How usable is Coursera? A usability analysis through eye-tracking and authentic tasks

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Massive Open Online Courses (MOOCs) are considered learning environments that eliminate many learning barriers. Online courses in MOOCs have become an opportunity for everyone during the lockdown of the COVID-19 outbreak. However, usability issues may cause problems such as high dropout rates and lack of learner's motivation. Therefore, in this study, the usability of Coursera, one of the most known MOOCs in the world, was evaluated. The evaluation was performed with ISO 9241-11 standard. The environment's effectiveness, efficiency, and satisfaction were evaluated with the authentic tasks requested to be done in Coursera. Additionally, the findings were supported by eye-tracking metrics such as fixation duration, fixation counts, heat maps, and gaze plots. Twelve individuals (six females, six males) participated in the authentic tasks, and three individuals (two females, one male) participated in the eye-tracking phase. Results of the study revealed that most participants successfully performed the authentic tasks and are generally satisfied with the usability of the environment. However, considering eye-tracking findings and Coursera Usage Satisfaction Survey, some usability problems such as inadequate language support and the difficulty of using the search feature emerged. In the end, possible reasons were discussed, and the suggestions were presented for usability improvements.

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Introduction

MOOCs provide an attractive learning platform for the users who may be out of training due to time, geographic location, formal requirements, and financial difficulties (McAuley et al., 2010). Because of this, the number of users in MOOCs increased compared to previous years. However, the users had high dropout rates (Gütl et al., 2014; Hone & El Said, 2016; Onah et al., 2014; Xiao et al., 2014). Studies explain that there are some causes of dropout problem such as lack of motivation (Mackness et al., 2013; Zaharias & Poylymenakou, 2009), subject difficulty and insufficient support (Mackness et al., 2010), lack of technological knowledge (Conole, 2013) and ineffective peer review (Onah et al., 2014). Moreover, some studies are showing that this problem may be caused by the level of usability of the learning environment (Park, 2007; Xiao et al., 2014). Wong et al. (2003) emphasized that the usability issue has a vital role in the success of e-learning environments. In this regard, investigating the usability of Coursera, the most used MOOC platform according to the user numbers (Classcentral, 2021), will make a unique contribution to the literature.

There are various definitions of usability in the literature. One of them is Nielsen's definition which explains usability with five different components. According to this definition, the "ease of communication between the interface of an environment and its users depends on "its learnability, efficiency, memorability, errors, and satisfaction" (Nielsen, 2012). Similar to Nielsen's usability definition, in ISO 9241-11, usability is explained as the use of a product in a context by certain users for performing specific tasks in terms of the effectiveness, efficiency, and satisfaction components of that product (Abran et al., 2003). To explain these components, effectiveness is that the user can do the task correctly and accurately. Efficiency is the resources that the user has spent while performing the specified task. Satisfaction is the positive or negative attitude of the user to the product (International Organization for Standardization, 2018).

Although the studies investigating the usability of MOOCs with eye-tracking are limited, there are some usability studies with different tools in the literature. For instance, Yousef et al. (2015) examined the usability of L2P-bMOOC, a MOOC platform founded by Aachen University. The platform's usability was measured by a questionnaire consisting of 21 questions and seven categories (eligibility for the task, being descriptive enough, eligibility for the user expectations, eligibility for learning, controllability, error tolerance, and customization). It was found from the research that the users found the L2P-bMOOC platform as usable, in general. In another study, the usability of leading MOOCs (e.g., Coursera, EdX, Udacity, Udemy, Miriada X) was investigated with a software called SortSite (Espada et al., 2014). This software examines the related webpage in many aspects (e.g., accessibility, browser compatibility, broken links, search optimization, and usability). The researchers found that Coursera had fewer problems than other MOOC environments and was more usable. Pireva et al. (2015) also explored the usability of Coursera, EdX, and Udacity platforms. Usability analysis was made by looking at users' facial expressions with a software called "Emotient Analytics". The findings showed that Coursera was more usable than the others considering the participants' facial expressions. Tsironis et al. (2016) compared the usability of EdX, Coursera, and Udacity platforms in their study. For the usability analysis of the MOOCs, the participants were expected to perform five tasks and were then asked to complete two usability surveys. The study results revealed that the participants performed the assigned tasks faster in Coursera and also viewed Coursera as more successful in terms of usability.

There are also various usability studies for MOOCs in Turkey. İşgör, Şimşek, and Turan

(2017) investigated usability issues on Coursera, Udacity, and Udemy by survey method. In this research, the MOOCs' environments were compared to each other in terms of system usefulness, information quality, interface quality, and usability in general. Although the research was conducted for mobile devices, some usability issues on Coursera are taken into account in general such as lack of language support and inadequate search options. In another study, the usability of the pages in Udemy, Udacity, and Coursera was examined by the cognitive walkthrough method (Şahin & Durdu, 2021). Users were asked to complete the given tasks to identify the usability of the system. According to this, lack of transcript in course videos, inaccessibility of documents, the absence of password change page, difficult access of help page, and lack of communication in live support were identified as usability problems. However, the variables of effectiveness, efficiency, and satisfaction, which show the effort spent by the users while performing the tasks, were not discussed in the study. The usability of the Khan Academy platform was also examined through EEG in another study by Kelekçi (2019). The attention averages of the participants were evaluated with the system usability scale. EEG recordings were taken while performing the tasks. Although data derived from the EEG could provide objective findings regarding usability issues, identifying users' performance on specific tasks such as how long they look or how long they spent time might reveal usability problems in detail.

The studies examining the usability of MOOCs are scarce considering discussed points above. Moreover, the usability in these studies was analyzed mainly by a questionnaire or with automated software. However, in the current study, the usability of the MOOC platform was evaluated by using authentic tasks and eye-tracking methodology. When the literature is examined, there is no study that investigates the usability of MOOCs by the eye-tracking method. Therefore, this study will be differentiated from the other studies and contribute significantly to the literature.

Purpose of the Study

This study aims to evaluate the usability of a course given in a MOOC platform considering the user experience and perspective to present recommendations on usability issues. For these purposes, the study answers the question of "What is the usability level of Coursera, as being a MOOC platform?" The sub-questions of the research are also as follows:

(1) What is the level of effectiveness for a course in the Coursera environment?
(2) What is the level of efficiency for a course in the Coursera environment?
(3) What is the level of satisfaction with a course in the Coursera environment?

The reason why Coursera was chosen for the research is that Coursera is the most used MOOC environment (Classcentral, 2021). Therefore, the research on Coursera could help to solve its usability problems and provide a design perspective in terms of usability issues to make other MOOC's environments more user-friendly.

Method

In this study, the usability test method was used. The participants were given authentic tasks, and the data were collected through a questionnaire including three open-ended questions and eye-tracking. The data were analyzed in terms of effectiveness, efficiency, and satisfaction within the scope of ISO 9241-11 standard which is a multi-part International Organization for Standardization standard that addresses the ergonomics of human-computer interaction. In line with the analysis, suggestions were made to increase the usability of

MOOCs. The research has two parts. The first part is usability analysis considering ISO 9241-11 with nine authentic tasks. The second part is eye-tracking research with seven tasks. Due to the closure of the forum page of the course during the research, the participants who did not manage to perform the forum usage-related tasks T7 and T8 using the eye-tracking method had completed seven tasks in total. Therefore, seven tasks were used for the overall study, and 2 extra tasks were added for the first phase.

Rubin and Chisnell (2008) point out three features of usability tests in the studies conducted to develop a product. These are (1) providing authentic users (2) with authentic tasks (3) in representative environments. Considering these suggestions, nine authentic tasks were determined for the participants to perform. While the participants carried out these tasks, the data on the achievement of the participants' tasks, the duration of the tasks, and the difficulties they encountered in performing these tasks were collected and recorded in terms of the ISO standard. In addition, with three open-ended questions, participants were asked to express their views on the environment usability issues and suggest solutions to the problems faced. The participation data were recorded via a program running in the background. In addition, eye-tracking technology was used to evaluate the usability of the learning environment and to support and enrich the findings. A consent form was prepared to obtain participants' consent for the research. Their real names and identities were carefully protected by the researchers considering ethical issues.

Participants

Volunteers studying or working at the education faculty of two universities in Turkey and with different demographic characteristics participated in the study. The convenience sampling method was chosen for the research. A total of 15 people participated in the research. Three of them only participated in the research phase using the eye-tracking method. Nielsen (2000) reported that five participants were sufficient to determine 85% of usability problems. Nielsen (2000) also stated that the number of participants should be 15 to determine most usability problems. According to this view, the number of participants included in the study is sufficient. The demographic characteristics of the participants are presented in Table 1.

Table 1. Demographic Characteristics of Participants.

Part.	Age	Gender	Graduation	Comp. and Inter. Literacy Level	Weekly Internet Usage Time (Hours)	Language Level (English)	Online Course Experience	MOOC Experience
P1	33	Female	Doctorate	High	20+	Advanced	Yes	Yes
P2	29	Female	Doctorate	High	16-20	Intermediate	Yes	No
P3	25	Male	Master	High	16-20	Intermediate	Yes	Yes
P4	20	Female	Undergraduate	High	6-10	Beginner	Yes	No
P5	19	Male	Undergraduate	High	20+	Advanced	Yes	No
P6	27	Male	Undergraduate	Low	11-15	Intermediate	No	No
P7	18	Female	Undergraduate	Intermediate	1-5	Advanced	Yes	No
P8	19	Female	Undergraduate	Intermediate	1-5	Intermediate	Yes	Yes
P9	19	Male	Undergraduate	High	20+	Beginner	Yes	No
P10	21	Male	Undergraduate	High	20+	Intermediate	Yes	Yes
P11	20	Female	Undergraduate	High	11-15	Intermediate	Yes	No
P12	29	Male	Undergraduate	Intermediate	11-15	Intermediate	No	No
ETP1	27	Female	Doctorate	High	20+	Advanced	Yes	Yes

ETP2	50	Female	Undergraduate	High	20+	Intermediate	No	No
ETP3	28	Male	Master	High	6-10	Intermediate	Yes	Yes

P=Participant; ETP=Eye-Tracking Participant

When the characteristics of the research participants in Table 1 were examined, their ages ranged between 18 and 50. The research included eight female participants and seven male participants. The majority of the participants' educational level were undergraduate (n = 10), followed by doctorate (n = 3) and master's degree (n = 2). Most of the participants (n = 11) defined their level of computer and Internet use as high, three participants defined it as intermediate, and one participant as low. When asked about their weekly Internet usage time, more than half of the participants (n = 6) said they used the Internet for more than 20 hours; two participants stated that they used it for 16-20 hours, three participants for 11-15 hours, two participants for 6-10 hours, and two participants for 1-5 hours. When asked about their English level, four participants said Advanced level, nine participants said Intermediate level, and two participants said they were at the beginner level. The vast majority of participants had already taken an online course (n = 12), while the number of participants who have never had an online learning experience is three. The number of participants who know about taking courses in MOOC environments is six, while the number of participants who have not taken a course in a MOOC is nine.

Data Collection and Analysis

The usability of Coursera was evaluated in the research and a participatory-based usability evaluation method was preferred. The most effective way to determine the usability of a product is to analyze the user's experiences as a result of the interaction with the product (Dix et al., 2004). Within the scope of this research, the Effective Speaking course on Turkish language content was selected as a MOOC environment. This course is a six-week course aiming to develop basic features that make one's speech more effective; where you are given the necessary information to breathe correctly, use the voice well and effectively, and use authentic accent and intonation. The course consists of 29-course videos, five quizzes, and a final exam.

First, the researchers examined the course environment to identify the authentic tasks. The tasks in the background are based on taking a course, carrying out course activities, and leaving the course system. Within the scope of the course system, 12 tasks were initially identified, and three of these tasks were observed to be similar to other tasks. Thus, these tasks were removed. Finally, nine tasks were identified for this study, as indicated in Table 2.

Table 2. Authentic Tasks

Authentic Tasks
T1: Register to the Coursera website.
T2: Find courses in Turkish on social sciences.
T3: Find the Effective Speaking course and register.
T4: Find the description of the Effective Speaking course.
T5: Find the 1st week of the Effective Speaking course.
T6: Find and display the 1st-week quiz of the Effective Speaking course.
T7: Open a new topic in the discussion forum of the 1st week of the Effective Speaking course.
T8: Write an answer to a previously opened topic in the discussion forum of the 1st week of the Effective Speaking course.
T9: Leave the Effective Speaking course.

In the first phase of the study, 12 participants were invited in a university classroom to research at different times. Participants performed the tasks with a 15.6-inch computer screen in 1366x768 resolution. Before the data collection, required checks and arrangements (resolution, light, Internet connection, camera, screen, and starting the sound recording) were made. The software was used in the background for recording audio and video data of the participants for ensuring the participant's natural behaviors. Screen recording of the participants led to the analysis of the data, such as how much time the participants spent on the task, whether they accomplished the tasks, and what task they had the most difficulty in. To equalize the starting point of the performances in the second and subsequent tasks, they were directed to start the task from the homepage. Therefore, the tasks were not connected as the participants performed each task separately. When a participant completed a task, she returned to the homepage to perform other tasks. The researchers informed the participants about the data to be collected and the purposes of using the data and read the tasks to the participants. The average data collection took almost 25 minutes per participant including informing them about the research and conducting the authentic tasks.

The second phase of the research was carried out in an eye-tracking laboratory with three participants who did not participate in the first stage. Three people were recruited as a convenience sampling method. The eye-tracking method was used to determine eye movements while performing authentic tasks at this phase. This method was applied in a Human-Computer Interaction Laboratory, and the eye-tracking data were collected with a Tobii T120 eye-tracking device. The device's calibration was conducted and the participants sitting positions and posture were adjusted before the tasks started. Then, the participants carried out the tasks respectively.

Once completing the tasks in both phases of the research, Coursera Usage Satisfaction Survey was applied to the participants. In this survey, there were four types of questions such as participants' demographic information, their satisfaction with the Coursera site, the challenges they faced, and their suggestions to address these challenges. Data were gathered about the participants' gender, level of education, level of computer and Internet use, level of foreign language (English), time of Internet use, online learning experience, and MOOC experience. After getting their demographic information, the following three questions were asked to the participants: "What do you think about Coursera in terms of the ease of use?", What are the difficulties you have experienced when using the Coursera website?, What are your suggestions for solving the challenges you faced on Coursera?"

In the data analysis process of the research, maximum, minimum, average, range, and total durations were evaluated about the achievement of authentic tasks and the time spent on the tasks by the participants. The participants' opinions in the Coursera Usage Satisfaction Survey were analyzed to understand to what extent the participants were satisfied with the usability. Fixation count and total fixation duration of the data obtained from the eye-tracking method were analyzed using Tobii Studio 3.4.6 software. To get information about where they looked, how long they looked, and how many times they looked on the screen while performing the tasks, heat maps and gaze plot data were used. The heat maps and the gaze plots were created from the homepage where the participants started to perform the tasks.

The qualitative data from the Coursera Usage Satisfaction Survey were analyzed with the authors to reveal the satisfaction level of the Coursera. The authors followed the data analysis steps provided by Creswell (2003). These are (1) organizing and preparing the data, (2) reading through all the data, (3) coding, and (4) interpreting for themes. To do this, an online

document including participants' comments was prepared and shared with all authors so that participants could read through all the comments. Then, they coded the conversations and made their comments on them about the usability issues. All the authors checked each other's codes on the document in order to provide an intercoder agreement (Creswell, 2003). After the coding and checking procedure, the themes were created with the agreement of all the authors considering codes.

Findings

Findings Related to the Effectiveness of Coursera's Usability

The ISO 9241-11 standard defines effectiveness as "the extent to which planned activities are realized and planned results are achieved." Effectiveness could be considered as an indicator of usability as many relevant studies employ the effectiveness variable to determine user's completion accuracy on specific tasks (Arthana, Pradnyana & Dantes, 2019; Green & Pearson, 2006; Hussasin, Mkpojiogu & Hussain, 2015). Therefore, the effectiveness variable was used to identify the tasks' performance and the participant's achievement percentage both in the research.

In the first phase of the study, 12 participants performed nine authentic tasks, and the effectiveness analysis was performed. The effectiveness analysis of the participants is presented in Table 3. This table presents the completion status of the tasks, task achievement percentage, and participants' overall achievement of accomplishing the tasks.

Table 3. Effectiveness Analysis of Coursera's Usability

Participants	T1	T2	T3	T4	T5	T6	T7	T8	T9	Achievement Percentage
P1	1	0	1	1	1	1	1	1	1	88,9
P2	1	0	1	1	1	1	1	1	1	88,9
P3	1	1	1	1	1	1	1	1	1	100
P4	1	0	0	1	1	1	1	1	1	77,8
P5	1	0	0	1	1	1	1	1	1	77,8
P6	1	1	1	1	1	1	0	0	1	77,8
P7	1	0	0	0	1	1	1	1	0	55,6
P8	1	0	1	0	1	1	1	1	1	77,8
P9	1	0	0	0	1	1	0	0	0	33,3
P10	1	0	0	0	0	1	1	0	0	33,3
P11	1	0	0	0	1	1	1	1	1	66,7
P12	1	0	0	0	1	1	1	1	1	66,7
Achievement Percentage	100	16,7	41,7	50	91,7	100	83,3	75	75	70,3

1=Complete; 0=Incomplete

Coursera's usability effectiveness was analyzed through the successful completion of authentic tasks. The participants completed 70.3% of the tasks. They successfully completed the "Register to the Coursera website" task (T1) and "Find and display the 1st-week quiz of the Effective Speaking course" task (T6). Web page components where these tasks are performed may be considered usable. While most of the participants were successful in the "Find the 1st week of Effective Speaking course" task (T5), only one failed. Furthermore, the

participants did not generally have problems viewing the contents of the courses they enrolled in. The majority of them completed T7, T8, and T9 related to using and leaving the discussion forum. Only half of the participants accomplished the "Find the description of the Effective Speaking course" task (T4), which shows that they had trouble finding the explanation about the course. Additionally, most of the participants failed the "Find the Effective Speaking course and register" task (T3). Based on this, they had problems in searching and registering for courses in Coursera. "Find courses in Turkish on social sciences" task (T2) had the least success percentage. The usability of the site's advanced search feature is low in the task that only two of the participants were successful at. Only one of the participants completed all tasks successfully.

Findings Related to the Efficiency of Coursera's Usability

The efficiency variable is also considered another indicator to determine usability issues. Efficiency presents the level of the user's time in completing the task (Arthana, Pradnyyana & Dantes, 2019) and measures how a system usage straightforward in providing data and information (Susanto, Prasetyo & Astuti, 2018). In this regard, efficiency data were collected to understand how Course usage is easy and accessible for the research.

In the efficiency analysis for Coursera, the time spent on the tasks was presented. The time spent by the participants for each task and the sum of these durations, the maximum and minimum time spent, and the average time spent on the tasks is presented in Table 4.

Table 4. Efficiency Analysis of Coursera's Usability

Participants	T1	T2	T3	T4	T5	T6	T7	T8	T9	Total Time (sec)
P1	19	132	31	25	26	51	52	37	67	440
P2	35	136	29	30	42	26	40	36	62	436
P3	28	37	31	15	23	27	32	29	8	230
P4	57	90	126	23	62	27	73	47	61	566
P5	45	93	83	49	45	22	42	32	46	457
P6	97	86	102	85	104	35	60	68	29	666
P7	34	68	139	76	89	25	119	65	113	728
P8	24	98	70	104	113	20	44	48	23	544
P9	116	44	69	80	63	20	109	88	92	681
P10	46	54	107	94	89	40	42	67	60	599
P11	30	159	140	60	21	25	37	32	19	523
P12	51	50	64	92	30	33	32	35	37	424
Minimum	19	37	29	15	21	20	32	29	8	230
Maximum	116	159	140	104	113	51	119	88	113	728
Range	97	122	111	89	92	31	87	59	105	498
Mean	48,5	87,3	82,6	61,1	58,9	29,3	56,8	48,7	51,4	524,5

When the participants are examined in general considering Table 4, the "Find courses in Turkish on social sciences" task (T2) is the one on which the participants spent the most time (87,3 sec). In this respect, it can be said that the use of advanced search within the site is not usable. In addition, this is the task where individual differences are the greatest (122 sec). The task with the lowest time spent in the "Find and display the 1st-week quiz of the Effective Speaking course" task (T6) with 29.3 sec. This task is also where individual differences are

the lowest since it has the least range value (31 seconds).

Findings from Coursera Usage Satisfaction Survey

The satisfaction levels of Coursera were identified through a survey conducted after the participants performed the authentic tasks. Through this survey, questions were asked to the participants. These themes emerged after analyzing the qualitative data namely, design issues, lack of language support, and complexity of search bar usage (Table 5).

Table 5. Themes, Codes, and Participants' Answers

Themes	Codes	Participant's Answers
Design issues	Out of date design perspective	P3: "From the design point of view, important parts on the Internet page are not sufficiently eye-catching."
	Usage complexity	P7: "It has a complicated system; I do not think it is user-friendly either." P10: "Everything is mixed up." P12: "It is so hard to use, to be honest." P12: "The sections were a bit confusing."
	Relatively usable design	P1: "General design and usability were high." P5: "In terms of design and usability, it is at a usable level."
Lack of language support	Absence of Turkish language	P3: "On the Turkish course page, I couldn't access the pages I wanted in some parts because my English was not good enough." P7: "Not being in Turkish may cause some trouble for the Turkish users." P3: "I had problems due to my lack of English." P12: "The fact that it was English made it difficult for me."
	Complex language usage	P12: "Some parts being in English made it difficult for me."
The complexity of search bar usage	Difficult to find courses	P7: "It is hard to find the advanced search feature. P1: "It is sometimes confusing which course is where." P2: "I had difficulty in finding forums."
	Lack of explanation	P1: "The explanations of the course search tool were insufficient.

The participants stated that the use of the environment, in general, was problematic. Moreover, the system was very confusing, and the essential parts of the site were not catching the eye. On the other side, the participants with a higher level of computer experience stated that the system is generally usable. Additionally, the participants, who said that using the system was complex, stated that it should be reorganized with a more precise and simple design. In line with these views, it was seen that Turkish language support could not be achieved at sufficient levels. The lack of language support of Coursera and the fact that the menus and applications in the learning environment are not fully adapted to the Turkish language are among the problems experienced by the participants.

The participants suggested a consistent design for language support. Apart from this problem, the difficulty in using the search feature in the environment was another major problem. The search feature in a web page has a vital role in finding the components of the task. In this respect, the problem with the search capability is a usability issue in the Coursera learning environment.

Overall, the general design has good usability for the participants, but it still has some usability issues. In this case, the design should be simplified. Language support is a vital

usability factor with a more specific perspective on usability issues. The user interface language is not Turkish, or that only a part of it is Turkish is seen as a big problem for the participants who do not speak English. In this respect, Coursera should provide consistent language support. In addition, they had difficulties in searching for courses and the search menu being complex, hard to understand, and reaching effects the completion of many tasks. Although the search bar is at the top, access to advanced search options was challenging for the participants. It can be suggested that the advanced search option be more clearly placed on the site.

Eye-Tracking Findings

Three participants took part in the second phase of the research, and seven tasks were performed in the eye-tracking method. Heat map and gaze plot were used in the analysis of eye-tracking data. Heat maps are the images where the focus points of the users are shown with the different colors according to the frequency of their focus. A gaze plot is the visual data indicating the order, number, and duration of the focus of one or more users on the screen (Nielsen & Pernice, 2009). In addition, the pages were divided into areas of interest to determine the focus of the participants on them.

None of the participants managed to perform the "Find the description of the Effective Speaking course" task (T4) (Table 6). However, the participants assumed they had completed the task and went on to the other task. There are different explanations in several areas of the Effective Speaking course in the Coursera area. In addition to this, the "Leave the Effective Speaking course" task (T9) was completed by one of the participants (ETP1) in a very long time (222 sec) compared to the other participants. Only one participant could not complete the "Find courses in Turkish on social sciences" task (T2) and "Leave the Effective Speaking course" task (T9), while others completed them.

Table 6. Data for Performance Tasks Recorded by Eye-tracking (duration)

Participants	T1	Dur.	T2	Dur.	T3	Dur.	T4	Dur.	T5	Dur.	T6	Dur.	T9	Dur.
ETP1	1	46	1	44	1	39	0	20	1	45	1	45	1	222
ETP2	1	88	0	131	1	45	0	46	1	23	1	29	0	70
ETP3	1	57	1	39	1	46	0	34	1	24	1	28	1	20
Mean		64		71		43		33		31		34		104

1=Complete; 0=Incomplete

The heat map and gaze plot data of the participant ETP2 for the "Find courses in Turkish on social sciences" task (T2), the task with the lowest completion rate, are presented in Figure 1. Having taken the lowest completion rate was obtained in the first phase of the study for T2 task, eye-tracking data was also examined to understand usability issues in detail related to the task.
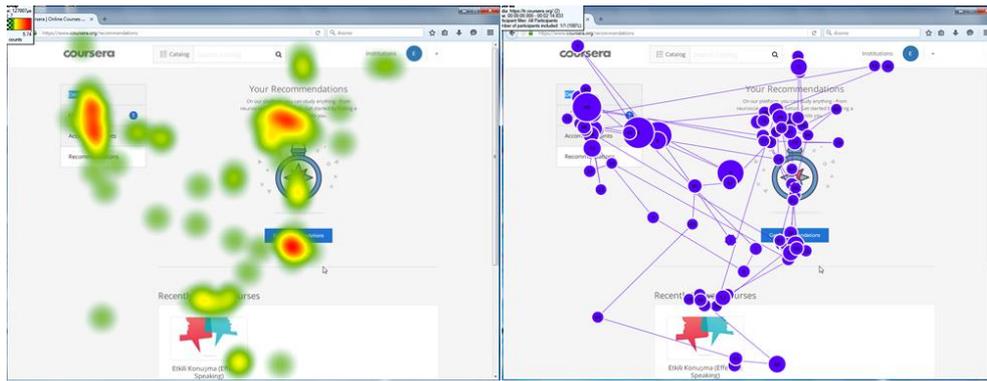
Figure 1**.** Participant ETP2's Heat Map and Gaze Plot of T2 (Find Courses in Turkish on Social Sciences)

Looking at the heat map in Figure 1, the participant had almost no focus on the search bar, which is the most critical area for the search task. This is evident that the heat zones in which the participant focuses heavily, the menu and the content part, are darker. Hence, placing the search bar, the essential component of searching the courses in a MOOC environment should be more visible and easier to reach. In addition, menu or content suggestions distract the participant's attention during the search. Figure 1 also shows where the participant was looking while performing the task. According to this data, the participant could not find the search bar and thus failed to perform the search task.
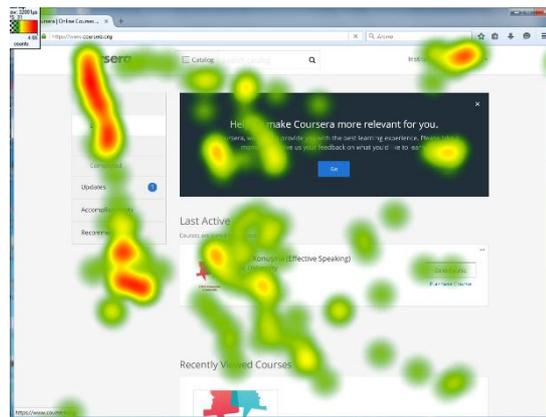

Figure 2**.** Participant ETP1's Heat Map of T9 (Leave the Effective Speaking Course)

Another eye-tracking data is the process of ETP1 fulfilling the "Leave the Effective Speaking course" task (T9) in Figure 2. The participant spent more time on this task (222 sec) compared to other tasks since she could not find leaving the course menu. She surfed in different pages, then learned how to leave the course from the website's help menu. Finally, she was able to leave the Effective Speaking course. That is, the tasks were performed mostly by the trial-and-error method by the participant. ETP1's eye-tracking data in Figure 2 show that she did not focus on the triple-dot mark "..." next to the course information used for leaving any course. This can be considered a vital usability problem in Coursera because a user who wants to leave the system may not understand a complicated symbol such as triple-dot (...).
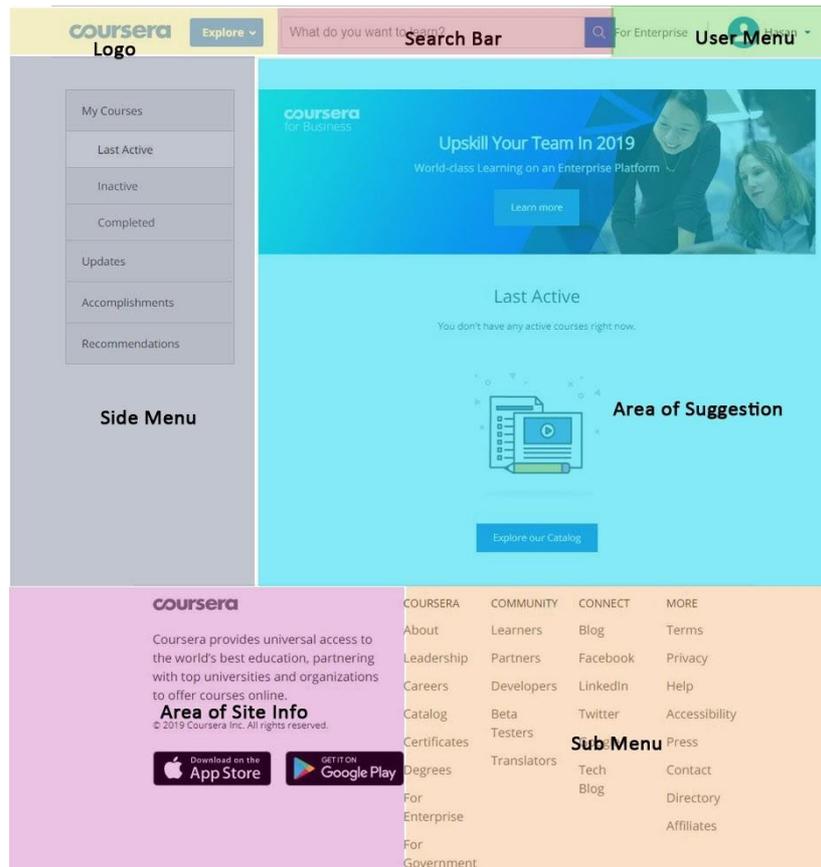
Figure 3**.** Area of Interests of the Coursera User Homepage

Eye-tracking data regarding the respective Area of Interests (AOIs) are presented in Figure 3. When the total fixation duration variable is taken into account of the eye-tracking data shown in Figure 4, the areas with the most duration from the fields on the user homepage are as follows: area of recommendation/suggestion and side menu. The areas with the least focus time are the logo, submenu, and search bar. According to this, after the participants have logged in to the Coursera site, it is seen that the recommendations area is more prominent on this screen. There are no performance tasks related to this field within the authentic tasks. However, it can be inferred that the relevant area has a blue and large icon with a distinctive design that attracts the participants' attention. As a result, they focus more on this region.
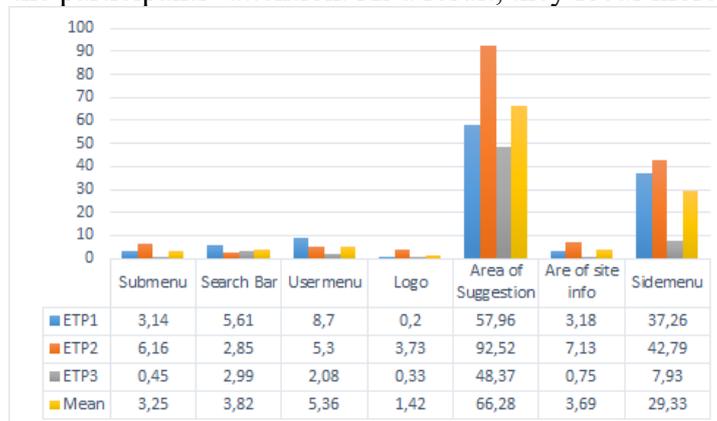

	Submenu	Search Bar	User menu	Logo	Area of Suggestion	Are of site info	Sidemenu
ETP1	3,14	5,61	8,7	0,2	57,96	3,18	37,26
ETP2	6,16	2,85	5,3	3,73	92,52	7,13	42,79
ETP3	0,45	2,99	2,08	0,33	48,37	0,75	7,93
Mean	3,25	3,82	5,36	1,42	66,28	3,69	29,33

Figure 4**.** Total Fixation Duration of the Participants

Additionally, the fixation count of the participants in the relevant AOIs is presented in Figure

5. The maximum fixation count found is 408. Although Internet users are generally familiar with menu area in web environments, the participants constantly focused on "area of suggestion" in this research while carrying out the tasks.
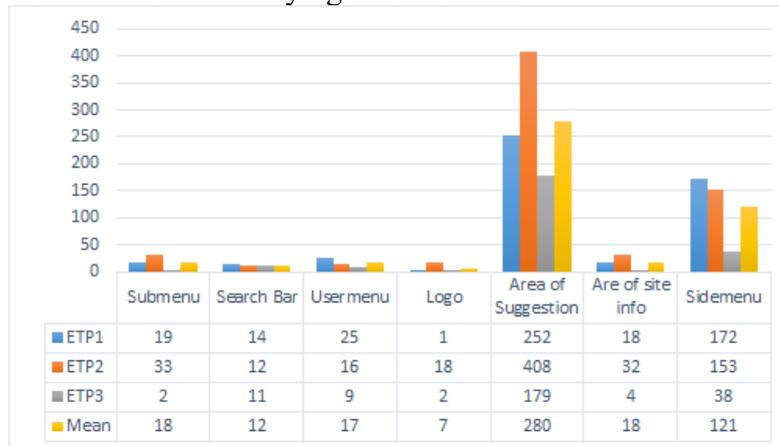

	Submenu	Search Bar	User menu	Logo	Area of Suggestion	Are of site info	Sidemenu
ETP1	19	14	25	1	252	18	172
ETP2	33	12	16	18	408	32	153
ETP3	2	11	9	2	179	4	38
Mean	18	12	17	7	280	18	121

Figure 5. Total Fixation Count of the Participants

According to the total focus time and the number of fixation counts, one of the important findings is data on the search bar. Given the low success rate of the "Find courses in Turkish on social sciences" task (T2), eye-tracking data supports this case. In other words, it was found that the participants did not focus too much on the search bar field in the search task they failed. This means that the participants did not use the search bar on the Coursera user homepage to search for a specific course.

Discussion

In this study, the usability of the Coursera learning environment was investigated to gain insight into the usability problems of MOOCs, which are mass educational environments, and to offer solutions for them. To determine the usability problems of the Coursera learning environment, the evaluations were made using different usability methods. In the study, effectiveness, efficiency, and satisfaction levels were analyzed, and the eye-tracking method was used.

When the effectiveness of the Coursera learning environment was examined, the successful completion of the tasks showed that Coursera's usability is generally acceptable. This finding is in line with the results of previous studies. Pireva et al. (2015) concluded that Coursera's usability level is generally considered sufficient by the users. In a similar study, it was stated that users described Coursera as a usable environment (Tsironis et al., 2016).

While the participants were generally successful in performing the tasks given in the Coursera environment, they were having difficulty using advanced search options. The participants found and registered the courses they were looking for, but they had trouble finding explanations about the courses. It should be pointed out that the participants who are successful in finding and registering for the systems have a higher level of using computers and the Internet. Research by Şahin and Durdu (2012) also indicated that Coursera has similar design problems such as the absence of a password change page, difficult access to the help page. Thus, considering the effectiveness of a learning environment appealing to millions of people like Coursera, search options are generally designed for people with more computer and Internet experience. Therefore, universal design principles should be considered in the context of usability, and users with different levels of usage knowledge should be considered

in the design process (Dix et al., 2004; Shneiderman & Hochheiser, 2001).

The results regarding the efficiency level of the Coursera learning environment were determined by the time the participants spent on the tasks. While Coursera offers users acceptable efficiency, this situation has some limitations. For instance, the participants spent a lot of time on tasks such as using the site's search options and finding and registering courses. When the time spent on the tasks is examined, the participants who have a high level of computer and Internet literacy also completed the tasks in less time. In this regard, to increase the efficiency of the Coursera learning environment for all users, search options need to be re-designed and developed as a search feature is very important for a website and affects usability significantly (Nielsen, 2002).

The participants' opinions were also examined to determine the satisfaction level of Coursera. While most participants stated that it was difficult to use, people who have a higher level of computer and Internet experience said that they are satisfied with the usability of Coursera. The general complaint of the dissatisfied participants is the environment does not provide language support, and only a part of the site is translated into Turkish. Moreover, the participants had language problems, despite indicating their level of English as intermediate and advanced. İşgör, Şimşek, and Turan (2017) also found in their research that Coursera has a language support problem similar to the current study's findings. The literature emphasizes that language support is an essential feature in terms of the usability of a system (Becker & Mottay, 2001; Nantel & Glaser, 2008). Thus, as stated in the participants' suggestions, it is essential to provide language support for Coursera's usability. Another reason that reduces the satisfaction of Coursera is the search options. Participants stated that search options should be improved as effectiveness and efficiency analysis support these assertions.

Eye-tracking data also supported the MOOC usability study. Similar data to the success rate in search tasks also appeared in eye-tracking data. When the heat map and eye-tracking metrics are examined, the participants do not focus too much on the search bar, which is an important function in the tasks. However, the user homepage's suggestion area and side menu area are the most focused regions. The process of suggesting a course to a user who has just registered in the Coursera environment is important. However, for the Coursera system, it may not be appropriate to interfere with a user for a possible course that s/he would like to register in the future. As Rayner (1998) states, the length of time the individual focuses on a particular region and the high number of fixation counts indicate the person's mental processing. Thus, in the search task, the participants' focus on the side menus and suggestions area, in general, is that these areas have a more attractive design structure than the other areas in terms of color, position, and shape. Additionally, traditional usability analysis techniques focus more on user performance rather than cognitive processes and could reveal fewer usability issues (Cooke, 2005). However, the eye-tracking method can measure efforts on a specific window or application page (Goldberg & Wichansky, 2003). Therefore, using the metrics of heat map, gaze plot, total fixation duration, and total fixation count in the research provided details about the cognitive process on specific tasks. For example, although many participants spent more time on the Leave Effective Speaking course" task (T9), it is difficult to understand why they spent too much time on the task. The heat map helped to reveal the problem regarding the design of leaving a course menu.

Suggestions

As a result of the research, some design suggestions for the MOOC environment can

be listed. First, the user interface of any MOOC should be precisely translated to the user's language as the users expect to understand what action happens during interactions of the environment. Second, the search function of the MOOCs should be easy to use. When users visit any MOOCs, they first go through the search bar to find appropriate courses. Lastly, in the study, it was determined that one of the participants who had good knowledge of English and computer skills could not leave the course. Hence, the triple-dot "..." mark next to the listed courses used to leave the system does not attract attention and is located in a problematic context. Therefore, using an icon or picture that is more noticeable may improve the leaving the course.

Conclusion

This study aimed to understand the usability issues of Coursera using ISO 9241-11 standard. The environment's effectiveness, efficiency, and satisfaction were evaluated with the authentic tasks performed in Coursera and the findings were supported by eye-tracking metrics such as fixation duration, fixation counts, heat maps, and gaze plots. The results of the study revealed that the levels of the effectiveness and the efficiency of the Coursera environment were seen as acceptable while the level of satisfaction of it was not. Since only the participants with a high level of computer and Internet experience were satisfied with the usability of the Coursera environment, others had difficulty. More interestingly, the findings showed that Coursera has inadequate language support even for the participants having intermediate and advanced levels of English. In conclusion, it is seen that Coursera has an effective and efficient environment in general but needs to be improved regarding the satisfaction level to include all learners using the Coursera.

Limitations and Recommendations for Future Research

In this study, various performance tasks were determined, and a usability study was conducted within the framework of effectiveness, efficiency, and satisfaction variables. Although data were collected from three participants through the eye-tracking method, there is a need for further studies related to different courses through collecting from MOOC environments based entirely on the eye-tracking method. Other MOOC environments would have different user interface designs which differentiate the usability issues. Therefore, research with the eye-tracking method on different courses would provide a design framework for MOOC environments. Lastly, the study was conducted with only one Turkish course (Effective Speaking). While the same design elements apply for each course, the usability test for different courses can be performed with other participants.

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