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The Effect of Instructional Techniques on Critical Thinking and Critical Thinking Dispositions in Online Discussion

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ABSTRACT

The aim of this research study was to explore the effect of instructional techniques on critical thinking and critical thinking dispositions in online discussion, based on triangulation design. Six Thinking Hats, Brainstorming, Role Playing, Socratic Seminar, and Anyone Here an Expert, were selected as an instructional techniques for online discussion. In the quantitative part, according to the results of ANOVA, except Socratic Seminar, there is no difference between groups in terms of scores of pre-tests and post-tests of critical thinking dispositions. In the qualitative part, according to the results of the analysis of critical thinking in online discussion, the Mixed Techniques group performed as having the best ability of critical thinking, the Anyone Here an Expert group was second and the Brainstorming group was third in terms of performing critical thinking ability in online discussion.

Keywords

Instructional techniques, Critical thinking, Critical thinking dispositions, Online discussion

Introduction

Higher order thinking skills like critical thinking, creative thinking and problem solving are considered necessary skills for 21st century individuals. On the other hand, technology competencies like using the Internet and its services effectively and learning in online environments are also skills required for the new generation. Hence, it is necessary and important to examine these dimensions from different points of view in order to develop ideas on the ways to best equip individuals with these skills and to make them more easily cope with emerging technologies and situations.

Although online teaching, or nowadays more commonly called e-Learning, is not a new phenomenon for the education world, few studies deal with both the implementation of instructional strategies and techniques within these virtual environments and the consequences of these various implementations in terms of enhancing critical thinking skills. We have to discover the best instructional techniques for students learning within online environments, as we do for face-to-face learning environments. As educators, we should consider the best practices which enhance students' thinking skills, academic achievement, retention and other important dimensions of student learning. Owing to these facts, this research study was carried out to explore whether or not selected instructional techniques can enhance students' critical thinking skills and critical thinking dispositions. Hence, six instructional techniques were used to conduct discussions in online environments in order to explore the critical thinking skills and critical thinking dispositions of students.

Critical thinking and critical thinking dispositions

Teaching students how to think critically is an essential issue in educational settings (Facione, 2007; Şendağ & Odabaşı, 2009) since critical thinking (CT) is very important to participate effectively in a democratic society with a set of skills in terms of workplace decision making, leadership, clinical judgment that affects directly professional success. As synthesised by Onions (2009) "Critical thinking is a way of thinking, and a set of skills, that encourages an informed, aware, systemic, considered and logical approach to deciding what to believe or do. Critical thinking leads to arguments and conclusions that are valid, substantiated and resistant to criticism" (p. 2). As also stated by MacKnight (2000), teaching CT by using online discussion is an essential approach in terms of enhancement of teaching and learning in electronic forums. Students should enhance their critical thinking abilities in order to cope

with the information explosion and other rapid technological changes that we are faced with in recent years and also for the upcoming years.

From a different point of view, Halpern (1999) underlined the importance of addressing student dispositions in terms of critical thinking instruction and stated that "Critical thinking is more than the successful use of the right skill in an appropriate context. It is also an attitude or disposition to recognize when a skill is needed and the willingness to exert the mental effort needed to apply it" (p. 72). Thus it is crucial to explore innovative ways to make our students value both good thinking and the effort that is necessary to use their skills. Yang and Chou (2008) explored the relationship between critical thinking skills (CTS) and critical thinking dispositions (CTD) and investigated the effectiveness of instructional strategies in improving students' CTS and CTD. Although they found a positive relationship between CTS and CTD, they concluded that only the students with high CTS and medium CTD possessed a significant correlation. The researchers also concluded that in terms of effectiveness of the instructional strategies, both CTS and CTD need to be and can be taught and cultivated. Han and Brown (2013) conducted a study which is based on an intervention designed to improve early childhood teacher candidates' critical thinking skills. Their findings indicated a significant increase in teacher candidates' dispositions toward critical thinking after the intervention and a growth in their own learning. Moreover, Loes, Pascarella and Umbach (2012) investigated "... the unique effects of exposure to classroom diversity and involvement in interactional diversity on growth in critical thinking skills during the first year of college." (p. 1). The researchers found that interactional diversity had a positive influence on critical thinking skills of diverse students.

Perkins and Murphy (2006) conducted an exploratory case study involving the development of a model for identifying and measuring individual engagement in critical thinking in an online asynchronous discussion, and underlined the potential usefulness and importance of identifying critical thinking in online asynchronous discussion groups based on their findings. Another researcher, Jeong (2003), examined group interaction and critical thinking in online threaded discussions. The researcher identified patterns in interactions and determined which interactions promoted critical thinking, and concluded that interactions having contradictory viewpoints stimulated more discussion and critical thinking. Furthermore, Walker (2004) examined the types of moves and strategies used by tutors facilitating the synchronous computer mediated communication debates in proportion to student responses in order to evaluate the efficacy of different move types. The researcher found that the most common move types were meta-statements, probe, challenge, inform and encourage

Based on the current literature, the findings of research studies are promising in terms of enhancing students' critical thinking skills in online environments based on various approaches. Results also support a gain in students' critical thinking dispositions.

Instructional techniques applied in online environments

Instructional techniques are educational activities which are shaped by instructional context like learning outcomes, content, and properties of a target group. Use of instructional techniques in online environments are so crucial since "… it is planned instructional methods that define formal education and allow for distinctions between serendipitous 'web surfing' and distance education" as stated by Kanuka, Rourke and Laflamme (2007, p. 261). Owing to this fact, many researchers investigated the impact of various instructional strategies like debate, Socratic questioning and problem-based learning, by considering different variables like academic achievement, critical learning, quality of instruction and deep learning (Kanuka, Rourke & Laflamme, 2007; Richardson & Ice, 2010; Khoshneshin, 2011; Park et. al., 2013; Lang et. al., 2013).

In their study, Şendağ and Odabaşı (2009) investigated how the online problem based learning (PBL) approach employed in an online learning environment influenced undergraduate students' critical thinking skills (CTS) and content knowledge acquisition. The researchers concluded that learning in the online PBL group had a significant effect on increasing the critical thinking skills. Another researcher, Hou (2011), conducted a case study which empirically explored the learning process of adopting collaborative online instructional discussion activities for the purpose of problem-solving using situated scenarios in a higher education course. Based on the findings, the researcher suggested "… when compared to general situated learning activity, discussions are of better quality when they involve a role-playing activity, which also yields the most diverse options for solutions" (p. 712).

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Yang, Newby and Bill (2005) investigated the effects of using Socratic questioning to enhance students' critical thinking (CT) skills in asynchronous discussion forums in university-level distance learning courses. The results of their study indicated that "… indicate that with appropriate course design and instructional interventions, CT skills can be cultivated and maintained in ADF [asynchronous discussion forums]." (p. 179). Similarly, Yang (2008), conducted a study to investigate whether students' critical thinking skills would improve after they participated in Socratic dialogues asynchronous online discussion forums, and concluded that an inspired instructor and some energetic teaching assistants who use Socratic dialogues during small-group online discussions can successfully develop students' critical thinking skills in a large university class.

Koh, Herring and Hew (2010) analysed the relationship between students' levels of knowledge construction during asynchronous online discussions with respect to engagement in project-based learning. Researchers found that although instructor's teaching discourse remained fairly consistent during project-based and non-project learning, students' "… online discussions during project-based learning were characterised by more advanced levels of knowledge construction, where ideas were rationalised and integrated into plausible solutions." (p. 284).

Kanuka, Rourke and Laflamme (2007) examined the influence of five groups of communication activities on the quality of students' contributions to online discussion. The researchers considered nominal group technique, debate, invited expert, WebQuest and reflective deliberation as communication activities, and cognitive presence for specifying the quality of discussions. As a conclusion, the researchers suggested that instructional methods affect the quality of students' contributions to online discussion. Richardson and Ice (2010) also investigated how various strategies can impact students' critical thinking levels. The researchers considered a case-based discussion, a debate, and an open-ended discussion as instructional strategies and they reached an evidence of critical thinking and underline the importance of students' comfort levels as a crucial factor in effective use of online discussions for enhancing higher order thinking skills.

Background and importance of the study

Although discussions are commonly used in online environments, pedagogical approaches used within these processes are rarely investigated. As stated by Bonk (2002), the major goal of more active and engagement for online learning experiences is to integrate expertise and experience of the learners to a group problem situation for discussion. Bonk (2002) also underlines the importance of usage of " … interactive and collaborative activities, a sense of variety and novelty in activities and delivery format, a sense of curiosity and fun in activities, engaging in discussion that involves multiple participants, and a supportive community of e-learners" (p. 90). Interesting and authentic problem situations from real context might increase learners' critical thinking dispositions. Based on the fact that critical thinking dispositions are directly related with motivation, all the factors which can be used to increase motivation should be taken into consideration. Besides, by designing the instructional process with given special emphasis to some issues such as instructional techniques, discussion rules and assessment criteria, educators should provide the sustainability of the motivation. According to Walker (2005), strategic concerns like presence of subject matter experts and guest facilitators, use of variety of writing activities, convergent, divergent, evaluative and Socratic-questioning strategies, case studies, and role playing activities can encourage critical dialogue. Hence, it is obvious that integrating various instructional methods of learning and motivation to promote critical thinking in online discussion environments are very important for effective discussion processes.

All of these studies and suggestions reveal the impact of different implementations in different settings on the critical thinking skills of students, which is at the very least, evidence of enhancement of critical thinking skills in online environments by selecting various instructional techniques. Based on these facts, the aim of this research study was to explore the effect of instructional techniques on critical thinking skills and critical thinking dispositions of students in online discussion based environments. For achieving this goal, Six thinking hats, Brainstorming, Role playing, Socratic seminar, and Anyone here an expert, were considered as instructional techniques for implementation in online discussions.

Methodology

Research design

This study was carried out in triangulation design. "The Triangulation Design is a one-phase design in which researchers implement the quantitative and qualitative methods during the same timeframe and with equal weight. This design is used when a researcher wants to directly compare and contrast quantitative statistical results with qualitative findings or to validate or expand quantitative results with qualitative data" (Creswell and Clark, 2007, p. 62).

The quantitative part was conducted in pre-test/post-test comparison design of quasi- experimental design. The independent variable of the study was instructional techniques having five levels as Six thinking hats, Brainstorming, Role playing, Socratic seminar, and Anyone here an expert. The dependent variables of the study were critical thinking and critical thinking dispositions. The scores of the critical thinking dispositions were gathered through California Critical Thinking Disposition Inventory (CCTDI). In the qualitative part of the research, after the four-week experimental process, the messages in online discussion were analysed and digitised based on the content analysis model of critical thinking. The design is presented in Table 1.

Table 1. Design of the study

Discussion groups	Pre-test	Discussion (4 weeks)	Post-test
Six thinking hats	CCTDI	D1	CCTDI Content analysis of critical thinking in online discussion (CACTOD)
Brainstorming	CCTDI	D2	CCTDI CACTOD
Role playing	CCTDI	D3	CCTDI CACTOD
Socratic seminar	CCTDI	D4	CCTDI CACTOD
Anyone here an expert	CCTDI	D5	CCTDI CACTOD
Mixed techniques	CCTDI	D6	CCTDI CACTOD

Participants

24 pre-service teachers who were attending a compulsory undergraduate course, the "distance education" offered by Computer Education and Instructional Technology (CEIT) at a private university in Turkey, participated in the study. Of the 24 students, 5 were female and 19 were male. Participants were randomly assigned to one of six groups by trying to equate academic achievement levels of group members (i.e. we tried to form homogenous groups). Each group composed of 4 students and there were a total of six groups formed for this study.

Context and process

The "Foundations of Distance Education" course was designed in a blended way, which uses both traditional and online activities through a learning management system, in concert. Chat was used as an online discussion tool by students to direct discussion sessions. During discussion processes, some students used the chat tool provided within the learning management system, while others preferred to chat via MSN messenger since they felt more comfortable with this system due to their prior experience. Starting with the 10th week of the course, chat sessions were conducted with six groups having different moderators each week. Hence, each student in each group played the role of moderator once. During discussions, Six thinking hats, Brainstorming, Role playing, Socratic seminar, and

Anyone here an expert, were used as instructional techniques for constructing the discussion process. The tutor didn't participate in any of the discussion sessions in order to prevent bias, but all the necessary information needed for an effective discussion process like ethics, discussion rules, implementation ideas and details of instructional technique were provided before discussion sessions.

With the Six thinking hats instructional techniques, students share their ideas about the problem from different perspectives according to the hat they are wearing. Parallel with the name of this technique, there are six hats with colours of white, red, black, yellow, green and blue. When students prefer the white hat, they might ask questions or call for information about the problem. With the red hat, they might express their emotions; with black hat, they might judge; with yellow hat, might be optimistic; with green hat, they might be creative including possibilities, alternatives or new ideas and with blue hat, they might think about their thinking process. While adopting this technique into online discussion, students wrote their thoughts with a different font colour according to the hats' meaning.

Brainstorming encourages students to share their ideas freely about the topic or problem. In this technique, students can express themselves with relevant or irrelevant words or ideas that are accepted without any criticism. After the idea sharing process is completed, teachers can go through the results and evaluate the responses for answering the problem. While adopting this technique into online discussion, students wrote relevant or irrelevant words or ideas. Then moderators evaluated the responses for answering the problem.

Role playing encourages students generate their ideas about the problem from different perspectives according to the roles they are assigned. With this technique, students might solve problem or share ideas from another perspective. In this study, students discussed their problems with assigned roles such as administrator, teacher, student and content specialist. They wrote assigned roles in parentheses with their nicknames.

Socratic seminar guides students to generate their ideas by asking questions of them, requesting clarification, evidence or suggestions from them. These interactive dialogues foster students to think more critically.

Anyone here an expert is similar to role playing. This technique encourages students to generate their ideas about the problem from different specialties they are assigned. In this study, students discussed their problems with assigned specialties such as technologist, programmer, social network expert and instructional designer.

Mixed techniques are composed of techniques mentioned above. Each week students discussed with different techniques respectively.

The students in this study have enrolled on a compulsory course "special instructional methods" focusing on the theoretical and practical issues of instructional methods and techniques. Nevertheless, instructional techniques were explained both in writing and verbally to the students. Before discussion sessions, California Critical Thinking Disposition Inventory was implemented for the students. Then the discussion topics were announced to students in order to provide students with enough time to search and get prepared for the session. After four weeks CCTDI were implemented to the students as a post-test.

The topics selected for discussion were as follows:
Do some professions such as Doctor, nurse, or paramedic, have their education in distance education programs? How much you can rely on these people when they receive a diploma from distance education programs?

We are aware that virtual communities create new structures based on a social software (blog, wiki, forum, chat, etc.) and social network (Facebook, Twitter, Flickr, Grou.ps, Ning, Delicious, etc.) for knowledge sharing. In this framework, discuss what are these applications? And which purposes are they used for?
Which teaching instructional methods and techniques may be more appropriate for e-learning process?
What do you foresee in terms of changes and innovations for the future of distance education? Based on your discussion what are your perceptions about the possible scenarios that we may face in the next five years?

Research questions

The aim of this research study was to explore the effect of instructional techniques on critical thinking and critical thinking dispositions in online discussion. For this purpose, questions presented below were answered:
1. Do instructional techniques affect critical thinking dispositions?
2. Do instructional techniques affect critical thinking?
3. What were pre-service teachers' critical thinking and critical thinking dispositions?

Data collection techniques

Quantitative - California critical thinking disposition inventory (CCTDI)

The original CCTDI includes 75 items having seven sub-scales. These are truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness and maturity. Kökdemir (2003) adapted this inventory to the Turkish. According to this adaptation study, 51 items having six sub-scales, analyticity, open-mindedness, inquisitiveness, self-confidence, truth-seeking, systematicity, were kept in the scale. The reliability coefficients of each sub-scale ranged from .61 to .78. Reliability of the whole scale was found to be .88 (Kökdemir, 2003).

Qualitative - Content analysis of the online discussion

Garrison, Anderson, and Archer (2001) created an efficient and reliable electronic assessment tool for the critical-thinking process (i.e., cognitive presence) as reflected in a computer-conference transcript. The element of cognitive presence has four categories in coding template such as triggering event, exploration, integration connecting ideas and resolution.

The first phase of the model is considered as the triggering event. In this event, an issue, dilemma, or problem that emerges from experience is identified or recognised. In the second phase, exploration, participants shift between the private, reflective world of the individual and the social exploration of ideas. This is a phase that students brainstorm, question, and exchange of information. In the third phase, integration, students construct meaning from the ideas generated in the previous phase. The last phase is a resolution of the dilemma or problem by means of direct or vicarious action.

Data analysis

To reveal whether there is a difference between groups, two way variance analysis (ANOVA) was calculated with the data gathered from Quantitative - California Critical Thinking Disposition Inventory. Moreover, the data in the online discussion was analysed and digitised based on the content analysis model of Garrison, Anderson, and Archer (2001).

Results

Critical thinking dispositions of pre-service teachers

The descriptive statistics of critical thinking dispositions of pre-service teachers are presented in Table 2.

Table 2. The descriptive statistics of critical thinking dispositions of pre-service teachers

Instructional Techniques	Pre-Test			Post-Test		
	N	Mean	*SD*	N	Mean	*SD*
Six thinking hats	4	205,75	26,56	4	208,00	38,56
Brainstorming	4	207,50	25,37	4	191,25	3,77
Role playing	4	201,00	20,03	4	203,25	15,41
Socratic seminar	4	195,50	7,42	4	204,50	34,51

Anyone here an expert	4	194,25	12,74	4	190,00	10,92
Mixed techniques	4	199,75	17,25	4	200,25	18,26

As seen in Table 2, the mean difference of pre- and post-test results of the groups showed very little difference. The major difference was observed for Socratic Seminar group. Therefore, the ANOVA results tested for whether there was a significant difference between pre- and post-test results (see Table 3). According to the results, there wasn't a significant difference between pre- and post-test results of the students' critical thinking dispositions [F(1,18)=0.47 p>.05]. In other words, discussing with different instructional techniques did not cause any significant differences to critical thinking dispositions. This result may show that the instructional techniques may not have impact on critical thinking dispositions.

Table 3. The ANOVA results

Source of Variation	Sum of Squares	df	Mean Square	F	p
Between-Subjects	12336,667	23			
Group		913,167	5	182,633	,288	,914
Error		11423,500	18	634,639		
Within-Subjects	6313,000	24			
Pre-post tests		14,083	1	14,083	,046	,833
Group*Pre-post tests		**732,917**	**5**	**146,583**	**,474**	**,791**
Error		5566,000	18	309,222		
Total	18649,667	47			

When weekly participation of pre-service teachers to online discussion according to instructional techniques was considered (Table 4), for the Six thinking hats group, the total number of sentences was 878, while the number of coded sentences was 473 and the number of non-coded sentences was 405. For the Brainstorming group, the total number of sentences was 558, while the number of coded sentences was 474 and the number of non-coded sentences was 84. For the Role playing group, the total number of sentences was 391, while the number of coded sentences was 272 and the number of non-coded sentences was 119. For the Socratic seminar group, the total number of sentences was 453, while the number of coded sentences was 393 and the number of non-coded sentences was 60. For the Anyone here an expert group, the total number of sentences was 663, while the number of coded sentences was 517 and the number of non-coded sentences was 146. For the Mixed techniques group, the total number of sentences was 603, while the number of coded sentences was 519 and the number of non-coded sentences was 84.

Table 4. The number of coded, non-coded and total sentences

Instructional Technique	Number of Coded Sentences	Number of Non-Coded Sentences	Number of Total Sentences
Six thinking hats	473	405	878
Brainstorming	474	84	558
Role playing	272	119	391
Socratic seminar	393	60	453
Anyone here an expert	517	146	663
Mixed techniques	519	84	603

When the data of weekly participation of pre-service teachers to online discussion according to instructional techniques was examined in general, it is easily seen that pre-service students shared the highest number of sentences in the Six thinking hats group. In second place was the Anyone here an expert group, and the third was Mixed techniques. But when coded sentences were examined, the Mixed techniques group was first, the Anyone here an expert group was second and the Brainstorming group was third. These results may show that the Mixed techniques group performed with the best ability of critical thinking, the Anyone here an expert group was second and the Brainstorming group was third in terms of performing critical thinking ability in online discussion.

Critical thinking of pre-service teachers in online discussion

When the phases of the critical thinking were examined in the coded sentences (Figure 1), the Six thinking hats group has 78 sentences for triggering event, 315 for exploration, 92 for integration and 0 for resolution phase. The Brainstorming group has 37 sentences for triggering event, 333 for exploration, 107 for integration and 0 for resolution phase. The Role playing group has 52 sentences for triggering event, 193 for exploration, 30 for integration and 0 for resolution phase. The Socratic seminar group has 61 sentences for triggering event, 297 for exploration, 42 for integration and 0 for resolution phase. The Anyone here an expert group has 81 sentences for triggering event, 409 for exploration, 39 for integration and 0 for resolution phase. And finally, the Mixed techniques group has 61 sentences for triggering event, 397 for exploration, 90 for integration and 0 for resolution phase.
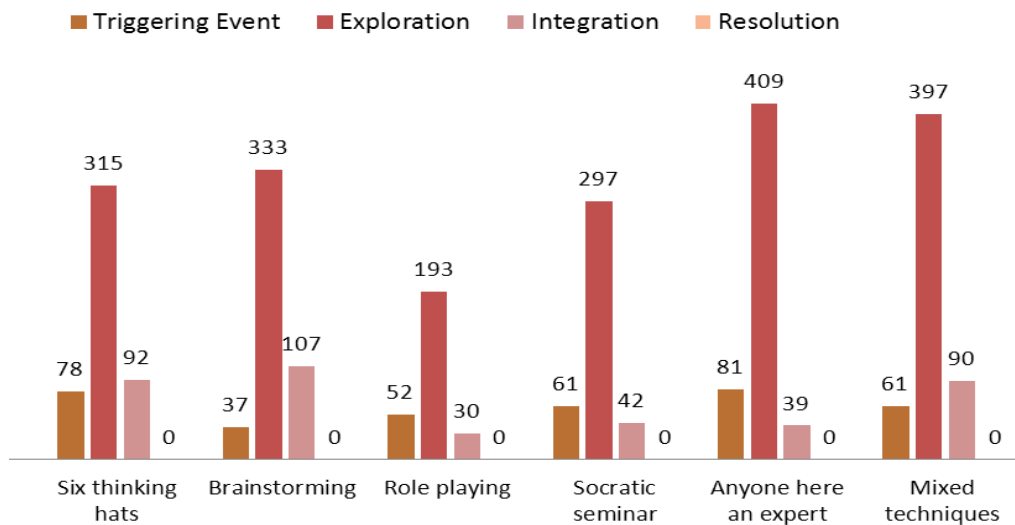

*Figure 1.*The phases of the critical thinking in the coded sentences

In the triggering event phase, the group of Anyone here an expert shared the most ideas, the second was Six thinking hats and joint third was Mixed techniques and Socratic seminar. In the exploration phase, the group of Anyone here an expert shared the most ideas, the second was Mixed techniques and Brainstorming was third. In the integration phase, the group of Brainstorming shared the most ideas, the second was Six thinking hats and the third was Mixed techniques. Finally, no group shared ideas matching with resolution phase. Sample statements from different discussion groups are presented below (Table 5).

Table 5. Sample statements from different discussion groups

Phases	Sample Statements from different discussion groups
Triggering event	Do you have any suggestions as a methodology expert? Which software should be used? (Anyone here an expert)
	To what extend can you trust doctors in case they educated at a distance and got their diplomas based on a distance education model? (Socrates seminar)
Exploration	I think that both educators and students have the chance of learning via interactive technologies like whiteboard and audio-conference applications (Mixed techniques)
	According to me that should be robots donated with human characteristics including the body infrastructure. These robots can be used by doctoral candidates to make their applications. (Brainstorming)
	Students may prefer more instructor-controlled environments for their teaching-learning processes. From different points of view, each social network can provide various contributions, but age and student characteristics are so important (Anyone here an expert)
	I prefer demonstration and hands-on experience in general. The method that I will choose can also change according to the course content. Let me introduce you the demonstration method (Role Playing)
Integration	I also agree that we cannot trust to all information shared on the Internet (Anyone here an

	expert)
	Yes, we can get members of various social network sites and make applications by using only one web address (Mixed techniques)
	Let us summarise what we have talked about up to now. Both face-to-face education and distance education has advantages and disadvantages. The important point is to merge the possible advantages of the two methods to reveal an effective approach by eliminating disadvantages (Six Thinking Hats)
	This is really a very nice innovation. As our moderator underlined, we currently cannot prevent cheating in distance education exams. By using this new technology, a new era is beginning. (Role Playing)
Resolution	None coded

Discussion and conclusion

The aim of this research study was to explore the effect of instructional techniques on critical thinking and critical thinking dispositions in online discussion. For exploring this effect, Six thinking hats, Brainstorming, Role playing, Socratic seminar, and Anyone here an expert were selected as an instructional techniques for online discussion.

Based on the quantitative analysis, it can be concluded from this research study that discussing with different instructional techniques (Six thinking hats, Brainstorming, Role playing, Socratic seminar, Anyone here an expert) did not cause any significant differences to critical thinking dispositions. The reason for this finding may be related with the motivation levels of the students, since critical thinking disposition of the students is directly related with their personal characteristics. On the other hand, the low number of students (each group was composed of 4 students) and the shortness of the discussion period (4 weeks) might also be indicated as the possible reasons for this finding. Some other possible contributors to this finding may be that students were not familiar with the instructional techniques (in fact this was the first time for an implementation of an instructional technique and discussing for a course in a virtual environment for all students) and this virtual discussion application was the first experience of students in terms of being a moderator. Some suggestions for overcoming these possible obstacles may be conducting discussions in larger groups (about 8-10 students) and making an increase in the duration of the discussion intervals (at least 6 or 8 weeks). Parallel with these ideas, exploring the process in depth by observing and making interviews may reveal obstacles faced by the students and give punctual and more realistic information about the context.

Another finding is that although not statistically significant, there is at least a difference between the Socratic seminar group and the other groups. Maybe in the discussion process, Socratic questioning helped students to exchange their thoughts, evaluate their perspectives critically and come to the conclusion about the discussion topic. This finding shows similarity with the other findings reported in the literature. For example, results of the study of Yang, Newby and Bill (2005) indicated that Socratic questioning helped students demonstrate a higher level of CT skills. Another study of Yang (2006) resulted that critical thinking dispositions could be enhanced via the teaching and modelling of Socratic dialogues on a series of asynchronous online discussions.

When the qualitative part of the study was examined, the Socratic seminar group performed with the least ability of critical thinking. In the qualitative part, the Mixed techniques group performed with the best ability of critical thinking, the Anyone here an expert group was the second and the Brainstorming group was third in terms of performing critical thinking ability in online discussion. Getting the best performance from Mixed techniques groups can be interpreted as this group used all of the instructional techniques one by one. This experience probably made the group realise the strengths and weaknesses of the discussion process and thereby make differentiation between the techniques. This group should also be more motivated at each discussion process, since they will try another instructional technique which increases their anxiety more than other groups. Individual differences between students might also cause for this result. Every student can prefer another technique for discussing. Thus, if one student cannot show a good performance with one technique, he/she can contribute more with another. As also stated by Keller and Suzuki (2004), "No matter how interesting a given tactic is, people will adapt to it and lose interest over time. Thus, it is important to vary one's approaches and introduce changes of pace" (p. 231). Hence, for discussion sessions in e-Learning environments the use of mixed techniques should be suggested for effectiveness in teaching. On the other hand, another way of increasing critical thinking performance and dispositions might be the presence of

the instructor in the discussion environment. Similarly, some studies conclude the importance of expert contribution to the discussion processes in terms of critical thinking (Yang, 2008; Dennen, 2002; Havard, Du & Olinzock, 2005). Hence a future study may apply these or other discussion techniques in online environments with the help of an expert.

The findings of the study indicated that Anyone here an expert group was the second in terms of critical thinking performance. Like the first group, this group also had some sources of motivation for each discussion session, since their roles of expertise and their viewpoints for discussing the topic changed each week. Considering the discussion topic from diverse expertise approaches, trying to get different point of views and evaluating new ideas from these diverse roles should lead each group member to express themselves in a more efficient way. Finally, getting Brainstorming group as the third group in critical thinking performance is not surprising, since this technique fosters creativity without worrying about the correctness of the proposed ideas in a flexible climate and is an unbounded discussion environment. Hence dealing with the motivation variable for the discussion processes can be another aspect for future studies.

Although limited in terms of the number of students, the duration of the discussions and the discussion topics, this research study revealed important aspects of virtual discussions in terms of critical thinking phenomenon. The main point which emerged from this study is the importance of using different instructional techniques or using instructional techniques that should make students think diversely for each distinct discussion process. Based on the findings of this study, it is obvious that when students perceive the discussion process as an ordinary situation, after each week they got used to it and their performance did not increase. As a conclusion, if the instructor makes at least slight differences in terms of nature of behaviour and thinking processes that the student will show in the discussion process, the performance of student's increases in a very short time with very few people. As instructors we should provide our students with rich learning environments and a variety of learning possibilities for effective teaching which shows the importance of considering individual differences and diversity in our instructional design processes (Bonk, 2002; Walker, 2005). Thus, future research studies should reconsider similar discussion topics or dilemma, and make use of different instructional techniques in order to measure critical thinking and dispositions by changing the duration and number of participants.

References

Bonk, C. J. (2002). *Online training in an online world.* Retrieved on May 3, 2012 from http://www.publicationshare.com/docs/corp_survey.pdf

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.

Dennen, V. P. (2002, April). *Learning online through asynchronous discussion: Instructional design and facilitation Issues*. Paper presented at American Educational Research Association Conference, New Orleans, LA.

Facione, P. A. (2007). *Critical thinking: What it is and why it counts*. Millbrae, CA: California Academic Press.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking and computer conferencing: A model and tool to assess cognitive presence. *American Journal of Distance Education, 15*(1), 7-23.

Halpern, D. F. (1999). Teaching for critical thinking: Helping college students develop the skills and dispositions of a critical thinker. *New Directions for Teaching and Learning, 89,* 69-74.

Han, H. S. & Brown, E. T. (2013). Effects of critical thinking intervention for early childhood teacher candidates. *The Teacher Educator, 48*(2), 110-127.

Havard, B., Du, J., & Olinzock, A. (2005). Deep learning: The knowledge, methods, and cognition process in instructor-led online discussion. *The Quarterly Review of Distance Education, 6*(2), 125-135.

Hou, H. (2011). A case study of online instructional collaborative discussion activities for problem-solving using situated scenarios: An examination of content and behavior cluster analysis. *Computers & Education, 56*(3), 712-719.

Jeong, A. C. (2003). The sequential analysis of group interaction and critical thinking in online threaded discussions. *American Journal of Distance Education, 17*(1), 25-43.

Kanuka, H., Rourke, L., & Laflamme, E. (2007). The influence of instructional methods on the quality of online discussion. *British Journal of Educational Technology, 38*(2), 260–271.

Keller, J. M., & Suzuki, K. (2004). Learner motivation and e-learning design: A multinationally validated process. *Journal of Educational Media, 29*(3). Retrieved on May 3, 2012 from http://www.gsis.kumamoto-u.ac.jp/ksuzuki/resume/journals/2004a.pdf

Khoshneshin, Z. (2011). Collaborative critical thinking in online environment. *Procedia-Social and Behavioral Sciences, 30*, 1881-1887.

Koh, J., Herring, S. C., & Hew, K. (2010). Project-based learning and student knowledge construction during asynchronous online discussion. *Internet and Higher Education, 13*(4), 284-291.

Kökdemir, D. (2003). *Belirsizlik Durumlarında Karar Verme ve Problem Çözme*. [Decision Making and Problem Solving under Uncertainty]. (Unpublished doctoral thesis). Ankara University, Ankara, Turkey.

Lang, G. M., Beach, N. L., Patrician, P. A., & Martin, C. (2013). A cross-sectional study examining factors related to critical thinking in nursing. *Journal for Nurses in Professional Development, 29*(1), 8-15.

Loes, C., Pascarella, E., & Umbach, P. (2012). Effects of diversity experiences on critical thinking skills: Who benefits? *The Journal of Higher Education, 83*(1), 1-25.

MacKnight, C. B. (2000). Teaching critical thinking through online discussions. *Educause Quarterly, 4,* 38-41. Retrieved on February 2, 2012 from http://net.educause.edu/ir/library/pdf/EQM0048.pdf

Onions, P. E. W. (2009). Thinking critically: An introduction, working paper. Retrieved on February 2, 2012 from http://www.patrickonions.org/docs/academic/2009%20Thinking%20critically.pdf

Park, M. Y., McMillan, M. A., Conway, J. F., Cleary, S. R, Murphy, L., & Griffiths, S. K. (2013). Practice-based simulation model: A curriculum innovation to enhance the critical thinking skills of nursing students. *The Australian Journal of Advanced Nursing, 30*(3), 41-51.

Perkins, C., & Murphy, E. (2006). Identifying and measuring individual engagement in critical thinking in online discussions: An exploratory case study. *Educational Technology & Society, 9*(1), 298-307.

Richardson, J. C., & Ice, P. (2010). Investigating students' level of critical thinking across instructional strategies in online discussions. *The Internet and Higher Education, 13*(1-2), 52-59.

Şendağ, S., & Odabaşı, H. F. (2009). Effects of an online problem based learning course on content knowledge acquisition and critical thinking skills. *Computers & Education, 53*(1), 132-142.

Walker, G. (2005). Critical thinking in asynchronous discussions. *International Journal of Instructional Technology and Distance Learning, 2*(6). Retrieved on May 3, 2012 from http://www.itdl.org/Journal/Jun_05/article02.htm

Walker, S. A. (2004). Socratic strategies and devil's advocacy in synchronous CMC debate. *Journal of Computer Assisted learning 20*, 172–182.

Yang, Y. C. & Chou, H. (2008). Beyond critical thinking skills: Investigating the relationship between critical thinking skills and dispositions through different online instructional strategies. *British Journal of Educational Technology, 39*(4), 666–684.

Yang, Y. C. (2006). Cultivation of critical thinking disposition via asynchronous online discussion. *Proceedings of the 28th Annual Conference of the Cognitive Science Society (CogSci)* (pp. 2631). NJ: Lawrence Erlbaum Associates.

Yang, Y. C. (2008). A catalyst for teaching critical thinking in a large university class in Taiwan: Asynchronous online discussions with the facilitation of teaching assistants. *Education Technology Research and Development, 56*, 241–264.

Yang, Y. C., Newby, T. J., & Bill, R. L. (2005). Using socratic questioning to promote critical thinking skills through asynchronous discussion forums in distance learning environments. *The American Journal of Distance Education, 19*(3), 163–181.