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The impact of reflective thinking activities in e-learning: A critical review of the empirical research☆

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ABSTRACT

The purpose of this study is to reveal the impact of e-learning environments supported with reflective thinking activities on students' academic success, social presence perception and on their motivation. Experimental design with pretest-posttest control group was used in the study. Three different learning environment were compared within the scope of the study. Students in Study Group I completed the experimental process using the podcasts supported with reflective thinking activities whilst students in Study Group II completed the process using podcasts which were not supported with reflective thinking activities and students in Study Group III completed the experimental process using web-based videos. The study was carried out for 6 weeks on 103 students studying in a distance education programme of a university. Both qualitative and quantitative data collection techniques were used; and the data was collected using achievement test, social presence perception scale, Instructional Materials Motivation Survey and student opinion identification form. The results of the study revealed that use of podcasts supported with reflective activities were more efficient in ensuring post-test success and motivation, compared to others. In terms of social presence perception, on the other hand, there was no significant difference between study groups. Based on the results of qualitative data analysis, recommendations were made on how to use reflective thinking activities in e-learning environment designs and on how to utilize podcast technology.

1. Introduction

Social structure and rapid change in needs increased the interest in distance education. According to the results of a research carried out by Allen and Seaman (2010), the number of distance higher education programmes has been increasing rapidly. In addition, it is also indicated in the same study that the growth rate in distance education programmes outruns the growth rate in other higher education programmes. Although the number of students in distance education programmes are increasing rapidly, studies show that almost 30%–50% of the students studying in a distance education programme fail to complete the courses and drop the programme/course (Dutton, Dutton, & Perry, 2002; Moore & Kearsley, 2011; Simpson, 2004).

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In a study conducted by Distance Education and Business Council, information from 61 institutions was collected. According to this information, almost 16% of the students who enrolled to distance education programmes never started the programmes, 57% of them could only complete one course and graduation rate from these programmes was almost 38% (Cited in. Moore & Kearsley, 2011). The high number of students dropping out of the programme increased the number of studies on the subject (Bolliger, Supanakorn, & Boggs, 2010; Kearsley & Lynch, 1996; McKinney, Dyck, & Luber, 2009; Moore, 2003; Offir, Lev, Lev, Barth, & Shteinbek, 2004; Rosell-Aguilar, 2013). Motivation is considered as an important factor for students in continuing learning in distance education, enjoying the process of learning and increasing their academic success (Bolliger et al., 2010; Çiftci, KılıçÇakmak, Üstündağ, & Karataş, 2009; Liao, 2006; Shih, Chu, Hwang, & Kinshuk, 2011). As for, Al-Samarraie, Teo, and Abbas (2013) motivation along with other factors is necessary for developing thinking skills in distance education. Owston (1997) claims that in order to ensure student motivation in distance education it is important for students to be mentally present in the learning environment and to take active roles in distance education process. And, there are various studies on how to utilize high-order thinking skills in ensuring student motivation in distance education (Bekele, 2010; Chen & Jang, 2010; Hartnett, 2010; Mohamad, Tasir, Harun, & Shukor, 2013; Pintrich & De Groot, 1990; Rahimi & Katal, 2012; Zhan, Xu, & Ye, 2011). Two main factors, which are (a) the strategy to be used and (b) the technology to be used, stand out in ensuring student motivation in distance education in the studies conducted.

When the factor related to strategy is analyzed, such high-order skills and approaches as critical thinking, metacognitive thinking and problem solving are approaches that could enable students to be mentally present in the learning environment and to take active role (Gleaves & Walker, 2013; Kay & Kletskin, 2012; Rahimi & Katal, 2012; Yeh, 2004). Another high-order thinking approach that can be used in e-learning process is reflective thinking. The aim of reflecting or reflective thinking is to analyze the existing condition and information and to use the findings of the analyzed information in changing or enriching possible conditions and events that could be encountered in the future (Brookfield, 1995; Dewey, 1933; Schön, 1983). Many studies in the literature indicate that reflecting plays a significant role in constructing knowledge and improving learning (Barnert, 2006; Chen, Wei, Wu, & Uden, 2009; Kızılkaya, 2009; White & Frederiksen, 1998).

In environments with reflective thinking activities students have more individual responsibility and are supposed to be more aware of their cognitive processes. Therefore, the importance of reflecting and reflective activities in e-learning environment increases. As for Uzunboylu, Bicen, and Cavus (2011) using reflecting efficiently in e-learning environments as a learning strategy is necessary. Especially, when the latest literature is reviewed, it is seen that reflective thinking approaches play a significant role in e-learning and technology-based learning studies (Chang & Lin, 2014; Mohamad et al., 2013).

When technology, the other important factor in student motivation in distance education, is looked into, it is seen that such technologies as social networks, blogs, web conferences and particularly web 2.0 technology and mobile learning have been utilized recently (Hew & Cheung, 2013; Uzunboylu et al., 2011). However, rather than using the latest technology, the main objective of technology use is to decide on the most convenient technology within the framework of instructional design. In addition, another important point is to decide on the technology that could support reflective thinking activities which is considered to have an increasing importance particularly in e-learning and technology-based learning environments. When students are physically away from the learning environment, it is difficult for the teacher to communicate with students as they do face-to-face in the classroom. Therefore, it is illustrated that teachers' encouraging reflecting and the use of technological tools in using reflective thinking skills have an important role (Herrington & Oliver, 2002; Kızılkaya, 2009; Lin, Hmelo, Kinzer, & Secules, 1999; Saito & Miwa, 2007). According to Jonassen and Carr (2000) technology can be used as a tool to create deep reflective thinking necessary for meaningful learning. Particularly asynchronous interaction environments give students the possibility to ask questions and think about ideas and viewpoints after reflective thinking (Cho, Lee, & Jonassen, 2011). Using various communication and sharing opportunities provided by educational technologies students are making discussions and sharing things about the problems they encounter in the process of learning. So, the use of technology in using reflective thinking activities is important. Researchers indicate that various web 2.0 tools and media such as wiki, blog, forum and social networks could be used to support reflective thinking (Hew & Cheung, 2013; Mohamad et al., 2013; Uzunboylu et al., 2011). Studies that discuss reflective thinking approach and technology use together, it is indicated that podcast technology could be used as an important tool in implementing reflective thinking approach (Kızılkaya, 2009; Leong & Tan, 2008; Turner, 2010).

Podcasts are media that aim to reach users without being bound by spatial and temporal obstacles and they include learning content towards the need of the user. With their time-independent and non-spatial use, podcasts offer various opportunities for online classes. That podcasts structure enabling the use of text, sound and images together as well as the ease of using it attracted the attention of many researchers to use it as a learning and teaching tool (Evans, 2008; Lee & Chan, 2007). Podcasts can be used in producing new learning materials and organizing existing materials (Hew, 2009; Kay, 2012). How podcasts, which has been widely accepted by users especially in the field of education lately and which has become quiet common, can be combined with reflective thinking approach, and how this approach and technology can be used together are issues to be studied. In order for educational podcast designs to be successful, it is necessary to consider method-media discussions in educational technology literature. When the nature of reflective thinking is looked into, it is seen that it includes preparing student for teaching/planning one's own learning process, questioning one's own learning-teaching and thinking processes, self-evaluation, and to think about what to due to solve the problems found as a result of self-questioning and self-evaluation. In the light of this, researchers want to know what kind of an effect will supporting learning materials, prepared as podcasts, with reflective questions that will enable them to plan, monitor and evaluate their own learning process, have on motivation factor which is seen as a main problem in distance education. In the light of this, what kind of an

effect will podcasts, supported with reflective questions that will enable student to plan, monitor and evaluate their own learning process, have on motivation is a topic to be studied in-depth.

One other issue of concern regarding whether podcast technology and reflective thinking used in e-learning could be used in education is if social presence perception changes depending on the existence of reflective thinking support in the podcast. The main aim of creating social presence perception in the learning environment is to create a motivating learning environment for teacher or students and to enable individuals to express themselves freely (Aragon, 2003). Social presence perception in e-learning environment is considered as a measure of students' feeling of being a community in the environment. Podcasts' features such as involving such multimedia elements as sound and image offers opportunities in asynchronous distance learning environments, where mostly students do not see the face of the teacher or hear the voice of the teacher, and thus, increase students face-to-face connection to the teacher. With podcasts compatibility with portable media devices, students are able to find the teacher in front of them through these podcasts at anytime and anywhere during the day. This results in the emergence of the idea that podcasts could be used as tools to help to increase social presence perception particularly in asynchronous distance education environments. Also, it is believed that among learning materials prepared as podcasts, questions towards students to plan, monitor and evaluate their own learning process will reduce the transactional distance between student and teacher and improve social presence perception. It is believed that podcasts supported with reflective questions will improve student-teacher interaction and social presence perception.

In the light of the hypothesis stating that podcast technology supported with reflective thinking activities will improve motivation and social presence, it is believed that it will effect success positively. Because it is anticipated that reflective questions in podcast learning materials towards planning, monitoring and evaluating one's own learning process will improve students' self-regulation competencies as well as their awareness on this issue and thus, will enable them to see their insufficiencies in learning and make an effort to remove these insufficiencies and as a result of this, podcasts supported with reflective thinking activities will improve academic success.

Based on the review of the literature, it is seen that there are many things to be studied on reflective thinking activities and podcast technology which has an increasing utilization particularly in distance education and technology supported learning environments. Taking all these into consideration, the overall objective of this study is to find out the effect of e-learning environments supported with reflective thinking activities on academic success, social presence perception and motivation of students. In the light of this objective, answers to the following questions are looked into:

1) Is there a statistically significant difference in academic success scores of the students using different e-learning environments;
   a) Depending on whether the learning environments are supported with reflective thinking activities,
   b) Depending on whether the used technology is a podcast or video?
2) Is there a statistically significant difference in social presence scores of the students using different e-learning environments;
   a) Depending on whether the learning environments are supported with reflective thinking activities,
   b) Depending on whether the used technology is a podcast or video?
3) Is there a statistically significant difference in motivation scores of the students using different e-learning environments depending on whether the environment is supported with reflective thinking activities?
4) What are student opinions on e-learning environments?

2. Method

2.1. Research design and the process of implementation

Experimental design with pre-test-post-test control group was used in the study. The first factor including the three levels in the design illustrates the three different experimental processes (Study Group I, using the podcast learning environment supported with reflective thinking activities, Study Group II, using the podcast learning environment that is not supported with reflective thinking activities and Study Group III using video learning environment not supported with reflective thinking activities; detailed in 2.4 section); whilst the second factor comprised of two levels, illustrates measurements before and after the experimental process (pre-test, post-test). Both qualitative and quantitative research methods were used in the study. And three different learning environments were used for three different Study Groups based on the use of reflective thinking activities and the type of technology used (podcast/video). At the beginning of experimental process, achievement test and social presence tests were administered to the students in the study groups. And after the experimental processes, students were administered success test, social presence test, Instructional Materials Motivation Survey (Study Group I and II) and student opinion forms towards identifying student opinions on e-learning environments.

2.2. Study groups

The study group of the study was 103 students studying at distance education programmes of a state university in Turkey. And the departments they studied were Turkish Language and Literature, Sociology and Computer Programming. The study

groups included in the scope of the study were formed considering the university entrance examination results of the students. To ensure the equivalency of the groups, after students in the study groups were put in order starting with the one with the highest university entrance examination score to the one with the lowest score, they were randomly assigned to three different study groups starting with the highest score. As a result of this random assignment, Study Group I had 34 students; Study Group II had 34 students and Study Group III had 35 students.

2.3. Data collection tools

The data of this study were collected through an academic success test covering information technology law, social presence scale used to measure students' social presence perception, Instructional Materials Motivation Survey used to measure student motivation and student opinion form used to identify student opinions on e-learning environments.

2.3.1. Achievement test

IT Law Achievement Test, used as pre-test and post-test in the study in order to identify student achievement, was developed by the researchers. The questions in the test were prepared in line with the objectives and learning outcomes identified in the relevant literature and then, sent for expert opinion. Based on the suggestions from the experts, necessary changes were made. The pilot study of the achievement test prepared was administered to 113 junior and senior students who previously took IT law course. By removing the test questions whose item difficulty and discrimination indexes were out of the limit values, the achievement test was finalized. Kuder-Richardson 20 (KR-20) reliability of the achievement test was calculated and the reliability coefficient was found as 0.78. And it surpassed the suggested threshold value of. (Nunnally, 1967). The item difficulty indexes of the items in the test range between .25 and .88. The discrimination indexes of the items in the test range between .23 and .53. The achievement test including 25 multiple choice questions was used as pre-test and post-test in the study.

2.3.2. Social presence scale

As it is stated in the second research problem of the study, in order to identify social presence perceptions of the students in the learning environment they study, social presence scale originally developed by Kang, Choi, and Park (2007); and adapted into Turkish by Olpak and Kılıç Çakmak (2009) was used. The social presence scale which was adapted into Turkish by Olpak and Kılıç Çakmak (2009) involves 3 subscales which are co-presence (5 items), influence (7 items) and cohesiveness (7 items) and a total of 19 items. All the items of the scale were positively formed. And the participants indicate to what extent they agree with each statement on a five point likert scale ranging between "I completely disagree (1)", "I disagree (2)", "I am not sure (3)", "I agree(4)", and "I completely agree (5)". High scores from the scale indicate that the individual feels socially present in the environment. Cronbach alpha values for the social presence scale involving three subscales was measured as 0.79 for co-existence; 0.86 for influence and 0.91 for cohesiveness factors. The reliability coefficient for the whole scale was found as 0.94. Before the scale was used in the study, its validity and reliability study was checked by administering it on 252 students and the reliability coefficient for the whole scale was found as 0.92. The scale whose reliability and validity were checked by the researchers was then, used within the scope of the study.

2.3.3. Instructional materials motivation survey

"Instructional Materials Motivation Survey" originally developed by Keller (2006) and adapted by Bolliger et al. (2010) towards student motivation related to podcast materials was adapted into Turkish by the researcher in order to measure student motivation. Instructional Materials Motivation Survey has four subscales which are attention (12 items), relevance (9 items), confidence (9 items) and satisfaction (6 items) and a total of 36 items. The 3, 7, 12, 15, 19, 22, 26, 29, 31, 34th items in the survey were recoded by reversing the likert-scale responses. Students indicated to what extent they agreed to each statement by choosing from a five-point likert scale ranging between "I completely disagree (1), "I disagree (2)", "I am neutral (3)", "I agree (4)", and "I completely agree (5)". High scores from the survey indicate that students' motivation towards the environment is high. In the language equivalence study in the adaptation process of the survey into Turkish, a high, positive and significant relationship was found between the original survey and the one adapted into Turkish [$r = 0.87$; $p < 0.01$]. To find out to what extent the original factor structure of Instructional Materials Motivation Survey was compatible with the collected data, concordance statistics were calculated using Confirmatory factor analysis (CFA) on 250 students. As a result of CFA, 7th and 26th items whose t values were not significant were removed from the survey and the final survey included 34 items. The analyses were conducted once again. The CFA results are as given: [$x^2(250) = 1640.90$, ($sd = 520$, $p = 0.0000$); $x^2/sd = 3.16$; RMSEA = 0.093, RMR = 0.11; SRMR = 0.079, GFI = 0.72, AGFI = 0.68, IFI = 0.96, CFI = 0.96, NFI = 0.94 and NNFI = 0.96]. Reliability coefficient for the whole scale was found as 0.95. And test-retest reliability of the scale was 0.91. These results, in other words, that the reliability and test-retest correlation of the survey are high, indicate that the survey is reliable.

When the results of the analyses are examined, it was seen that x^2/sd value was 3.16 and it is stated that values 5 and smaller than 5 shows an average fit (Kline, 2005; Sumer, 2000). RMSEA values smaller than 0.10, on the other hand, indicate a poor fit (Tabachnick & Fidell, 2001). It is stated that SRMR values at 0.08 and below indicate a good fit (Brown, 2006; Hu & Bentler, 1999). RMR value below 0.10 indicates that it is acceptable (Anderson & Gerbing, 1984). Here, although the RMR values of the tested model are below 0.11, they are close to that value. GFI values above 0.85 and AGFI values above 0.80

indicate an acceptable fit (Anderson & Gerbing, 1984). That the GFI value is 0.72 and AGFI value is 0.68 in this tested model indicates that these are beyond acceptable values. The reason behind this could be that GFI and AGFI are both very sensitive to sample size (Tabachnick & Fidell, 2001). In addition, IFI, CFI, NFI and NNFI indexes above 0.90 is an acceptable fit (Tabachnick & Fidell, 2001).

2.3.4. Student opinion form

In order to find out student opinions on the e-learning environments where students studied a Student Opinion Form including semi-structured questions was developed. And this student opinion form was administered as a post-test to the students in the study groups after the experiment. Based on the answers of the students in student opinion form, students' opinions on environments with and without reflective thinking activities and on learning environments where podcast and video were used, were determined.

2.4. Learning environments

Three different learning environments for three different study groups (Study Group I, Study Group II and Study Group III) were developed in the study. These were;

- Podcast Learning Environment supported with Reflective Thinking Activities (Learning Environment I),
- Podcast Learning Environment not supported with Reflective Thinking Activities (Learning Environment II),
- Video Learning Environment not supported with Reflective Thinking Activities (Learning Environment III).

The main differences between these three learning environments were as given: In Learning Environment I, the learning contents were presented to students as podcasts and in the process of preparing these podcasts, reflective thinking activities were included. Each week, questions towards reflective thinking were asked before, during and after the podcast learning contents. In addition, in order to support students' reflective thinking on the topics to be learned and to enable them to make reflective discussions, blog was added to the Learning Environment I and it was utilized during the discussion process. Blogs included examples from everyday life on the topics that were presented to the students via the podcasts every week and students were asked reflective questions on these topics; thus, they were expected to participate in thinking activities and make discussions on the topic.

In Learning Environment II, the learning contents were also presented to students as podcasts yet in the process of preparing these podcasts, reflective thinking activities were not included unlike Learning Environment I. In Learning Environment III, on the other hand, the learning contents were presented to students as videos over the Learning Management System (LMS) and as in Learning Environment II, reflective thinking activities were not included here. Which Study Group would use which learning environment was randomly assigned.

The main purpose of comparing video and podcast environments is to examine whether accessibility to learning contents has an impact on academic success, social presence perception and motivation. Podcasts which are mostly shown as alternative to videos have certain differences compared to videos: The content in podcast could be both an audio file or video as well as other contents and documents in mp3, mp4, pdf, pptx, jpg, docx, page link (url) format on internet. The main feature of podcast is the subscription. After subscription, the learning contents/materials (new episode) automatically download on your mobile device/computer. The podcasts prepared in this study are broadcasted over podbean.com free podcast hosting web page. With their Really Simple Syndication (RSS) feeds, podcasts uploaded to the podcast-hosting site are available on iTunes as well. Students are given the subscription links through (LMS).

2.4.1. Reflective thinking activities

Study Group I carried our various reflective thinking activities throughout the learning process. The reflective question and sample cases given in Study Group I were prepared by the researcher based on literature review. Later, these questions and sample cases were sent for expert opinion and according to the suggestions from the experts, necessary arrangements were made and the questions and sample cases were finalized. The following practices were conducted in Study Group I within the scope of reflective thinking activities.

Before the podcast learning material that was opened for student access weekly was opened for student access, students were presented "*Let's Think Before we start the Course*" activity and they were asked various reflective questions towards questioning themselves on the topic of the week. The aim with these questions, which were prepared within the framework of self-questioning approach of reflective thinking process, was to check students' prior knowledge, to make them make comments and produce new ideas. Within the scope of questioning oneself approach, students were asked such questions as: "*Do you have prior knowledge on the topic? If yes, what do you know?", "What kind of benefits do you think knowing this topic will bring you?", "Where do you come up with such things as you will learn about this topic in everyday life*?" After students answered these questions through the LMS, podcasts prepared on the topic of the week were uploaded on the mobile devices/computers of the students through a membership system.

Reflective thinking activities were also included within the podcasts; and these activities were based on reflective questions asked within the framework of self-questioning approach and sample cases. Among the learning content taught in

the podcast within the scope of self-questioning approach, by asking such reflective questions as: "*When you compare this subject with the ones you learned before, which one does it look like? Could you please indicate the similarities and differences and explain by indicating their relationship?*" before, during and at the end of the learning process, students were made to think in-depth over the topic, control their learning process and results and gain an awareness of this process and its results. While students questioned themselves with these reflective questions, the aim was to make them compare their prior knowledge with the new, to activate their prior knowledge and to become aware of the parts that are not understood. Thus, the aim was to make students question their strengths and weaknesses, to think on how they can define them best, to recognize the steps they follow while fulfilling a task and the methods they used, to recognize the benefits or disadvantages of these steps and methods and to evaluate them.

After students studied the relevant podcasts on the topic, students started making discussions over a sample case after they log on the blog which became active every week in the subject domain. In addition, in order to make students think on the subject and enable them to reflect it on their own lives, such reflective questions as: "*How would you behave if you come up with such a thing in your life*?" were also asked. Discussions on the blog continued for the week.

At the end of the course, "*Let's Think at the end of the Course"* activity was presented in the weekly subject domain in the LMS and students were asked to complete this activity. *Let's Think at the end of the Course"* was prepared based on self-questioning approach of reflective thinking and within the scope of this activity such questions as *"Are there any points that you have difficulty in understanding? If so, what else can you do to overcome this?*" were asked to make students question and evaluate themselves on the subject they learned. The aim of asking these questions was to make students evaluate themselves about the subject learned during the week and to identify the things they could not learn and thus, to learn them. After students answered these questions, the podcast learning contents of the following week were opened to student access.

3. Finding

3.1. Findings on academic success scores

The first research question was whether there was a statistically significant difference in academic success scores between groups which used/did not use reflective thinking activities (Study Group I - Study Group II) and whether there was a statistically significant difference depending on the use of podcast or video technology (Study Group II- Study Group III).

When the IT law pre-test success scores of the students in Study Group I ($\bar{x} = 58.12$, $sd = 11.19$) and Study Group II ($\bar{x} = 52.59$, $sd = 11.57$) were checked depending on whether the podcast learning environment was supported with reflective thinking activities or not, whether there was a significant difference in post-test success scores were tested using covariance analysis. Both of the assumptions of homogeneity of the variances and regression were satisfied ($F = 3.74$; $p > 0.05$), before proceeding to the ANCOVA. To test whether this difference in the post-test scores of the groups was significant, covariance analysis was conducted and the result of the analysis are shown in Table 1.

When Table 1 was analyzed, the pre-test scores of the study groups were assigned as a covariate variable, grouping main effect was significant in terms of adjusted average scores with a small effect size, [$F(1,65)$: 5.74; $p = 0.019 < 0.05$; Cohen's $f = 0.06$]. In other words, it was seen that Study Group I ($\overline{X} = 58.27$) was more successful than Study Group II ($\overline{X} = 52.43$) based on adjusted post-test success scores on IT law topics.

When the IT law pre-test success scores of the students in Study Group II ($\bar{x} = 52.59$, $sd = 11.57$) and Study Group III ($\bar{x} = 50.74$, $sd = 9.44$) are checked depending on whether the used technology was video or podcast, whether there was a significant difference in post-test success scores were tested using covariance analysis. Both of the assumptions of homogeneity of the variances and regression were satisfied ($F = .00$; $p > 0.05$), before proceeding to the ANCOVA. To test whether this difference in the post-test scores of the groups was significant, covariance analysis was conducted and the result of the analysis are shown in Table 2.

When Table 2 was analyzed, the pre-test scores of the study groups were assigned as a covariate variable, grouping main effect was not significant in terms of adjusted average scores [$F(1,66)$: 1.40; $p = 0.242 > 0.05$]. In other words, it was seen that Study Group II ($\overline{X} = 52.74$) did not show a statistically significant difference compared to Study Group III ($\overline{X} = 50.59$) based on adjusted post-test success scores on IT law topics ($p > 0.05$).

3.2. Findings on social presence perception scores

In second research question of the study, answers to whether there was a statistically significant difference in social presence perception scores of the groups depending on whether there were reflective thinking activities or not (Study Group I

Table 1
The Results of Covariance Analysis of the Academic Success Scores of the Students in Study Group I and Study Group II.

Source	Sum of squares	df	Mean square	F	p
Pre-test	1993.352	1	1993.352	19.74	0.000
Group	579.795	1	579.795	5.74	0.019
Error	6562.413	65	100.960		
Total	9075.529	67			

Table 2
The Results of Covariance Analysis of the Academic Success Scores of the Students in Study Group II and Study Group III.

Source	Sum of squares	df	Mean square	F	p
Pre-test	3679.085	1	3679.085	64.34	0.000
Group	79.739	1	79.739	1.40	0.242
Error	3773.836	66	57.179		
Total	7511.652	68			

and Study Group II); and whether there was a statistically significant difference between groups (Study Group II and Study Group III) depending on the technology used (podcast or video) were looked for.

When the pre-test scores of the students in Study Group I ($\bar{x} = 69.26$, $sd = 19.02$) and Study Group II ($\bar{x} = 72.09$, $sd = 13.65$) were checked depending on whether they were supported with reflective thinking activities in podcast learning environment or not, whether there was a significant difference in post-test scores were checked using covariance analysis and the results of the analysis are given in Table 3. Both of the assumptions of homogeneity of the variances and regression were satisfied ($F = 0.964$; $p > 0.05$), before proceeding to the ANCOVA.

When Table 3 was analyzed, and when the Social Presence Survey pre-test scores of the study groups were assigned as a covariate variable, it was seen that grouping main effect was not significant in terms of adjusted average scores [$F(1,65) = 0.01$; $p = 0.911 > 0.05$].

When the Social Presence Survey pre-test scores of the students in Study Group II ($\bar{x} = 72.09$, $sd = 13.65$) and Study Group III ($\bar{x} = 72.77$, $sd = 16.37$) were checked depending on whether the technology used was video or podcast, whether there was a significant difference in post-test scores were checked using covariance analysis and the results of the analysis are given in Table 4. Both of the assumptions of homogeneity of the variances and regression were satisfied ($F = 3.55$; $p > 0.05$), before proceeding to the ANCOVA

When Table 4 was analyzed, and when the Social Presence Survey the pre-test scores of the study groups were assigned as a covariate variable, it was seen that grouping main effect was not significant in terms of adjusted post-test average scores [$F(1, 66) = 0.69$; $p = 0.411 > 0.05$].

3.3. Findings on motivation scores towards podcast

The third research question of the study looked for an answer to whether there was a statistically significant difference in motivation scores of the students using different e-learning environments depending on whether the environment was supported with reflective thinking activities or not. To find an answer to this question, whether there was a significant difference in the Instructional Materials Motivation Survey post-test scores of the students in the study groups was checked through *t*-test. The results of *t*-test relating to motivation level scores of the students towards podcasts are given in Table 5.

When Table 5 was analyzed, it was seen that there is a statistically significant difference in the motivation scores of the students towards podcasts between Study Group I ($\bar{x} = 130.26$, $sd = 19.84$) and Study Group II ($\bar{x} = 120.71$, $sd = 17.73$). Accordingly, the motivation scores of the students in Study Group I were significantly higher compared to students in Study Group II with a small effect size, ($t(66) = 2.09$, $p < 0.05$, Cohen's $d = 0.25$).

3.4. Student opinions towards E-Learning environment

When all the answers students in different study groups gave to the questions in student opinion forms were taken into consideration, some positive and negative sub-themes were found as a result of content analysis. These themes are evaluated in general below.

When the themes arising from the content analysis were examined, it was seen that students in Study Group I, Study Group II and Study Group III preferred to listen videos and podcasts mostly at home. And students stated that the reason behind it was that home was more comfortable and quiet. This result of the study is parallel to the result of the study carried out by Tynan and Colbran (2006). The results of the study indicated that students accessed the podcasts uploaded mostly from their personal computers (72.3%) and listened to the podcasts at home (80%). Majority of the students (74%) indicated that podcasts had a significant place in their learning and that they were supportive tools (65.3%) for their education. Whilst students in Study Group I preferred to listen to the learning materials mostly from a desktop computer, students in Study Group II and Study Group III preferred to listen to the learning materials from a laptop. Students explained the reason of this as easiness and portability. In a study by Maag (2006), it was found that large majority of the students listened to the podcasts on their mp3 players. Whilst students in Study Group I indicated that the podcasts were useful in terms of learning understandable, lasting and new information, accessing the podcasts anytime, anywhere and revising; students in Study Group II indicated that the podcasts were visual and easy to access. These results of the study are parallel to the results of the studies of Maag (2006), Nataatmadja and Dyson (2008), Tynan and Colbran (2006). Students in Study Group III, on the other hand, indicated that videos were understandable and lasting. When students were asked what kind of features could be added to the podcasts, majority of the students in Study Group I indicated that the existing podcasts were sufficient, and a number of them indicated that visuals and easy use could be included. While the majority of the students in Study Group II indicated that

Table 3
The Results of Covariance Analysis of the Post-test Scores of the Students in Study Group I and Study Group II When Their Social Presence Survey Pre-test Scores are Taken Under Control.

Source	Sum of squares	df	Mean square	F	p
Pre-test	7182.590	1	7182.590	42.80	0.000
Group	2.110	1	2.110	0.01	0.911
Error	10908.763	65	167.827		
Total	18226.882	67			

Table 4
The Results of Covariance Analysis of the Post-test Scores of the Students in Study Group II and Study Group III When Their Social Presence Survey Pre-test Scores are Taken Under Control.

Source	Sum of squares	df	Mean square	F	p
Pre-test	7726.637	1	7726.637	67.65	0.000
Group	78.353	1	78.353	0.69	0.411
Error	7538.270	66	114.216		
Total	15272.957	68			

Table 5
t-Test Results of the Students in the Study Groups Relating to Their Instructional Materials Motivation Survey Post-test Scores.

Study groups	N	$\overline{X}$	sd	**df**	t	p
Study Group I	34	130.26	19.84	66	2.09	.04
Study Group II	34	120.71	17.73			

the existing podcasts were sufficient, a number of them said that visuality and sound quality could be improved. This result of the study is similar to Tynan and Colbran (2006) results. While majority of the students in Study Group III thought that the existing videos were sufficient, a number of them stated that videos could include additional examples and more detailed information. When students were asked what learners could do to benefit more from the learning environment, whilst students in Study Group I and Study Group III mostly stated that revising was important, Students in Study Group II emphasized the importance of attention. Most of the students in the Study Groups indicated that they had no problems in the process of learning. Majority of the students in the Study Groups indicated that participation of this course was more effective compared to other courses and that they wanted this approach to be used in other courses as well.

4. Result and discussion

The findings of the first research question of the study revealed that post-test success scores of the students in Study Group I were higher compared to the students in Study Group II. In addition, it was seen that the post-test success scores of Study Group II were not different from Study Group III. These findings of the study indicate that using video or podcast as the interaction medium does not create a difference on post-test success yet the existence of reflective thinking activities create a significant difference on post-test success although the effect sizes for this difference was relatively small (Cohen, 1988). Although the findings on success variable have similarities to the findings in other studies in the literature, it has certain differences as well. For example, O'Bannon, Lubke, Beard, and Britt (2011) compared podcast instruction with those who received lecture instruction. The result of their study revealed that there were no statistically significant differences between the two groups in terms of success. In our study, no statistically significant difference was found between the success scores of podcast and video groups. However, it was found that podcasts supported with reflective activities created a statistically significant difference on success. In Boster et al.'s (2007) study, on the other hand, he reported that the students who used video streaming scored significantly higher than students who did not use them. Also, Traphagan, Kusera, Kishi (2010) suggest that webcasts could have positive effects on students' learning experiences and performance, even if class attendance does decline. These results indicate that it is the content design, rather than the access/environment, that is more important. Different from the studies given above, in this study, the podcast and video environment were compared to find out the impact of accessibility and it was seen that there was no statistically significant difference between the two. Similarly, Hill and Nelson (2011) emphasized that the key to improving the student learning experience appears to lie not in adopting new pedagogy, but in reflexively developing the existing pedagogic strategies employed by both teachers and learners.

Related to the success variable, environments supported with reflective thinking activities were also involved, and the relationship between reflective thinking activities and success was looked into. In some studies, it was found that reflective thinking activities did not effect success (Atasoy, 2009); whilst in others, it was found that reflective thinking activities increased success (Kızılkaya, 2009; Mohamad et al., 2013; White & Frederiksen, 1998). The results of content analysis in which student opinions were compared supported these findings about academic success. The results of qualitative data analysis

indicated that students preferred environments with visual and audial features in e-learning environment design. Students indicated that they found the medium and materials in Study Group I more useful and accessible. However, although students in Study Group II, where only podcast was used; students in Study Group III, where video was used liked the accessibility of the podcasts, there was no statistically significant difference in terms of success. Again students in Study Group I indicated that reflective thinking activities provided such opportunities as self-questioning, planning the learning process, and evaluating the process. And this supports the finding that students plan, monitor and evaluate the learning process and this cause to a difference in academic success of between groups. In addition, because this study used podcast and reflective thinking activities together and because there are no other similar studies in the literature, there are no studies to compare the results of this study. It will be useful to re-test the generalizability of this case in future studies.

The second research question of the study looked for an answer to whether reflective thinking activities in podcast medium increased social presence perceptions of the students or not. In line with the findings from the second research question of the study, it was seen that the post-test scores of Study Group I from Social Presence Scale was not different from the scores of Study Group II. Also, the post-test results of Study Group II from Social Presence Scale were not different from Study Group III. These findings of the study illustrate that providing the learning contents in podcast or video environment does not effect the social presence perceptions of the students. Similarly, supporting the learning materials with reflective thinking activities does not change social presence perception. The presence of a teacher in the podcast supported with reflective thinking activities is believed to strengthen the interaction between student-teacher; and also it is anticipated that social presence perception will improve depending on the increase in student-student and student-teacher interaction through the questions asked to enable reflective thinking. However, these findings indicate that discussions over the questions asked to support reflective thinking do not effect students' social presence perceptions. There could be some reasons behind this case. First of all, because questions of reflective discussions are questions that require students to be cognitively active/and to think, students might feel comfortable in these environments and naturally, this could have hindered them to participate in the discussions. And in this case, a significant impact might not have been created on social presence perception. While the findings of this study indicate that podcast use does not effect social presence perception, Kang and Gretzel (2012) study found that podcast use improved social presence perception. It is believed that the reason of this is the difference in learning environments. Because in the mentioned study, guidance to tourists visiting a national park was provided via podcasts. Therefore, it is believed that a difference could be due to using podcast for different purposes: one for education and other for travelling.

The third research question of the study looked for an answer to whether reflective thinking activities provided for students in podcast medium increased the learners motivation towards learning or not. To this end, in the light of the findings under the third research question of the study, when the Instructional Materials Motivation Survey post-test scores of the students in the study groups are compared scores of the students in Study Group I are found to be higher than the scores of the students in Study Group II. The findings of this study are compliant with the studies in the literature. According to this, in a study by Bolliger et al. (2010), they looked into the impact of podcast use in online learning environment on student motivation. The results of the study indicated that the impact of podcast on motivation differed depending on gender, class level and having/not having distance education experience. Bolliger et al. (2010) results indicate that overall podcast users were motivated by the use of podcasts. In our study, we compare the design of podcasts it was seen that podcasts supported with reflective thinking activities improved motivation compared to podcasts which are not supported with reflective thinking activities. This finding of the study indicates the importance of reflective thinking activities in increasing the efficiency of podcasts. In their study, Bolliger et al. (2010) emphasized that investigating how instructors implement and utilize podcasts in online courses was necessary. In addition, in terms of motivation, the planning of how podcasts may be integrated to their environments of usage is just as important as the way they are designed. Collaborative discussion tools and environment could also be included in this process. As in Study Group I, students could also make discussions on podcasts in blog environment. In addition, discussions could be made individually or collaboratively and constructively. In the studies carried out, it is seen that collaborative studies are used to increase motivation (Renninger, Cai, Lewis, Adams, & Ernst, 2011). For example, in virtual learning communities, establishing cooperative working groups and having those groups prepare podcasts and engaging in discussions may increase motivation.

Recommendations for practices

- Within the scope of this study, e-learning environments were supported with reflective thinking activities. In this respect, the efficiency of the trainings could be improved by using approaches that require high-order thinking skills and that necessitate working together.
- In this study, podcasts were used as course materials during the learning process. It is believed that using podcasts as a tool for support and evaluation of the course as well as course materials will be beneficial.
- Based on the feedback from students, it should be considered that the podcasts and videos to be prepared should be between 10 and 15 min for students not to lose their concentration.
- The sound and image recordings of the podcasts and videos used in the study were conducted in a studio. However, in order to create a more friendly and warm environment with the students in podcast and videos, doing the recordings in natural settings/classrooms will be useful. The quality of the sound and images in these environments should also be considered.

- In this study, podcasts were prepared by the researchers and opened for student access. New practices could enable students to prepare podcasts and share them in the learning environment and make discussions about the podcasts they prepared. Thus, the student participation and motivation could be improved.

Restrictions of the study and recommendations for further studies

- Because this was an experimental study, it was conducted on a limited number of students. Future studies could be carried out with larger number of participants from different educational background and age groups.
- Within the scope of reflective thinking activities students were asked reflective questions before, during and at the end of the course. The aim was to enable students to think reflectively. Future studies could be designed according to adaptive learning systems that enable guiding students based on their answers to reflective questions.
- In this study, the impact of reflective activities on academic success was tried to be identified based on pre-test and post-test. In future studies, the impact of such assessment types as self-assessment, peer-assessment on determining the impact of reflective activities on academic success could be studied.
- In future studies, the use of podcasts supported with reflective thinking activities on student engagement could be studied with such methods as log files.

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