in the front of other side students, because they are afraid that it affects human relationship in classrooms, misinterpreting debate as something like real battle of words, even though they know debate is just a logical game.

The purpose of this study is proposal of an educational program using an internet-based debate support system in order to realize such effective education and application of the proposed program to the actual high school education aiming at cultivating students’ critical thinking disposition.

2 PROPOSAL OF A PROGRAM

In this chapter, the authors propose an educational program for cultivating students' critical thinking disposition.

2.1 An overview of the program

A study about teaching thinking points that not only teaching knowledge and how to think in lectures, but also experience of thinking practice using knowledge is very important for "understanding thinking"[6]. Moreover, a social psychological study says that an attitude toward something which is made through actual experience will be strong[7]. Based on these studies, the authors presume that experience of critically thinking is effective to cultivate disposition to think critically. Consequently, it is necessary to learn knowledge of thinking for students, before thinking practice for cultivating disposition of thinking for students because critical thinking is not natural way of thinking for humans.

Accordingly, the proposed program consists of four phases including debate learning using the debate support system as shown in Fig. 1. In the first phase, "reading textbook", students read a textbook of critical thinking to obtain basic knowledge. In the second phase, "critical reading exercise", students read a doubtful text, critically think about the text, and write their impression. In this phase, students get technique of critical thinking. The first phase and the second phase are individual training. In the third phase, "research and presentation", each student picks up their own theme, researches the theme, makes a presentation on the results of their critical thinking about the themes, and discusses it with group members, after presentation. Purposes of the third phase are pre-training of argument and assertion in debate learning and cultivating critical thinking disposition, through interaction between students. In the last phase, students participate in "debate learning" using the debate support system in order to cultivate critical thinking disposition. The system was developed by a part of the authors[8] and it provides Computer Mediated Communication (CMC) environment for holding debate via the Internet. Each participants of the program uses one personal computer that is connected to the Internet in debate learning.

2.2 An overview of the debate learning system

The procedure of debate using the debate support system are shown in Fig. 2. The features of the system are (a)discussion based on Toulmin model, (b)2 pros and 2 cons (or 3 pros and 3 cons) in one group based on one-to-one discussion and (c)four steps formal description of discussion consisting of first argument, counterargument, rebuttal and second counterargument in order to realize smooth and active discussion. Fig. 3 shows a screenshot of counter argument step of the debate learning system. The system has other characteristics that solve some problems mentioned in introduction of this paper. First, student can participate in debate without face-to-face exchange mediated by the system. This characteristic can solve the mentioned problem that students have difficulty in criticizing other side's position in the front of other side students. Moreover, the system allows many students to participate in debate at the same time, which make it easy to apply debate learning to actual high school education.

3 APPLICATION IN HIGH SCHOOL EDUCATION

The proposed program was practiced in a Japanese high school for thirteen weeks in the first semester of 2008 and 438 students of 11 classes participated in the practice. Here, (i)pre-presentation test, (ii)pre-debate test and (iii)post-debate test were conducted using a Japanese critical thinking disposition scale[1] which was originated in D'ANGELO[9], translated by MIYAMOTO et al.[10] and

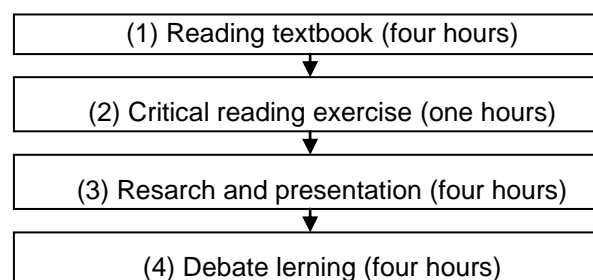


Figure 1 The flow of the proposed program.

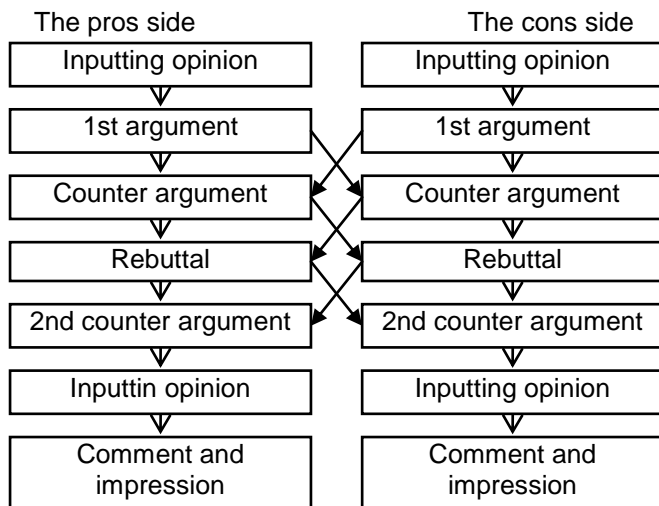


Figure 2 The procedure of debate using educational debate system.



Figure 3 A screenshot of counter argument step of the debate learning system.

statistically analyzed by HIROOKA[11], in order to evaluate the effectiveness of the proposed program. The critical thinking disposition scale consists of three factors of “objectivity”, “good-faith” and “inquiring mind”. Students answered to each test with 7-point scale(from “Don’t agree” to “Agree”).

Objectivity consists of items related to objective and casual thinking, such as “Following a line of reasoning consistently to a particular conclusion” or “Relying on empirical evidence and valid arguments, and not being influenced by emotive and subjective factors in reaching conclusions”. Good-faith consists of items related to faithful attitude and respect for others thought, such as “The acceptance of statements as being true, when there is sufficient evidence, even though it negates some of our cherished beliefs. Inquiring mind consists of items related to inquiring and pursuing thinking, such as “To persist in seeking ways of resolving disputes”. Some themes in environmental issues were used in the practice of debate learning. Table 1 shows a list of themes that were discussed in the debate learning.

4 RESULT AND DISCUSSION

Number of valid response of (i)pre-presentation test, (ii)pre-debate test and (iii)post-debate test was 287. An item of critical thinking disposition scale was removed from analysis because it had a problem in its question text. All answer was converted into number(“Don’t agree” is 1 point and “Agree” is 7 points) before analysis.

4.1 Analysis of factors

Factor score was calculated from answers of three tests with critical thinking disposition scale. The range of a factor score of objectivity is from 11 points to 77 points, that of good-faith is from 8 points to 56 points, and that of inquiring mind is 7 points to 49 points. Table 2 shows average and standard deviation of factor scores of critical thinking disposition scale. Here, one-way ANOVA(ANALYSIS OF VARIANCE) was conducted to reveal cultivation of three factors of cultivating critical thinking disposition through the proposed program, and its results of significance assessing of pair comparison are also

Table 1 Subjects of debate learning

- Japan has to introduce a deposit system of beverage containers.
- Japanese government has to introduce an environment tax.
- Japan has to introduce daylight saving time.
- Japanese government has to prohibit installation of automatic vending machine, and remove existing automatic vending machine.
- Use of plastic bottles has to be prohibited in Japan.
- Japan has to promote introduce of cars which use gasoline bleded with bioethanol.
- Japan has to prohibit convenience stores from staying open until late at night.
- Collection and recycling of plastic bottles have to be stopped in Japan.

Table 2 Average and standard deviation of factor scores of critical thinking disposition scale

	Pre presentation	Pre debate	Post debate
Objectivity	43.5(8)	44.7(7.4)	46.5(8.8)
Good-faith	35.3(4.6)	36.1(5.9)	37.3(6.5)
Inquiry mind	31(5.4)	31.4(5.4)	31.7(5.5)

*:p<0.05,**:p<0.01

shown in Table 2. ANOVA tables are shown in Table 3, Table 4, and Table 5

As the results of one-way ANOVA, it was found that the factor scores of objectivity, good-faith and inquiring mind significantly increased through the proposed program. As the results of Scheffe's paired comparison, it was also found that the scores of objectivity and good-faith were improved between

Table 3 ANOVA table of the factor score of objectivity

Source	SS	df	MS	F	p
subject	46079.45	286	161.67		
measurement time	1278.37	2	641.85	34.80	0.00
error(AS)	10520.3	572	18.44		
total	57878.11	860			

Table 4 ANOVA table of the factor score of good-faith

Source	SS	df	MS	F	p
subject	17075.07	286	59.70		
measurement time	601.46	2	300.73	15.55	0.00
error(AS)	11063.21	572	19.34		
total	28739.74	860			

Table 5 ANOVA table of the factor score of inquiring mind

Source	SS	df	MS	F	p
subject	20367.66	286	71.22		
measurement time	60.60	2	30.30	3.35	0.04
error(AS)	5176.07	572	9.05		
total	25604.32	860			

(i)pre-presentation and (ii)pre-debate, and between (ii)pre-debate and (iii)post-debate, (i)pre-presentation and (iii)post-debate ($p < 0.05$), while that of inquiring mind was not significantly improved ($p > 0.05$) except for (i)pre-presentation and (iii)post-debate.

The results suggest that the proposed program can cultivate critical thinking disposition especially the factors of objectivity and good-faith. This is because debating needs logical persuasion and faithfully listening to others proposition and these characteristics may cultivate objectivity and good-faith. However, the improvement of inquiring mind was comparatively lower than those of other factors. This may be because debating with a given theme and a given position doesn't essentially stimulate students' creativity and curiosity which are related to inquiring mind.

4.2 Analysis of items

Next, the answers of each item were analyzed in order to reveal effectiveness of the proposed program clearly. Friedman test and Schaffer's pair comparison analyzed change of each item of critical thinking disposition though three measurement times, (i)pre-presentation, (ii)pre-debate, (iii)post-debate, regarding each item's answer as ordinal scale. As a results of Friedman test, seven of eleven objectivity items, four of seven good-faith items, and one of seven inquiring mind items show significant difference at 1% or 5% significance level. As a whole, Items of objectivity and good-faith significantly improved, and items of inquiring mind seldom improved significantly, it is consistent with the into analysis of factors. However, there were some exceptions which are not significantly improved despite of belonging to objectivity or good-faith

To investigate what causes these exceptions in improvement of critical thinking disposition scale, a ceiling effect has to be concerned. Spearman's rank-correlation coefficient between (a)results of (i)pre-presentation, (b)improvement of results of (ii)pre-debate compared to (i)pre-presentation, and (c)improvement of results of (iii)post-debate compared to (ii)pre-debate of all items were calculated. As a result, (a)results of (i)pre-presentation and (b)improvement of results of (ii)pre-debate compared to (i)pre-presentation of all items have a negative significant correlation ($p < 0.1$). Next, (b)improvement of results of (ii)pre-debate compared to (i)pre-presentation have a negative significant correlation and (c)improvement of results of (iii)post-debate compared to (ii) pre-debate of all items also have significant correlation ($p < 0.1$). Consequently, there were clear ceiling effects, therefore, critical thinking dispositions that were originally high could not be improved so much.

Average of items whose improvements were not significant despite of belonging to objectivity or good-faith were already 5 points or more at (i)pre presentation test, and it can be seen as relatively high. Therefore, most of non-improvement of objectivity or good-faith items can be interpreted by ceiling effects. Nevertheless, even if ceiling effects are considered, the reason why an item, "To avoid slanting certain facts to support a particular position" was not improved significantly cannot be explained. it is supposed that it was because debate learning requires students to support a particular position(given own position), even if the position was not felt right.

Moreover, one item of inquiring mind, "To persist in seeking ways of resolving disputes" was significantly improved through the proposed program. The reason is speculated to be that this item is exceptionally not related to students' creativity and curiosity in inquiring mind, and related to problem solving. Themes of debate learning were the issues of political options to solve environmental problem, therefore, it is related to problem solving.

5 CONCLUSION

In this study, an educational program using the debate support system for cultivating critical thinking disposition has been proposed and practiced into Japanese high school. In conclusion, the effectiveness of the proposed program to cultivate critical thinking disposition was confirmed especially for the factors of objectivity and good-faith. In the future, the authors would like to propose a new educational program which can improve the critical thinking disposition, not only objectivity and good-faith but also inquiring mind.

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