*Journal of Moral Education*, 2015
Vol. 44, No. 2, 232–251, http://dx.doi.org/10.1080/03057240.2015.1043875

# Scaffolding computer-mediated discussion to enhance moral reasoning and argumentation quality in pre-service teachers

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This study investigated the effect of scaffolding computer-mediated discussions to improve moral reasoning and argumentation quality in pre-service teachers. Participants of this study were 76 teaching education students at a Turkish university. They were divided into three groups: (1) a computer-supported argumentation group; (2) a computer-mediated discussion group; and (3) a control group. Participants in the computer-supported argumentation group were instructed in argumentation, and were provided with note starters and graphical argumentation tools. The computer-mediated discussion group, however, was engaged in unstructured interaction on the Moodle forum, a free popular learning management system having a threaded discussion forum. The control group did not receive any instruction and neither did they participate in any discussions. As for the results, the computer-supported argumentation group outperformed the control group, but not the computer-mediated discussion group on DIT score and argumentation quality. Thus, it was concluded that both giving instruction on argumentation and appropriately designing the interfaces of computer-mediated discussion environments can enhance argumentation quality in students' writings and also their moral reasoning.

*Keywords:* computer-mediated discussion, note starters, moral development, moral reasoning, argumentation

## Introduction

Teachers are moral agents, whose moral decision-making process is manifested in many areas, including but not limited to selection of learning outcomes, structuring of classroom activities and interacting with students and parents (Oser & Althof, 1993). Therefore, as Cummings, Dyas, Maddux, and Kochman (2001, p. 145) noted, '[i]f teachers are to take seriously their responsibility as moral agents, they must be able to reason about moral issues and dilemmas at the

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principled level and have an awareness of their own moral and ethical responsibilities'. This theoretical stance is supported by empirical research findings. Some researchers (Benninga, Sparks, & Tracz, 2011; Chang, 1994; Cummings, Harlow, & Maddux, 2007) reviewed research on the relationship between teacher behaviors and teachers' moral reasoning level, finding that teachers whose moral reasoning level is more complex (higher level) are more likely to be flexible and democratic in their teaching methods (O'Keefe & Johnston, 1989) and more responsive to the moral, intellectual and interpersonal demands of the classroom (Reiman & Peace, 2002). Furthermore, teachers' moral development is associated with their view of classroom discipline and with their perception of their roles in the classroom.

Teachers who are in higher stages in Kohlberg's moral development schema tend to perceive their role as more democratic and closer to that of a facilitator (Johnston & Lubomudrov, 1987; MacCallum, 1991), empathize with students and tolerate diverse viewpoints (O'Keefe & Johnston, 1989) and be better at perspective-taking and social role-taking (Cummings et al., 2007). In contrast, teachers at lower moral reasoning levels may view their role as more authoritarian (Johnston & Lubomudrov, 1987; MacCallum, 1991) and may be prejudiced against minority groups (Guthrie, King, & Palmer, 2000).

Given the importance of moral development for the teaching professions, it is interesting to note that studies of scores on the Defining Issues Test (DIT), an objectively scored multiple-choice test of moral reasoning based on Kohlberg's six-stage scheme of moral development (Kohlberg, 1973, 1984), indicated that pre-service teachers score lower than students in other disciplines (Lampe, 1994). Furthermore, while most research findings indicate that undergraduates with majors other than education show significant increases in moral reasoning score as they progress through the phases of their university education (Bakken & Ellsworth, 1990; Rest, Narvaez, Thoma, & Bebeau, 1999), there is no improvement in pre-service teachers' moral reasoning scores from freshman to senior year (Yeazell & Johnson, 1988). Chang (1994) concluded that 'although teaching is moral by nature and teachers make moral decisions continuously, teachers do not seem to be well prepared for this aspect of their jobs' (p. 72). Thus, it can be seen that teacher education institutions need to pay greater attention to the moral aspect of education and also to conduct research to identify effective curriculum interventions to enhance the moral reasoning level of pre-service teachers in order to help them inform teacher education policies and practices at their institutions.

In the context of the Kohlbergian approach, which Kohlberg (1973) developed based on the theoretical works of Piaget (e.g., 1932) and Dewey (1922), cognitive conflict is accepted as most suitable method for increasing both cognitive and moral development (Binfet, 2000). Under this approach, classroom 'dilemma discussions' are a key factor in fostering moral development. In dilemma discussions, students have the chance to explicate their perspective on some dilemma, become aware of other participants' perspectives, and identify inconsistencies and

inadequacies in their and others' ways of thinking in order to find ways of resolving them that can foster cognitive and moral development.

Today, information and communication technologies provide new means for dilemma discussions and asynchronous online discussions are becoming a core component of both traditional and distance education. However, the social dynamics of asynchronous online discussions are quite different from those of traditional dilemma discussions (Thomas, 2002), and an examination of these differences could lead to the emergence of new, different considerations for the design of dilemma discussions to improve moral development. In this context, this study aims to shed light on the effectiveness of computer-mediated discussion for fostering moral development.

To the author's knowledge, there are no studies that analyze the effect of different discussion methods within asynchronous online discussion environments on pre-service teachers' moral reasoning levels. Thus, in this study, features of online discussion environments and formerly used face-to-face discussion environments in order to increase moral reasoning levels are compared and possible effects of online discussion environments on moral reasoning levels are discussed. Furthermore, to help increase moral reasoning levels, this study also aims at providing a conceptual background emphasizing research studies on improving the quality of argumentation, which is thought to foster cognitive conflict in online discussion environments.

### *Asynchronous online discussions*

Computer-mediated communication (CMC) tools are emerging as a new means to foster interaction in online learning environments. Asynchronous discussion, a form of CMC, supports information exchange and group interactions through a variety of electronic communication tools such as email and online discussion forums (Bodzin & Park, 2000). Although there is very little empirical research on the effectiveness of asynchronous online discussion for moral development, studies have shown that asynchronous online discussion can facilitate higher-order thinking skills such as critical and reflective thinking.

For instance, Jonassen and Kwon (2001) examined how asynchronous online discussions affected communication during problem-solving stages of 18 undergraduate engineering students. For this purpose, the researchers compared students' communication in an online asynchronous discussion environment to their communication in a face-to-face discussion environment in terms of perceptions of the communication process, the role of communication in problem-solving, and problem-solving patterns. The research suggested that students perceived discussion in an online asynchronous environment as being of better quality and more satisfactory than when conducted face-to-face; students stated that there were more exchanges of views and perspectives in asynchronous online discussions, and more exchanges of messages of agreement or disagreement.

Online discussions have a number of characteristics, such as text-orientation and asynchronicity, which can either foster or hinder cognitive conflict and moral development. With regard to advantages, asynchronous communication tools allow participants to participate in dialogue at their own convenience in terms of time and place. Asynchronous communication environment provide participants with as much time as they require to think on a dilemma, compare different ideas and develop their own views (Hara, Bonk, & Angeli, 2000; Joiner & Jones, 2003). Asynchronous online discussions are able to provide an effective environment for critiquing, questioning, analyzing, making connections (Williams et al., 2001) and fostering cognitive activity (Alavi, 1994). Asynchronous communication tools allow for saving a copy of the text of a conversation, giving participants an excellent opportunity to retrospectively investigate their own ideas and reflect on the transformation of those ideas.

However, asynchronous online discussions have disadvantages as well. Written interaction demands a significant time commitment (Jonassen & Kwon, 2001; Meyer, 2003), which could be frustrating for some students and may negatively influence their level of participation and their cognitive engagement. For instance, Peters and Hewitt (2010) analyzed students' behaviors and the reasons for those behaviors in an asynchronous online discussion environment, using data obtained through questionnaires and interviews with students enrolled in graduate-level distance education courses. The researchers reported that asynchronous discussions increased students' workload and that as a result, students tended to skim or ignore messages or threads. In a similar vein, Hewitt, Brett, and Peters (2007) found that students tend to scan or ignore longer messages in asynchronous discussions. Asynchronous online discussions enable students to express their ideas without considering turn-taking procedures or similar pragmatic requirements of face-to-face communication; thus, students can interact without disrupting or commanding the whole of the group's attention. However, again, this enhances the probability of the emergence of multiple threads on the same topic or of incoherent sequences of messages. Without sufficient facilitation, these behaviors therefore could inhibit the productivity of discussions (Brooks & Jeong, 2006).

There is a consensus that asynchronous discussion is beneficial in fostering reflectivity but that it fails to support exchanging opposing views or different viewpoints (Koschmann, 2003). In a study conducted by Marttunen and Laurinen (2002) in Finland, 11 students in a university's education department, who were enrolled in an academic discourse class, were divided into two email study groups, and email discussions were carried out using a role play method. The researchers analyzed 326 emails in total, and found that during email discussions, students did not assume an argumentative role but tended to merely agree with or ignore their peers' ideas. In a similar vein, Kanuka and Anderson (1998) reported that students avoid contradicting each other in bulletin board discussions.

*Computer-supported argumentation*

Rich argumentation is widely accepted to constitute the core of high-quality discussion (Jeong, 2004; Marttunen, 1998; Nussbaum, 2005; Nussbaum, Hartley, Sinatra, Reynolds, & Bendixen, 2002). According to Jonassen and Kim (2010), '[a]rgumentation is the means by which we rationally resolve questions, issues and disputes and solve problems. Embedding and fostering argumentative activities in learning environments fosters productive ways of thinking, conceptual change and problem-solving' (p. 439).

Andriessen, Baker, and Suthers (2003) classified the mechanisms by which argumentation provides opportunities for learning into three parts. First, in argumentative dialogue students try to explain themselves, leading to reflection and awareness of their own beliefs and assumptions. Second, in argumentative dialogue students try to support their claims, and eliminate flawed parts of those claims in the process. Although they do not generally abandon their views totally, they may make subtle changes in their positions. Third, argumentation can help students refine their positions and in this way foster a consensus between different viewpoints. However, studies have shown that without any scaffolding, students are not good at constructing arguments (Cerbin, 1988).

Andriessen and Schwarz (2009) suggest that in order to elicit argumentative dialogue, discussions should be scaffolded by the teacher and/or by means of representational tools like note starters, message tags, etc. One approach to developing argumentation skills is to train students in argumentation via direct instruction. Using an interrupted time-series quasi-experimental design, Yang, Newby, and Bill (2005) investigated the effects of Socratic questioning on enhancing students' critical thinking skills in asynchronous discussion forums in university-level distant learning courses. Researchers reported that students instructed in argumentation and exposed to model Socratic questioning prior to online discussion produced more messages and showed an improvement in their critical thinking skills. In a similar study, conducted by Sanders, Wiseman, and Gass (1994), an intervention group received instruction in argumentation, while a control group received instruction in introductory interpersonal communication. Researchers reported that the intervention group outperformed the control group in argumentation skills. Thus, direct instruction in argumentation potentially increases the quality of the argumentation in students' writing.

An alternative approach to developing argumentation skills is by scaffolding asynchronous discussions. The characteristics of the environment in which students interact affect their interactions, or put differently, the affordances of the online discussion environment, affect student argumentation patterns and quality. Accordingly, researchers have developed a number of interface design strategies in order to enhance quality of argumentation in online discussions.

For instance, note starters (also known as sentence openers; these are synonymous terms in this paper) simply consist of a top-down menu from which participants are required to choose a phrase in order to begin their message. Once a

phrase is selected, it automatically appears in the response field. Note starters are intended to encourage students to think more deeply (Nussbaum et al., 2002). They are included in CSILE, the online discussion system developed by Scardamalia and Bereiter (1991), and are used to structure online discussions among K–12 students. The researchers reported that 'CSILE resulted in the generation of higher-level questions, more elaborate explanations, and deeper conceptual understanding' (p. 6). In a similar vein, Yiong-Hwee and Churchill (2007, p. 209) suggested that 'the use of sentence openers supported thinking in collaborative online learning environments. Researchers have also found that sentence openers support learning by helping students focus on their thinking, consider multiple perspectives, develop in-depth arguments as opposed to superficial statements, and communicate clearly.

To sum up, classroom 'dilemma discussions' are being accepted as a key factor in fostering moral development. However, information and communication technologies are transforming education, as they are all walks of life. In this context, online discussions are supplementing and supplanting face-to-face classroom discussions. These two modes of discussion have different dynamics. Previous research shows that in online asynchronous discussions, students tend to superficially agree or to send unconnected utterances (Hewitt, 2003; Joiner & Jones, 2003). Cognitive conflict may arise if any of the variety of different viewpoints that are encountered in a conversation contradict the individual's existing perspective and better explain reality (Tudge & Rogoff, 1999). Therefore, to foster cognitive conflict in asynchronous discussions, teachers should find ways to support students to engage in argumentative discussions in which they will encounter different viewpoints, analyze them, and reflect on their own viewpoints.

The aim of the present study was twofold: to investigate which type of online discussion foster student growth in moral reasoning to a greater degree, and to investigate the effects of argument scaffolding on online discussion quality. The following research questions were addressed:

*Research questions*

(1) Do participants in a computer-supported argumentation group show significantly greater growth in moral reasoning as compared to a control group, as indicated by the DIT?
(2) Do participants in the computer-supported argumentation group show significantly greater growth in moral reasoning as compared to a computer-mediated discussion group, as indicated by the DIT?
(3) Do participants in the computer-mediated discussion group show significantly greater growth in moral reasoning as compared to the control group, as indicated by the DIT?
(4) Do participants in the computer-supported argumentation group show significantly greater growth in argumentation quality as compared to the control group?

(5) Do participants in the computer-supported argumentation group show significantly greater growth in argumentation quality as compared to the computer-mediated discussion group?
(6) Do participants in the computer-mediated discussion group show significantly greater growth in argumentation quality as compared to the control group?

## Method

### *Participants*

The participants in this study were 76 teaching education students enrolled in a course in 'Theoretical Foundations of Educational Technology' at a Turkish university. All the students were sophomores and with high self-reported levels of computer experience. The participants were randomly divided into three groups: the computer-supported argumentation group, the computer-mediated discussion group and the control group. Each of the former two groups was then itself divided into five groups each consisting of five students. The ages of the students in the computer-supported argumentation group ranged from 18- to 26-years-old, with a mean of 20.8 years; gender composition was 15 males and 10 females. In the computer-mediated discussion group, students' ages ranged from 17- to 24-years-old, with a mean of 21 years; gender composition was 14 males and 11 females. Finally, the control group was composed of 26 students whose age ranged from 18- to 25-years-old with a mean of 20.5 years; gender composition was 15 males and 11 females.

### *Procedure*

In the first phase of the experiment conducted for the present study, after gaining participants' consent, they were asked to complete the Turkish version of the DIT and write an essay about Internet censorship. Then, they were randomly assigned to one of three groups: computer-mediated discussion, computer-supported argumentation, and control. The discusssions were carried out outside the class hours.

In the second phase of study, the intervention took place. In the first week of intervention, the computer-supported argumentation group trained to understand the qualities of good argument. For this training, a list of criteria for a good argument developed by Nussbaum and Schraw (2007) was used, according to which a good argument should:

- have a clear position on an issue
- provide adequate supporting reasons
- provide opposing viewpoints (counterarguments)
- integrate both sides of an issue and reach a claim (argument–counterargument integration)
- be well organized.

After being informed why each criterion here was essential for a good discussion, participants in the computer-supported argumentation group provided (intentionally) good- and poor-quality arguments to be analyzed in the classroom using Nussbaum and Schraw (2007) criteria by the researchers, who had already delivered model activities to the participants. Then, participants were asked to examine former samples based on the criteria above and develop arguments suitable to the criteria they picked. In the next session, participants were asked to describe the strengths and weaknesses of sample arguments that they analyzed and to read arguments that they developed. Analysis of arguments and strengths and weaknesses of arguments were discussed in class.

Last, participants in the computer-supported argumentation group received instruction on using the argumentative discussion software developed for this study. This discussion environment consisted of two kinds of forum: text forums and graphic forums. Text forums are designed to facilitate threaded discussions, with each message field divided into three parts. Each part started with a 'note starter'. This design is aimed to identify who can produce arguments considering the main idea (or argument) and who can elaborate, support or rebut other arguments. Note starters aim to encourage participants to compose their message considering alternative viewpoints and elaborating their arguments. Using note starters, the participants were encouraged to elaborate on their ideas. The basic idea behind the note starters is that of using the concepts of space and distance with regard to map relational data. The note starters were as follows:

- According to me
- On the other hand
- I agree with this idea, but,
- Because
- I don't think so, because
- I think so, because

The graphic forum or argumentation map consisted of circles, boxes and colors to show relationships between different parts of an argument. Argument mapping is a diagrammatic representation of argument structure (Twardy, 2004) that helps us to better understand and critique arguments, visualize the beliefs and assumptions behind decisions and reflect on the limitations of our perspectives in order to induce cognitive change (Hoffmann, 2007). Participants in the computer-supported argumentation group took the opportunity to display each claim schematically by using the graphic forum feature with references, rebuttals, and quantifiers. To teach participants how to use the graphic forum, the professor, who is also the researcher, constructed a sample argument using the software. Later, participants were asked to visualize their sample arguments by using the software. The professor controlled each student's argument diagram, and helped them deal with ambiguities.

The computer-mediated discussion group, trained only in online discussion procedures and the use of Moodle, had no structure provided to help them deal

with dilemma discussions. Moodle, which was constructed based on a social constructivist pedagogy (Nedeva, 2005), is a popular free learning management system with open source code. Moodle also includes a threaded discussion forum in order to enhance tutor–student and student–student interaction.

The intervention lasted 12 weeks; each week, computer-mediated discussion and computer-supported argumentation groups were given a dilemma to discuss among themselves over the course of the week. In all, 12 moral dilemmas were assigned. Dilemmas constructed for the research were discussed by the computer-supported argumentation group in a discussion forum constructed with note starters and argument mapping, and, by the computer-mediated discussion group, via the Moodle discussion forum, which had no scaffolding tool. In general, these dilemmas were composed of debatable scenarios that were developed in lessons. For instance, the dilemma presented in the 10th week was as follows:

> Teacher Mehmet, who works at a public school, found a second job due to an increase in family expenses, and started to work at a private institution which was established particularly to improve children's homework and help them succeed in their lessons. Some public school students were enrolled at this private institution. This situation caused an argument in a parents' meeting at the school. Some of the parents stated that they were thankful for teacher Mehmet, because they could not help their children with their homework. On the other hand, some parents said that it was not possible for them to send their children to that private institution for several reasons, and this would lead to inequality among the children. Discuss the issue from both the parents' and the teacher's perspective.

In the last phase, participants retested using the DIT Turkish version and were again asked to write an opinion essay on censorship on the Internet.

### *The DIT*

The Turkish version of the DIT (Cesur, 1997), which includes four dilemmas, was used in the present study. Participants were asked to read each dilemma and decide on a resolution for each. Then, they were asked to rate 12 items, each presenting an idea or concept for consideration in resolving the dilemma under investigation, and assign it a value for making a decision about the relevant dilemma, using a five-point Likert-type scale ranging from 'no importance' to 'great importance'. Finally, the participants were asked to rank the four most important of the 12 items, in order.

The DIT scale can yield several scores. In the present study P-score (the 'principled score') was used to assess participants' moral development. P-score, usually expressed as a percentage, ranges from 0 to 95. Higher P-scores indicate higher levels of moral reasoning. In addition, in order to eliminate inconsistent or meaningless responses, the M-score was used. M-scores ('meaningless item scores') represent the participants' tendency to endorse certain answers for their pretentiousness rather than their meaning. Both test-retest correlations and internal reliabilities average in the .80s (Rest, 1994).

DIT P-scores have been shown to have high levels of test-retest reliability and construct validity. The Turkish version of the DIT was validated by the researchers (Cesur, 1997; Cesur & Topcu, 2010) and is used by many researchers in Turkey (see Cesur & Topcu, 2010; Haskuka, Sunar, & Alp, 2008).

*Assessing argumentation quality in opinion essays*

To allow the assessment of argumentation quality, participants were asked before the intervention to write their opinions about censorship on the Internet in

Table 1. Rubric for assessing quality of argumentation in students' opinion essays (Cho & Jonassen, 2002, p. 12)

| Score | Criteria |
|---|---|
| Claim | |
| 6 | The writer states generalizations that are related to the proposition and which are clear and complete. |
| 4 | The writer states generalizations that are related to the propositions, but the assertions are not complete. Enough information is available to figure out the writer's intent, but much is left to the reader to determine. |
| 2 | The writer makes generalizations that are related to the proposition, but the assertions lack specificity or offer unclear referents. The writer leaves much for the reader to infer in order to determine the impact of the claim. |
| 0 | No claim related to the proposition or unclear assertions. |
| Grounds | |
| 6 | The supporting data are complete, accurate, and relevant to the claim. |
| 4 | The data offered are relevant but not complete. The writer leaves much for the reader to infer from the data. The writer may offer data, which are not complete enough to allow the reader to determine their significance. |
| 2 | The data or evidence are weak, inaccurate, or incomplete. |
| 0 | No supporting data are offered or the data are not related to the claim. |
| Warrants | |
| 6 | The writer explains the data in such a way that it is clear how he or she supports the claim. |
| 4 | The writer explains the data in some way, but the explanation is not linked specifically to the claim. |
| 2 | The writer recognizes a need to connect the data to the claim and gives some elaboration of data, but fails to make the connection. Or, most rules and principles are not valid or relevant. |
| 0 | No rules and principles are offered. |
| Backings | |
| 6 | The writer states correct, relevant, and specific sources of warrants. |
| 4 | The writer states correct, relevant sources of warrants but the sources are very general, not specific. |
| 2 | The writer states incorrect, irrelevant sources of warrants. |
| 0 | No sources of warrants are given. |
| Rebuttals | |
| 6 | The writer states complete and systematic identification of constraints of solutions. |
| 4 | The writer identifies constraints of solutions but the constraints are not sufficient. |
| 2 | The writer offers few constraints of solutions but the constraints are not elaborated. |
| 0 | No recognition of constraints of solutions. |

Turkey, and again after the intervention. Together with this assignment, participants were given a handbook to help them to write their opinion essays. The handbook encouraged participants to support their views with evidence and to consider alternative viewpoints on the issue in question and respond to them when stating their final claims. Participants' opinion essays were assessed using a rubric adapted from Toulmin, Rieke, and Janik (1984) by Cho and Jonassen (2002) and consisting of five argumentation categories: 'claims', 'grounds', 'warrants', 'backings', and 'rebuttals'. The researcher and an independent rater using Cho and Jonassen's (2002) rubric independently scored all of the opinion essays. In this process each opinion essay was assessed for each of five argumentation categories and given a score between 0 and 6 for each category (see Table 1).

To assess overall argumentation quality in the students' opinion essays, the scores for each category were added and a total score for each student calculated (range 0–30). To calculate interrater reliability, the number of agreements was divided by the sum of the number of agreements and the number of disagreements and then multiplied by 100. Interrater reliability was 82% for the pre-test and 87% for the post-test. The researcher and the other rater then discussed scoring discrepancies and finally reached agreement for both pre-test and post-test.

## Results

Of the 76 participants who participated in the study, 12 whose M-scores on the DIT test were equal or higher than 9 were excluded from the analysis because of the inconsistent DIT scores they yielded. To test the assumption that groups were in fact random, a one-way analysis of variance (ANOVA) was conducted on pre-test DIT scores and argumentation scores. The results indicated that the groups were not significantly different in their moral development as measured by DIT score ($F[2, 61] = .220$, $p > 0.05$) and argumentation scores ($F[2, 61] = .424$, $p > 0.05$). Improvement of the moral reasoning and argumentation quality evident in students' writing was measured by subtracting the pre-test score from the post-test score and taking the resulting value as representing gain in moral reasoning or argumentation quality (respectively). To test the normality assumption, a Shapiro–Wilk test and kurtosis and skewness values for each group's gain scores were examined (see Table 2). The normality assumption was not violated.

### *Normality tests for DIT (moral reasoning) and argumentation quality gain*

In order to test whether different discussion techniques affected participants' moral reasoning level as measured by DIT, a one-way ANOVA was conducted; the results indicated a significant difference between the three groups ($F[2, 61] = 5.38$, $p < 0.05$). Levene's test for equality of variances revealed that equality of variance could be assumed for DIT gain scores ($F = .469$, $p = .628$). Next, Tukey HSD post hoc test procedure was conducted to enable pairwise comparisons among the three

Table 2. Normality tests for DIT (moral reasoning) and argumentation quality gain scores

| | Groups | *N* | Shapiro–Wilk (*p*-values) | Kurtosis | Skewness |
|---|---|---|---|---|---|
| DIT (Gain Scores) | Computer-Supported Argumentation Group | 22 | 0.133 | 0.635 | 0.158 |
| | Computer-Mediated Discussion Group | 22 | 0.42 | 0.028 | 0.067 |
| | Control Group | 20 | 0.207 | 0.117 | –0.394 |
| Argumentation Quality (Gain Scores) | Computer-Supported Argumentation Group | 22 | 0.109 | –0.849 | –0.436 |
| | Computer-Mediated Discussion Group | 22 | 0.108 | 0.055 | –0.371 |
| | Control Group | 20 | 0.132 | 0.894 | 0.312 |

Table 3. Means and standard deviations for DIT and argumentation quality gain scores

| | Groups | *N* | Mean | SD |
|---|---|---|---|---|
| DIT (Gain Scores) | Computer-Supported Argumentation Group | 22 | 4.773 | 4.1482 |
| | Computer-Mediated Discussion Group | 22 | 3.409 | 4.1936 |
| | Control Group | 20 | 0.875 | 3.1701 |
| | Total | 64 | 3.086 | 4.1486 |
| Argumentation quality (Gain Scores) | Computer-Supported Argumentation Group | 22 | 4.545 | 4.1487 |
| | Computer-Mediated Discussion Group | 22 | 2.273 | 2.8483 |
| | Control Group | 20 | 0.6 | 2.2572 |
| | Total | 64 | 2.688 | 3.5495 |

groups' gain scores. The results indicated that participants in the computer-supported argumentation group ($M$ = 4.77) showed a significantly greater increase in P-scores than did those in the control group ($M$ = 0.87, $p$<.01), but that the difference between the computer-supported argumentation group and the computer-mediated discussion group ($M$ = 3.40) was not statistically significant ($p$ > .05). Participants in the computer-mediated discussion group also showed a greater increase in DIT scores than did those in the control group, but the difference was not statistically significant ($p$ > .05) (see Table 3).

*Means and standard deviations for DIT and argumentation quality gain scores*

To test whether group performance varied in terms of argumentation quality, a one-way ANOVA analysis was conducted using gain scores as a dependent variable, showing that there were significant differences between the three groups ($F$[2, 61] = 7.89, $p$ < 0.05) (see Table 4 for descriptive statistics).

Table 4. Descriptive statistics for the argumentation quality in opinion essays

| | Groups | Claims | Grounds | Warrants | Backings | Rebuttals | Total |
|---|---|---|---|---|---|---|---|
| Pre-test | Computer-Supported Argumentation Group | 4,64 | 2,82 | 1,27 | 0,36 | 0,27 | 9,36 |
| | Computer-Mediated Discussion Group | 4,45 | 2,73 | 1,55 | 0,45 | 0,27 | 9,45 |
| | Control Group | 4,50 | 2,60 | 1,30 | 0,30 | 0,20 | 8,90 |
| Post-test | Computer-Supported Argumentation Group | 4,73 | 3,64 | 2,91 | 1,45 | 1,18 | 13,91 |
| | Computer-Mediated Discussion Group | 4,55 | 3,27 | 2,09 | 1,09 | 0,73 | 11,73 |
| | Control Group | 4,30 | 3,00 | 1,40 | 0,50 | 0,30 | 9,50 |

*Descriptive statistics for the argumentation quality in opinion essays*

To test the homogeneity assumption, Levene's test for equality of variances was conducted, and revealed that equality of variance could not be assumed for argumentation quality gain scores ($F = 5.237$, $p<.05$). In light of the violence of the homogeneity of variance assumption, the Games–Howell post hoc test procedure was conducted to allow pairwise comparisons among the three groups' argumentation quality gain scores. The test results showed that the computer-supported argumentation group ($M = 4.55$ SD = 4.15) obtained higher post-test argumentation scores than did the control group ($M = .60$, SD = 2.26). However, there were no statistically significant differences between the computer-mediated discussion group ($M = 2.27$ SD = 2.85) and the control group ($M = .60$, SD = 2.26), nor between the computer-mediated discussion group ($M = 2.27$ SD = 2.85) and the computer-supported argumentation group ($M = 4.55$ SD = 4.15).While the minimum argumentation gain score was -4 in all three groups, the maximum argumentation gain score was 10 for the computer-supported argumentation group, 8 for the computer-mediated discussion group and 6 for the control group.

## Discussion

The results presented above show a significant increase in both DIT and argumentation quality scores in the computer-supported argumentation group as compared to the control group. The computer-supported argumentation group received argumentation education and discussed the dilemmas in an argumentation forum developed using note starters and an argumentation map. On the other hand, there was no significant difference in either DIT or argumentation quality scores in either the computer-mediated discussion group, who discussed the dilemmas in a Moodle discussion forum and who received education only about how to use this this forum and did not use any structuring tools, or the control group, who was not part of any intervention.

In this section, first of all, the meaningful increase in DIT scores in the computer-supported argumentation group compared to the control group is discussed in light of previous studies. Next, the non-significant difference in DIT scores between the computer-mediated discussion group and the control group, a finding contrary to expectations, is discussed. Finally, differences that emerged between groups in terms of the increase of argumentation quality scores are discussed.

The results of this study show that the computer-mediated argumentation program that provided direct instruction and scaffolding for argumentation thereby increased moral reasoning scores among student teachers. In the moral development literature, no previous study investigates the relationship between moral reasoning and online argumentation. However, it is widely acknowledged that teaching activities, if they aim to improve moral reasoning abilities, should provide opportunities for social interaction (Binfet, 2000). Nevertheless, it cannot be claimed that any kind of social interaction or cognitive conflict will trigger moral development (Berndt, 1981). Kohlberg and Hersh (1977) have stated that in order to facilitate the moral development of students, teachers 'must help the student to consider genuine moral conflicts, think about the reasoning he uses in solving such conflicts, see inconsistencies and inadequacies in his way of thinking and find ways of resolving them' (p. 57). In fact, this is exactly what argumentation aims to do in educational settings. Effective argumentation helps students to distinguish ideas, elaborate and form connections between ideas, consider alternative perspectives, experience cognitive conflict and recognize weakness in their views (Andriessen et al., 2003).

In this study, various techniques were used to teach argumentation and foster it via computer scaffolds. The note starters and argumentation maps used in this study helped make disagreements visible and thus foster social conflict, and in turn cognitive conflict, in online moral discussions. This shows that if the goal is to foster moral development in pre-service teachers, argumentative activities could be usefully embedded in learning environments.

One basic question that emerges from the results of this study is why the computer-mediated discussion group failed to show a significant increase in moral reasoning as measured by DIT. Schlaefli, Rest, and Thoma (1985, p. 346) conducted a meta-analysis of intervention studies using the DIT and found that 'moral dilemma' intervention studies reported a 'moderate but definite' effect on moral reasoning. However, that study used face-to-face dilemma discussions, in contrast to the online discussion environment used here, and it is widely acknowledged that online and face-to-face discussions have different characteristics. In order to better understand the findings of this study it could be beneficial to discuss differences between online and face-to-face discussions in terms of what we need to trigger moral development in dilemma discussions.

Berkowitz (1980, p. 13) argues that 'moral stage development results from discussions in which each member engages the reasoning of his/her discussion partners with his/her own reasoning. Rather than merely providing consecutive assertions, discussants "operate" on each other's reasoning'. The dilemma discussions

approach assumes that students will actively take part in discussions and thus experience cognitive conflict. This may sometimes not be a reasonable assumption, especially for online discussions. Research studies indicate that in online discussions students tend to ignore conflicting viewpoints or treat them superficially (Gao, Wang, & Sun, 2009).

Joiner and Jones (2003) compared asynchronous online discussions and face-to-face discussions in terms of the quality of the arguments and of the development of argumentative reasoning. Joiner and Jones found that participants in the face-to-face condition were more likely to ask more transactive questions, request a response from the partner, than those in the online condition; on this basis, they reported that the quality of the argumentation in computer-mediated discussions was lower than that in-face to-face discussion. In a similar vein, Marttunen (1998) reported that in CMC, students often do not respond or reply to each other's messages, and the quality of discussions is lower than face-to-face. More specifically, Marttunen reported that while 15% of the messages in CMC were unconnected to the ones that preceded them, this figure was only 3% in face-to-face discussions. In light of this finding, we should be careful in transferring research findings derived from the face-to-face dilemma discussion context to that of online discussions, since the latter have unique characteristics. Therefore, in order to identify or develop more effective strategies for engagement in these conversations to foster moral development, further research is needed.

Not surprisingly, the data from the present study showed that the student participants who were engaged in a computer-supported argumentation program showed significantly larger growth in argumentation quality in their opinion essays than did the students in the control group. This finding is in alignment with previous research findings. Kuhn, Shaw, and Felton (1997) showed that extended engagement in argumentative discourse may enhance the quality of the individual's argumentation as a whole. Thus, this study seems to indicate that teaching basic argumentation principles and providing an environment that can scaffold and foster argumentative discourse can increase the argumentation quality of students' opinion essays. Cho and Jonassen (2002) showed that a graphical argumentation scaffold enhanced quality of argumentation in individual problem-solving. The researchers have also reported that a scaffolded argumentation group improved more than the control group. In a similar vein, Nussbaum et al. (2002) found that note starters encourage students to consider alternative points of view in discussing an issue.

The computer-mediated discussion group did not show a significant increase in argumentation quality scores in their opinion essays. Although it is claimed that asynchronous communications provide students with the necessary conditions for argumentation, previous research findings have shown that students are reluctant to disagree with their peers and instead are often inclined to agree with each other without thinking deeply about the topic being expressed or questioning the soundness of claims made by peers in online discussions (Jeong, 2004; Koschmann, 2003; Marttunen, 1998). Thus, computer-mediated discussions usually stay at

surface level. Various approaches to this situation have been suggested by researchers to enhance argumentation in online discussions. The ones with the greatest proven use are scaffolds like note starters (McManus & Aiken, 1995), message labeling, and message constraints.

The perspective, which suggests that peer interaction would cause critical cognitive conflicts and thus affect teachers' way of thinking (Piaget, 1932), is one of the main reasons for the wide use of the case discussion method in teacher education (Merseth, 1996). However, in educational contexts, interaction does not appear by itself, and it is hard to maintain it when it is artificially created. For this reason, it is essential to design discussion activities and environments carefully. Requirements for designing an activity or environment vary depending on the parameters, but may include the aims of the discussion, participants' characteristics, and so on. The existing literature is not exhaustive enough to allow explicit principles to be put forward (Andriessen & Schwarz, 2009). The implication of this study for the design of online interaction for teachers' moral education can be summarized as follows: in dilemma discussions, both: (a) informing pre-service teachers about argumentation; and (b) appropriately structuring online discussion environments can contribute to the increase in the moral reasoning levels of pre-service teachers. One of the implications of this study for teachers and teaching is that if the goal is improving students' moral development, teachers should not only encourage different viewpoints but also discuss different viewpoints and reflect on their own, with argumentation (Kuhn, 1991).

Similar to this research, various studies have investigated the effects of how online discussions are directed (An, Shin, & Lim, 2009), the effectiveness of group structure in terms of the number of students in groups, the characteristics of participants (Özçınar, 2009), and tools that can be used to restructure online discussions (Nussbaum, Hartley, Sinatra, Reynolds, & Bendixen, 2004) on the quality of the discussion. However, there remains a need for research studies that investigate these parameters together as well as the interaction between them and thus provide a whole picture of how to design dilemma discussions for different assignment types and discussion aims. In addition, this study was carried out over the course of a semester in which it was seen that argumentation education and scaffolding online discussions increased the benefits pre-service teachers derived from dilemma discussions as well as their moral development levels. On the other hand, there are not yet any data on whether this is a long-term effect. Thus, it would be beneficial to replicate this study over a longer period.

In this study, the effects of argumentation quality on students' cognitive conflict levels and the effects of cognitive conflict level on level of moral development were not investigated. The relationships identified here on the basis of large-scale experimental study may contribute to the field, especially since in the literature, cognitive conflict is generally investigated through questionnaires, which can successfully test learners' cognitive conflict levels in relation to an issue or a concept but not easily cover changes in level of cognitive conflict that may happen as learners read or create a new message. Therefore, studies that employ think-aloud

protocols or reflective journals that help collect learners' feelings and thoughts in computer-mediated discussion environments might be beneficial for our understanding of participants' feelings, thoughts, and behaviors in dilemma discussions.

Finally, several limitations to this study need to be noted. First, the participants were all students in the same department in a rural Turkish university, and the number of participants was relatively small. Therefore, the generalizability of the findings of this study may be limited. Second, it was impossible to isolate participants from their normal social environments; thus, it is likely that they discussed their dilemmas in contexts other than through the online discussion environments. This point should also be considered when interpreting the findings. Third, in this study, there were no follow-up data gathered, and so it is hard to say whether the effects of the interventions were temporary or long lasting. Nevertheless, this study has shown that giving instruction on argumentation and appropriately designing the interface of computer-mediated discussion environments have the potential to enhance argumentation quality in students' writings as well as their moral reasoning.

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