The Effect of Digital Concept Maps in Online Learning Environments on Students' Success and Disorientation

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ABSTRACT

Concept and knowledge maps are used often in learning process as two dimensional learning materials. These maps are important in comprehending concepts of a subject and relationships between these concepts. Nowadays, concept maps can be used beyond student drawings as digital navigation tools in real life. The aim of this study is to investigate the impact of the use of digital concept maps as navigation tools in online learning environments on student success and disorientation. There are two subdimensions of the navigation tool: the concept map and the content tree. The achievement test designed by the researcher in order to determine success of the student is used in the research. To evaluate the level of the student's disorientation, the disorientation scale and navigation data were used in hypermedia. Web navigation data were recorded in the database, while participants were doing their weekly tasks, and Needleman-Wunsch algorithm was used to determine the level of disorientation. As a result of the study, the success of students in both groups has a significant increase positively. Besides, students who used websites with a content tree are more successful than students who used websites with concept maps. There is not a significant difference in the perception of disorientation between groups according to the navigation tool that they used. Nevertheless, according to the results of analyses that are made with using web navigation data, it is seen that there is a difference in disorientation of students, considering the number of subjects or concepts in the navigation tool, the content of the task that has been given etc. Lastly, suggestions about what to pay attention to while using concept maps or concept maps in online learning sites have been given.

Keywords: *digital concept map, student success, disorientation, Needleman&Wunsch algorithm*

INTRODUCTION

Nowadays, the digital literacy level has increased with the development of web technologies, computers, mobile devices, and wireless network technologies (Amedieu & Salmerón, 2014). Computers that were developed to calculate information initially are used for many different purposes as entertainment, communication, reading, and learning. Learning activities in computers are usually performed in hypermedia. Hypermedia is an environment that has visual and aural contents as well as textual contents and that has connections, which are linked and can be identified within the text. One of the most important qualities of these environments is that it gives a preference of choosing his/her own way of learning to the student with presenting a non-linear navigation opportunity to him/her (Alomyan, 2004; Otter & Johnson, 2000; Chen, 2002; Su & Klein, 2006). Using graphical presentations instead of navigating in texts decreases the cognitive overload of students, makes it easier for students to comprehend relations between complicated concepts, and presents multiple ways of reaching information in these environments (O'donnell, Dansereau, & Hall, 2002). However, non-linear navigation opportunity may cause users to get lost in the learning process. The increase of links within texts according to the amount and complication of information in hypermedia causes the loss during navigating and contradiction in terms along with cognitive load of students (Tergan, 2005; Somyürek, 2008; Amadieu, Van Gog, Paas, Tricot, & Mariné, 2009; Dias, Gomes, & Correia, 1999). In this study, the effect of using digital concept maps as a navigation tool on the success and disorientation of students is investigated. From this point view, these research questions were investigated.

- Is there a significant difference between the success of the students who navigate with the content tree and who navigate with the concept map?
- Is there a significant difference between disorientation scores of students who navigate with the content tree and who navigate with the concept map?
- Is there a significant difference between perceptions of disorientation of students who navigate with the content tree and who navigate with the concept map?

Concept Maps

Concept maps were first developed by Novak and Gowin (1994), based on the meaningful learning model of Ausubel (1968), which is one of the cognitive learning theories. The assimilation model, which is in the meaningful learning model of Ausubel (1968) and suggests information to be coalesced with lessons from the past, is the foundation of concept maps (Novak, 1998). Concept maps can be described as a visual presentation of information from a field with using textual and graphical elements (Novak, 1990).

Mind, concept, knowledge and subject maps can be given as examples of graphical representations of information. These maps have pros and cons according to what they are used for (Hanewald & Ifenthaler, 2014). For example, concept maps are different from knowledge maps, concept graphs, and mind maps in terms of it depending on assimilation principle of Ausubel and it having semantic and structural differences (Carnot, Feltovich, Hoffman, Feltovich, & Novak, 2003). Concept maps are stated in many studies that they have a positive contribution in learning (Horton and others, 1993; Nesbit & Adesope, 2006). It is claimed in many studies that the use of concept maps have a positive contribution in learning.

Lee and Segev (2012) indicated that concept maps are useful in conditions that are stated below:

- Students usually use the content or index parts specified by the person, who prepared the context, because learners at the beginning of the learning process have different foreknowledge levels on a specific topic. The content part directs students to only one specific chapter; index part just presents terms in alphabetical order in this situation. In addition to this, links between terms are not stated in the index part. In conclusion, the content and index parts do not give information about terms in a chapter or relations between terms.
- If time period for research is limited, the content and index parts does not present any information about which terms are important.
- If the document about the topic is long or complicated, the reader’s comprehension of terms and relations between these terms becomes harder.

Disorientation

One of the most important qualities of hypermedia is that it presents non-linear navigation opportunity and provides the student to prefer to his/her own way of learning (Alomyan, 2004; Otter & Johnson, 2000). Increasing of links within the texts in hypermedia according to the amount and complexity of information causes the cognitive overload of students along with them getting lost during navigation and experiencing contradiction in terms (Tergan, 2005; Somyürek, 2008). Users not knowing where they are in the websites or not knowing how to get to where they think of is named as the disorientation problem

(Conklin, 1987). The disorientation condition takes place in three situations that are stated below (Elm & Woods, 1985):

- If the user does not know where to go in the next Web page
- If the user does not know how s/he approached to the Web page s/he is in
- If the user does not know in which part of the structure s/he is

Even though the disorientation condition is the most dominant problem of hypermedia usage, there are limited number of researches about measurement of disorientation (Otter & Johnson, 2000; Ahuja & Webster, 2001; Gwizdka & Spence, 2007).

In order to evaluate disorientation, disorientation perception scale or navigation data of users may be used. Yatim (2002) indicated that methods such as taking feedback from users, testing the concept model, and evaluating performances of the users can be used. It is claimed that by using these methods; how much time users spent on the task, the rate of true answered questions, and how often users got lost data can be used to measure lostness (Yatim, 2002). In the research conducted by Smith (1996), it is suggested to measure disorientation not according to users' perception of being lost but according to decrease in performance. Because the condition of disorientation might change without the perception of the student, there are studies that claim to analyze disorientation according to navigation data (Gwizdka & Spence, 2007; Güyer, Atasoy, & Somyürek, 2015). In this research, disorientation scale in hypermedia was used for measuring of perception of disorientation and navigation data towards given task was used to determine the level of disorientation.

RESEARCH METHOD

Research Model

In this research, the effect of the navigation tool that is used in online learning environments on success and disorientation of students is investigated. In this regard, the independent variable of the research is the type of navigation tool used in the learning environment. The navigation tool has two sub dimensions: with a content tree and with a digital concept map.

Dependent variables of the research are success and disorientation of students. The pattern with pretest - posttest control groups was used to analyze the effect on successes of students. In order to measure disorientation, weekly tasks that must be performed in the websites were created (Appendix A), and students are wanted to perform the tasks. The symbolic view of the research is given in Table 1.

Table 1. Applied Model for the Measurements of Success in Research

Group	Pre test		Post test
G_1	O_1		O_2
G_2	O_1	X	O_2

G_1: The group that navigated with a content tree
G_2: The group that navigated with a concept map
O_1: Pre test of success, O_2: Post test of success,
X: Experimental method (The use of the concept map as a navigation tool)

The same teaching process was performed on both groups in the research, and the same instructor gave lessons to both groups. While control and experimental groups were created: one class was designated as control, the other is experimental. For the purpose of examining lostness of students during navigation, weekly tasks and contents of lessons were activated for 6 weeks in application process, students were asked to perform the tasks and deliver the answers of the tasks with writing on paper.

Participants

The study group of the research is composed of students who studies at Department of Computer and Instructional Technologies Education and enroll Instructional Design lesson in the spring semester of 2014-2015 school year. There are 66 students in the study group: 30 in the experimental and 36 in the control group. Students that study at the indicated department have Cognitive Technologies lesson that they took before and can improve their skills in fundamental computer skills in their syllabus. That is why it can be said that students of both groups have similar qualifications in terms of computer using skills. Along with that the researcher checked the process during the application, and it is observed that students have not got any problem about computer using skills.

Learning Environment

In order to carry out the education and provide the navigation of students, a web-based learning site named "Hayalimdeki Üniversite/ Dream University" was developed and published on website "www.hayalimdekiuniversite.com," to the extent of the study. Before the application, content of Instructional Design lesson was prepared with using tests and visuals in virtual platforms by taking an opinion of a field expert.

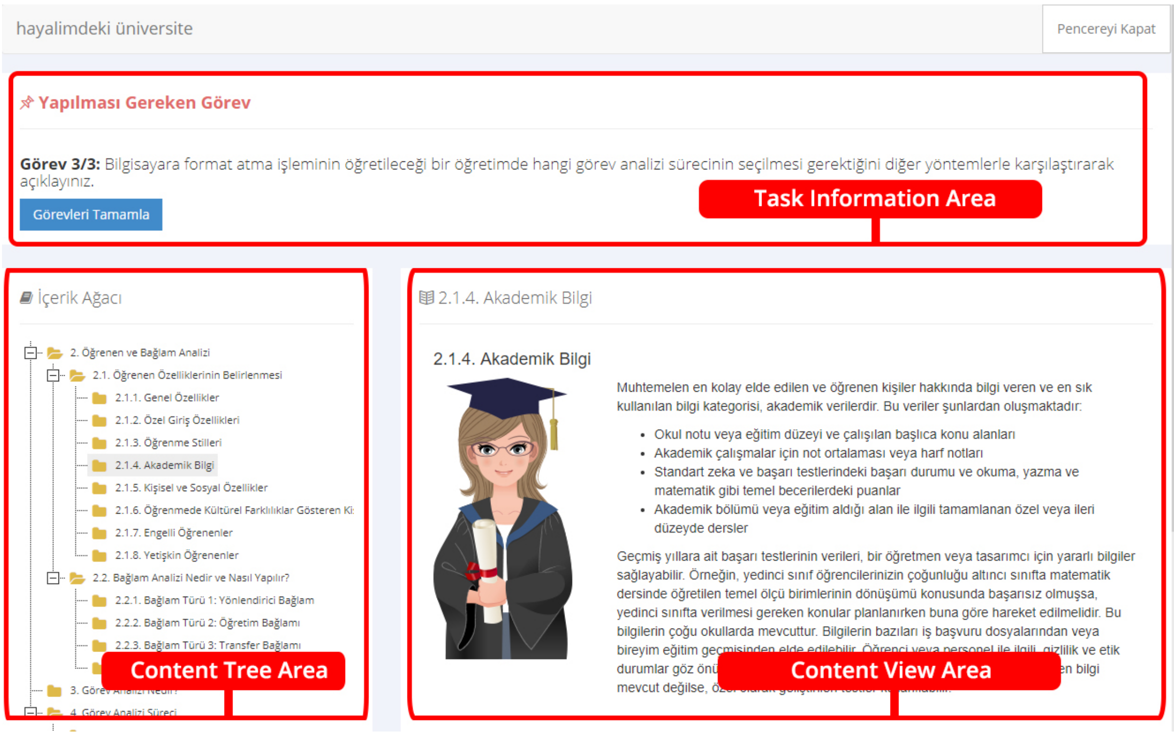

Figure 1. Navigation site with a content tree

The visual of a navigation site with a content tree is given in Figure 1. Task content that the student should complete is indicated at the top of the screen. After the indicated task is completed, they can pass to the next task with using "Pass to Next Task" button at the bottom of the task text. Thus, time spent on the task and which pages s/he navigated in were automatically recorded to the system. After all tasks are completed, "Tasks to Do" part at the top becomes hidden. On the navigation with the content tree screen, there is a content tree with subjects on the left, and there is a content viewing area that contexts clicked are displayed on the right.

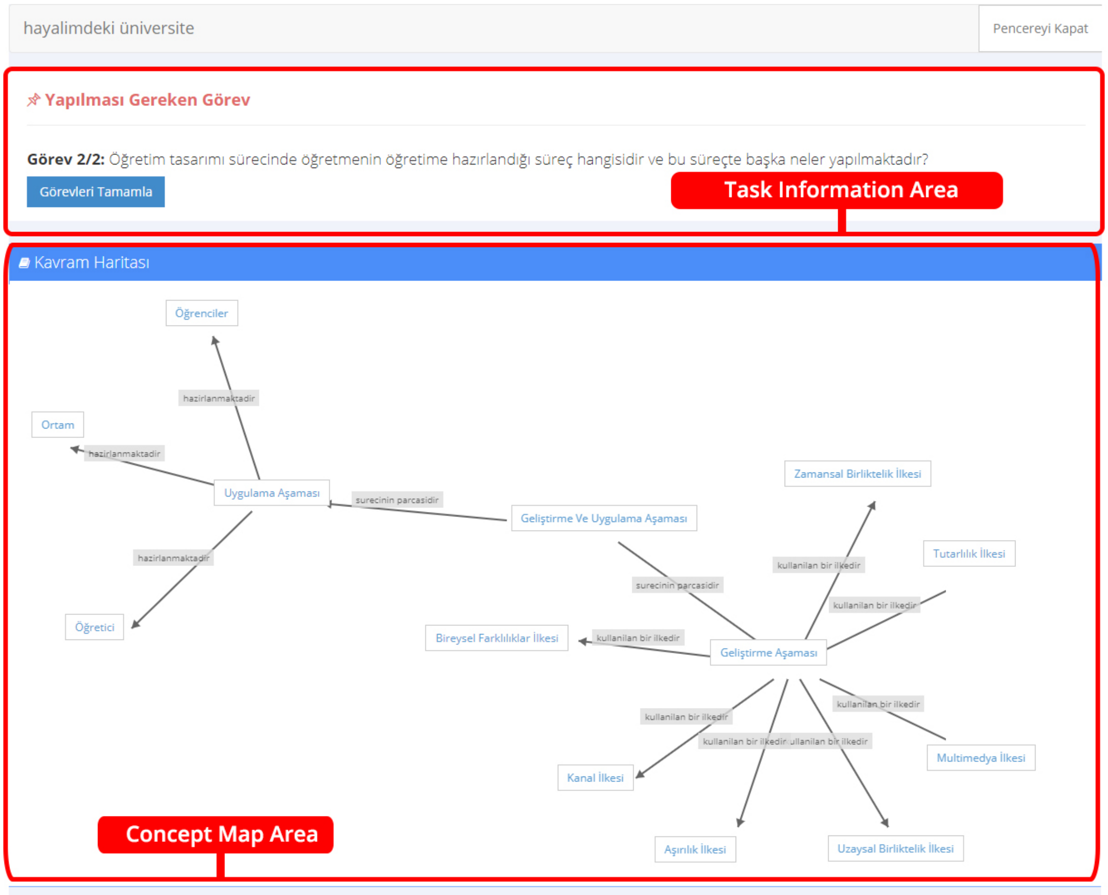

Figure 2. Navigation site with a concept map

A navigation site with using a concept map is given in Figure 2. There is content of tasks to do at the top in this site, as it was in the navigation site with a content tree. Recording and progressing processes of tasks in this screen is the same as the process of the navigation screen with a content tree. The user can see terms and relations between terms on this screen. Every single term on the screen has a qualification of a title, and clicking any term will open a screen as shown in Figure 3, and subject content is displayed on the screen.

Figure 3. Display of content in the navigation environment with a concept map

Data Collection Tools

Achievement Test

In order to measure knowledge level before the experimental process and achievement after the process of students in the study group, table of specifications was prepared. A test with multiple choices is prepared with taking the table of specifications into consideration, and opinions of a field expert and an assessment and evaluation specialist on extent of the test and validity of the criteria and opinions of a field expert of Turkish language on grammar correction of the test prepared were taken. The achievement test that was prepared were applied to 64 students, who took Instructional Design lesson before, and reliability of the test were determined by using Kuder-Richardson-20 (KR-20) technique with making item analysis considering these data. The KR-20 reliability coefficient of the achievement test that was prepared as a result of preliminary application is calculated to be 0.84. Biserial correlation coefficient technique was used in calculation of discrimination value of items in the achievement test (Crocker & Algina, 1986). 19 questions, in which discrimination index is below 0.30, were examined; 5 questions were updated with taking an opinion of an assessment and evaluation specialist, and 14 questions were left, with taking opinions of an assessment and evaluation specialist and a field expert, in the test because they were not related to the curriculum of their learning process of students, who answered the questions before. The difficulty value of the test with 55 items was calculated to be 0.40.

Navigation Data

The paths students have followed to complete the tasks are recorded in oys_icerik_gezinme_log table. Data that are recorded in the navigation table and explanations regarding data are given in Table 2.

Table 2. Information and Explanation of Recorded Data

Field Name	Explanation
USER_ID	Information of the user, who navigated is recorded in this part.
CONTENT_ID	Page number of the displayed site during navigation is recorded in this part.
DATE	Date information of the navigation is recorded in this part.
TASK_ID	Task number of the completed task is recorded in this part.
TASK SITUATION	Start and finish information of the completed task is recorded in this part.

In addition, data of the resumed tasks are recorded in lms_user_task table after the user exits from the system and logs in again. Data that are recorded in this table and explanations regarding data are given in Table 3. The reason that task situations of the users were recorded in another table is to provide the user to access resumed task faster.

Table 3. Data Information and Explanation That Recorded in the User-Task Table

Field Name	Explanation
USER_ID	Information of the user, who navigated is recorded in this part.
TASK_ID	Task number of the completed task is recorded in this part.
TASK_SITUATION	Whether the task is completed or not is recorded in this part.
ACTIVE	Information of which task was resumed is recorded in this part.

Navigation data got from database were analyzed using Needleman&Wunsch algorithm. Detailed information on measuring disorientation with using Needleman & Wunsch algorithm is given below.

Measuring Disorientation with Using Needleman & Wunsch Algorithm

Needleman & Wunsch (N-W) algorithm is an algorithm developed to determine similarities between amino acid sequences of two proteins (Needleman & Wunsch, 1970). This algorithm is developed based on the reasoning of solving complicated problems by breaking them down into simpler sub problems.

Input of N-W algorithm is as written below:

M_1: First text sequence

M_2: Second text sequence

T: (m+1)*(n+1) sized table

There are two texts and a relationship table that shows relationship level between these two texts as an input in N-W algorithm. Alignment between two texts in this algorithm is performed, so that the sum of values in the relationship table is maximized. Gap penalty points can be used in mutual non matching conditions in the alignment process. There is not enough detailed information in how N-W algorithm was used in the study made by Gwizdka and Spence (2007) on measuring lostness using N-W algorithm.

Navigation data of the user and pages that must be tracked while completing the duty are approached as two text sequences in this algorithm, and calculation is done in order to get the maximum point from the relationship matrix, based on the opinion of an expert. Sites that are not in the scope of task but make a contribution in the problem indicated in the task are provided to make a contribution in the lostness value, thus more precise calculation is done.

In the study of Güyer, Atasoy, and Somyürek (2015) in which disorientation was measured using N-W algorithm, sites that the user have been on during navigation for the task and sites that were to be used in optimum navigation were listed in text, and relationship matrix between these sited were taken into consideration to calculate disorientation value. There are four input variables in the method developed: navigation data of the user, optimum navigation data, relationship matrix between sites, and gap penalty. Inputs of algorithm are stated below:

1. **Text of student navigation in task scope:** This input contains navigation of students between pages in the task scope.
2. **Text of optimum way in task scope:** The optimum way for the task to be completed is described with this input.
3. **Similarity matrix of pages:** Similarity matrix of pages is a matrix, which describes the similarity rate between pages in the task scope. Similarity values between pages can be defined between 0 and 1. This input provides navigated sites, which are not in the task scope but help the task to be completed, to be taken into consideration, while lostness is estimated. Similarity matrix of pages can be developed based on opinions of an expert.
4. **Determining penalty point:** This value is a penalty value that is used in empty parts after the existing user navigation and proper alignment of optimum way texts, and this value is determined to be smaller than the minimum point that is got from correct matches. Penalty point is important in estimating disorientation with separating pages navigated by the user in the task scope from other pages that s/he navigated.

Disorientation values of students are calculated with using inputs above by stages indicated by Güyer, Atasoy, and Somyürek (2015).

Disorientation Scale in Hypermedia

To measure disorientation perception subjectively, Disorientation Scale in Hypermedia developed by Beasley and Waugh (1995) and adapted by Karadeniz and Kılıç (2004) into Turkish was used. In analyses made with using collected data of 301 students, who study in different departments of Gazi Faculty of Education, Cronbach Alpha internal consistency reliability value calculated to test the reliability of the scale is calculated to be 0.77. Scale developed consists of 7 items, and each question is in 5 point Likert scale. Minimum point that can be got from the scale is 7, while maximum is 35. Students, who got lower point than the median of the scale, 21, did not get lost, while students who got higher is lost. According to the results of the analysis made to test the reliability of the scale on 54 students, Cronbach Alpha internal consistency reliability value of the scale is calculated to be 0.89, while Spearman Brown semi partial test correlation is 0.94.

Data Analysis

To test discrepancy of the difference between success points of students before and after the experiment according to the group they are in (navigation with a content tree, navigation with a concept map), Two-Way ANOVA for Mixed Measures analysis for complex measures is made. Stages being followed to analyze navigation data are given in Figure 4.

Figure 4. Stages followed in analysis of navigation data

Similarity matrix of pages, one of the inputs of N-W algorithm, is carried out by the web based learning site developed by 2 field experts (Figure 5). In this site, field experts have entered the similarity values in intersection text boxes of subjects. In cases where number of rows and columns of the table are so many, information about which subject the selected box is about is displayed above the text box for the system to be practical. Besides, users can investigate contents via clicking on the subject that are in rows and columns on this screen.

	Eğitim	Öğretim	Tasarım	Teknoloji	Performans	Öğretim Tasarımı
Eğitim	1	0.9	0.8	0.8	0.2	0.8
Öğretim	0.9	1	0.9	0.9	0.2	0.9
Tasarım	0.8	0.9	1	0.5	0.2	0.9
Teknoloji	0.8	0.9	0.5	1	0.8	0.8

Figure 5. Input screen of Relationship Matrix between Pages

Average relationship matrix was calculated with taking the average of similarity values entered by field experts. To calculate the similarity between the student navigation data and the optimum way, average relationship matrix is used. Points that students got from navigation data are calculated with using N-W algorithm and with taking navigation data of the student, optimum way, and average relationship matrix as inputs. Because number of stages that must be taken is different from task to task and values taken from N-W algorithm depend on the number of pages in the optimum way, final disorientation value is calculated by the division of calculated points by the number of pages in the optimum way. To calculate whether calculated disorientation values are different according to groups or not, independent samples t-test method is used.

FINDINGS

Findings Related to the First Research Question

In this section, results about the first sub problem of the research, "Is there a significant difference between the success of the students who navigate with the content tree and who navigate with the concept map?" are given. Firstly, whether scores that experimental and control groups took from pre test show significant difference or not according to groups is investigated. t-test results of the students in control and experimental groups according to their pre test scores from the achievement test is given in Table 4.

Table 4. t-test Results of Pre Test Scores According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	28	32,53	10,93	62	1,79	,077
Navigation with a content tree	36	37,22	9,90			

Average points of students in both groups are calculated over 100. According to the results that are gotten from the achievement test, there is not significant difference in success levels of students at the beginning [t(62) = 1,79, p>,05]. Because 2 of the participants in the study did not fill the pre test out, scores that 64 students have gotten from the achievement test are included in the analysis.

Table 5. Mean and Standard Deviation Values Relating Success

Group	PRE TEST			POST TEST		
	n	$\bar{X}$	sd	n	$\bar{X}$	sd
Navigation with a concept map	28	32,53	10,93	28	57,34	14,60
Navigation with a content tree	36	37,22	9,90	36	71,92	15,66

As it can be seen in Table 5, while before any experiment, mean of points of the students, who navigated with a concept map is 32.53, it became 57.34 after the experiment. While mean of points of students, who navigated with a content tree, is 37.22 before the experiment, it is seen that it became 71.92 after the experiment. According to these, it can be claimed that succeeded of students in both groups have increased.

Two-Way ANOVA results are given in Table 6 about whether there is significant difference between success scores before and after the experiment of students, on whom two separate experiments were performed.

Table 6. ANOVA Results of Pre Test-Post Test Scores From the Achievement Test

Sources of Variance	Sum of Squares	df	KO	F	p
Between Subjects	16962,061	63			
Group (Concept/Content)	2925,222	1	2925,222	12,921	,001
Error	14036,839	62	226,401		
Subjects	35605,831	64			
Measurement (Pre test - Post test)	27881,291	1	27881,291	248,583	,000
Group*Measurement	770,573	1	770,573	6,87	,011
Error	6953,967	62	112,161		
Sum	52567,892	127			

As it is seen in Table 6, it can be claimed that there is a significant difference before and after the experiment on success levels of students, who used two different navigation tools [F(1, 62) = 6,87, p<,05]. This finding shows that navigation with a concept map and with a content tree have different effects on increasing the success of the student. It can be understood from the results given in Table 6 about points that are gotten in pre test and post test that navigating with a content tree is more effective than navigating with a concept map.

Findings Related to the Second Research Question

In this section, results about the second sub problem of the research, "Is there a significant difference between students who navigate with the content tree and who navigate with the concept map?" are given. Before the disorientation values that are gotten from navigation data are analyzed, lost data values are assigned with maximization method with taking quantity and structure of lost data into consideration (Köse & Öztemur, 2014; Akbaş & Tavşancıl, 2015). Findings that are gotten based on the list of tasks (Appendix A) and analysis results of data collected from the tasks (Appendix B) are given in Table 7.

Table 7. Results from Tasks

Row	Result	Task No
1	Texts about the task being in a concept map or in a content tree makes the navigation more effective.	1, 2, 4
2	There are not any significant difference in terms of the use of similar titles in the concept map and the content tree.	1, 2, 3, 4, 6, 9, 12, 14
3	Tagging the relationships between titles in a concept map makes navigation with a concept map more effective than with a content tree.	5
4	If the context used while completing a task is also used in the next task, disorientation in the next text decreases in this condition.	7
5	If the task content has parallels in navigation, students who navigate with a content tree are more successful in terms of disorientation.	8, 10, 13
6	If number of pages that must be navigated in content tree are more than number of pages that must be navigated in concept map, disorientation level in the content map is greater.	11
7	If there is a necessity of comparing of contexts in the task, in this situation students who used concept maps get less lost than students who used content trees.	15, 16
8	Increase in number of steps on the optimal way comes with an increase in disorientation.	17
9	As number of pages in the environment gets closer to the optimal way's, disorientation decreases.	18

Findings Related to the Third Research Question

In this section, results about the third sub problem of the research, "Is there a significant difference between perceptions of students who navigate with the content tree and who navigate with the concept map?" are given. t-test results relating to whether the perception of lostness differs according to the navigation tool they used or not are given in Table 8.

Table 8. t-test Results of Scores Gotten from the Disorientation Scale in Hypermedia According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	21	15,43	5,22	52	,456	,651
Navigation with a content tree	33	14,82	4,52			

As a result of the analysis, it is understood that there is not a significant difference [t(52) = ,456, p>,05] between students navigated with a concept map ($\bar{X}$ = 15,43) and students navigated with a concept tree ($\bar{X}$ =14,82). Scores gotten from both groups in hypermedia being less than 21, the median of lostness scale, can be interpreted as lostness perception of students in both groups are low. Because 12 students have not attended to applied hypermedia in the last week of the application, the analysis scale was applied on 54 students.

DISCUSSION, CONCLUSION AND SUGGESTIONS

One of the important findings is that using only a concept map or a content tree as a navigation tool is not always effective in terms of disorientation, according to the content of the given task both navigation tools have pros and cons in comparison to the other. Even though demonstration of information as a graphical element has an important place in the perception of information, it is not effective in the situations that graphical demonstrations do not provide enough qualities (Nilsson & Mayer, 2002). Because of that, with grouping the tasks, which navigation tool is more effective in which group can be investigated in the future studies.

In the research, it is seen that texts about tasks that must be completed taking parts in a concept map or a content tree makes the navigation more efficient. Hence, it is thought that the use of texts about learning goals in the navigation screen makes the navigation tool more efficient. One of the important findings of the study is that when similar titles are used in concept maps and content trees, there is not a difference in terms of disorientation. Therefore, if similar terms are used in the concept map and the content tree, the concept map can be used as an alternative navigation tool. Tags being present between concepts in concept maps is one of the most important qualities of this tool (Novak, 1990). Although it is seen that there is not a difference in term of disorientation, when the same concepts are used, tags of relationships between titles makes navigation with a concept map more effective in some tasks. Therefore, texts between subjects in the concept map being supplementary and linking to learning goals might increase the effectiveness of navigation. While completing a task, if the content navigated is used in the next task, too, disorientation in the next task decreases in this situation. Learning the content of a navigated page and giving a task that involves the previous tasks make it easier for users to find what they are searching for.

If the content of a task has linearity in navigation, students that navigate with a content tree are more successful than students that navigate with a concept map in this situation. Therefore a content tree as a navigation tool can be used in a proper environment, which the content that will be taught is navigated linearity. If comparison between contents or checking is the situation, disorientation with the concept map navigation is less. For this reason, a concept map instead of a content tree can be used if there is a situation of comparison between concepts.

If number of steps that must be followed in an optimum way for a task to be completed increases, the increase in disorientation comes along. This situation especially occurs in contexts with a lot of titles because students must navigate in pages in order to find which title the given task belongs to. In the analysis of navigation data, repeated navigation is marked as a penalty score, and disorientation levels come up to be so high because of this. Nonetheless if the task scope requires navigation in a major part of the context, disorientation value comes up to be small. If the fact that the given tasks are related to learning goals is thought, it can be also thought that navigation sites prepared in extents of learning goals can decrease the disorientation.

It is seen that students who navigated with a content tree is more successful than students who navigated with a content map. During the research, the researcher observed that students who navigated with a concept map are less interested in the lesson that students who navigated with a content tree. The reason of the students who navigated with a content tree being more successful than the students who navigated with a concept map might be their levels of interest. Therefore the effect of navigation with a concept map and with a content tree on success could be evaluated and inspected again with different researches.

In this research, level of disorientation while navigating with a concept map and with a content tree is measured with using N-W algorithm. Measuring of disorientation takes place based on traditional scales or algorithmic methods. The second way is started to get more common nowadays. However, there are not enough studies to claim that these two measurements give consistent results. Thus, which method is more effective on measuring disorientation can be investigated with developing different lostness measurement methods.

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APPENDICES

Appendix A

Task No	Subject	Task Sequence	Task Explanation
1	Definitions and Basic Concepts	1	Determine the differences between an assessment and evaluation specialist and a field expert.
2	Definitions and Basic Concepts	2	Determine the elements that effect human performance.
3	Definitions and Basic Concepts	3	Determine the differences between the learning theory and teaching theory.
4	Definitions and Basic Concepts	4	One of the factors that determines the teaching method choice that will be used in class is number of students in the class. What could be the other factors?
5	Definitions and Basic Concepts	5	In which conditions and why would we require a instructional design?
6	Definitions and Basic Concepts	6	Explain the main difference between Instructional Design and Teaching Systems Development.
7	Definitions and Basic Concepts	7	Explain the main differences between Instructional Design and Teaching Technologies with using definitions of these concepts and components they have.
8	Analysis Phase 1	1	Explain the components of the requirement analysis process.
9	Analysis Phase 1	2	Explain the differences between Requirement Analysis and Goal Analysis.
10	Analysis Phase 1	3	Explain the factors that affect the performance and solution suggestions.
11	Analysis Phase 2	1	Age range of individuals who are in the target audience during instructional design varies between 25 and 30, and prior knowledge levels of students on the subject that will be taught are different. In this case, explain which qualities must be analyzed while determining qualities of students.
12	Analysis Phase 2	2	Explain briefly the differences between types of context analysis.
13	Analysis Phase 2	3	Explain which goal analysis process must be picked with comparing to other methods while teaching how to format computer.
14	Analysis Phase 3	1	Explain which aspects to be careful about according to fields of study.
15	Design Phase	1	During the instructional design phase, the analysis phase is completed and then comes the design phase. In this phase, the instructor approved to perform distance education, and s/he decided to make a multiple choice test at the end of each lesson to determine students' the level of learning. With which components can these actions of the instructional designer be explained? Explain.
16	Development-Application Phase	1	Sound and subtitles come up at the same time in an animation that was developed after the instructional design. Which design principle is the material developed in this way against?
17	Development-Application Phase	2	Which process of instructional design is the teacher gets prepared to teach, and what else should be done in this process?

18	Evaluation Phase	1	Mr. Yusuf, who is a instructional designer, would evaluate the differences that came up at the end of the instructional design process that he performed. For Mr. Yusuf to evaluate these differences in any way, explain what to evaluate in which phase according to Kirkpatrick Evaluation Model.

Appendix B

Table 9. t-test Results of Disorientation Scores from the 1st Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,51	,40	64	-1,19	,238
Navigation with a content tree	30	,62	,35			

Table 1. t-test Results of Disorientation Scores from the 2nd Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,28	,86	41,47	-1,59	,119
Navigation with a content tree	30	,52	,24			

Table 2. t-test Results of Disorientation Scores from the 3rd Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,78	,15	64	,017	,987
Navigation with a content tree	30	,78	,17			

Table 3. t-test Results of Disorientation Scores from the 4th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,91	,26	64	,228	,820
Navigation with a content tree	30	,89	,13			

Table 4. t-test Results of Disorientation Scores from the 5th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,22	,80	43,76	-2,23	,031
Navigation with a content tree	30	,54	,26			

Table 5. t-test Results of Disorientation Scores from the 6th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	-,13	1,16	58,59	-1,83	,072
Navigation with a content tree	30	,30	,70			

Table 6. t-test Results of Disorientation Scores from the 7th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,74	,24	64	1,03	,306
Navigation with a content tree	30	,68	,23			

Table 7. t-test Results of Disorientation Scores from the 8th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,79	,25	64	3,40	,001
Navigation with a content tree	30	,57	,27			

Table 8. t-test Results of Disorientation Scores from the 9th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,81	,17	64	-,138	,891
Navigation with a content tree	30	,82	,13			

Table 9. t-test Results of Disorientation Scores from the 10th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,93	,20	56,08	2,39	,020
Navigation with a content tree	30	,80	,24			

Table 10. t-test Results of Disorientation Scores from the 11th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,35	,41	56,70	-3,44	,001
Navigation with a content tree	30	,63	,23			

Table 11. t-test Results of Disorientation Scores from the 12th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,67	,29	60,95	-1,71	,093
Navigation with a content tree	30	,77	,19			

Table 12. t-test Results of Disorientation Scores from the 13th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,65	,26	58,93	-2,26	,027
Navigation with a content tree	30	,77	,16			

Table 13. t-test Results of Disorientation Scores from the 14th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,69	,27	64	-,85	,397
Navigation with a content tree	30	,74	,23			

Table 14. t-test Results of Disorientation Scores from the 15th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,28	,48	52,87	-2,31	,025
Navigation with a content tree	30	,49	,24			

Table 15. t-test Results of Disorientation Scores from the 16th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	-,54	,86	64	-2,70	,009
Navigation with a content tree	30	-,01	,70			

Table 16. t-test Results of Disorientation Scores from the 17th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,89	,43	64	2,83	,006
Navigation with a content tree	30	,74	,43			

Table 17. t-test Results of Disorientation Scores from the 18th Task According to Groups

Group	n	$\bar{X}$	sd	df	t	p
Navigation with a concept map	36	,71	,23	64	4,74	,000
Navigation with a content tree	30	,47	,23			