INTERACTION IN DISTANCE EDUCATION ENVIRONMENTS
A Trend Analysis

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The aim of this study is to determine the trend concerning interaction in distance education between the years 2011 and 2015. According to this aim, 544 articles in the databases of EBSCO, Scopus, and Web of Science were examined. The examination has been conducted on the basis of various variables including year, country, number of authors, discipline, sample size, research model, interaction type, dependent-independent variables, base theories, and technologies being used. The results of the study show that researchers continue to pay attention to interaction and try to integrate new technologies into learning environments and examine their outcomes; however, there is a need to strengthen the theoretical infrastructure.

INTRODUCTION

Distance education, which has been constantly changing and developing since it began, has gone through a number of phases and has been transformed today from correspondence learning to platforms using a range of technologies, including video conferences, discussion forums, and virtual classes. Distance education is frequently used not only by individuals, but also institutions, and these institutions provide ample opportunities for distance education to their students as well (Ally, 2008; Einfeld, 2014; Watson, Murin, Vashaw, Gemin, & Rapp, 2013).

Distance education has a number of forms, such as e-learning, online learning, and mobile learning and, as is suggested by Moore and Kearsley (2011), these concepts are generally used interchangeably. In fact, today's technology has caused the concepts to intertwine. For instance, online environments used to be available only via computers, whereas today they can also be accessed via smartphones, which enable individuals to receive online education anywhere and at any time.

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Today, one of the most common types of distance education is online learning, and one of the most important factors that affects the quality of online learning is interaction (Kuo, 2010; Yueh, Lin, Liu, Shoji, & Minoh, 2014). Moore (1989) suggests that education without interaction can only constitute a basic transfer of information. Frequently cited in many distance education theories (Karataş, 2008), interaction is one of the key elements seen to be required in a quality online learning environment (Yoo, Jeong Kim, & Young Kwon, 2014).

Interaction, one of the most important factors in all educational methods, has a number of definitions in the literature (Kuo, 2010). Wagner (1994) defines interaction as "reciprocal events that require at least two objects and two actions" (p. 8) and suggests that interactions occur when these objects and events mutually influence one another. According to Thurmond (2003), interactions occur when students are engaged with instructors, other students, the course content and the technological devices being used in courses. Similarly, Sherry (1995) defines interaction as the engagement of students to fellow students and instructors. On the other hand, Simpson and Galbo (1986) embrace interaction as a reciprocity in verbal-nonverbal, conscious-unconscious, permanent-temporary behaviors and the responses that occur in various relationships. Nevertheless, even though there is no consensus regarding the definition of interaction, its importance in education is explicitly emphasized in the literature.

As defined by Moore (1989), the most common interaction types used in distance education are learner-instructor, learner-learner, and learner-content interactions (Wang & Yang, 2005). In addition to Moore's (1989) interaction types, Hillman, Willis, and Gunawardena's (1994) student-interface interaction, Sutton's (2000) vicarious interaction, and Anderson and Garrison's (1998) instructor-content, instructor-instructor, and content-content interactions are also frequently encountered in literature.

As well as the definitions of types of interaction, guidance about how it is, and should be, applied in educational environments are important. This guidance could be determined through specifying the trends in interaction (Karataş, 2008). Trend analysis summarizes past studies and prepares us better for difficulties encountered in future studies (Alper & Gülbahar, 2009). As distance education constantly changes, it is necessary to always evaluate the progress in the field and determine what remains to be done. Thus, determining trends in distance education and the meaning of these trends for future distance education is required, although this might be a challenging task (Wilson, 2005).

The first study on trends concerning interaction was conducted by Wanstreet (2006). This study comprises 42 pieces of research that were carried out between 2000 and 2004 concerning interaction in distance education. As a result of the study, some conclusions were drawn regarding the definition of distance education, publication issues according to journals, and the types of distance education that were examined. A similar study was conducted by Karataş (2008) between 2003 and 2005. As a result of this study, some important information was gathered regarding the contexts in which interaction was investigated, distribution of articles by year and journal, methods used in studies, and variables that were featured together with interaction. Chen and Macredie (2010) examined 60 studies that were conducted between 1993 and 2009 on the relationship between web-based interaction and human factors (gender, preliminary information, and cognitive style). There are also meta-analytical studies examining the effect of interaction types on success in distance education (Bernard et al., 2009) and studies conducted as literature reviews concerning interaction alone (Hannafin, 1989). In some trend studies (Allen, Bourhis, Burrell, & Mabry, 2002; Lister, 2014), although the main goal is not

to determine trends regarding interaction, interaction is featured as a variable.

Even though the literature involves many studies aimed at determining the trends in distance education, it has been a long time since the last study was conducted concerning trends in interaction (Karataş, 2008). Today, rapid changes in technology and the involvement of technology in learning environments causes constant changes in communication, learning strategies, teaching methods, and learner-instructor interaction (Abdoli-Sejzi, Aris, Ahmad, & Rosli, 2015). Thus, it is very important to determine the trends regarding interaction considered significant by educational theorists in the field (Anderson, 2003; Anderson & Garrison, 1998), in terms of determining the future development of distance education.

In light of all this information, this study aims to determine tendencies regarding interaction by examining articles published between 2011 and 2015 concerning interaction in distance education environments. The following questions will be answered:

1. What is the distribution of studies concerning interaction in distance education according to the year of publication and the countries in which the primary authors' work?
2. What is the distribution of studies according to the countries where the educational activities are conducted?
3. What is the number of authors of each study?
4. What is the distribution of studies according to subject area?
5. What is the discipline of the study sample and the subject area examined?
6. What are the sample sizes?
7. In which sample stages are the studies conducted?
8. Which study models and patterns are used?
9. Which interaction types are used in studies?
10. Which data collection tools are used?
11. Which data analysis techniques are used?
12. Which dependent variables are featured?
13. Which independent variables are featured?
14. Which theories are used to ground the studies?
15. Which technologies are used?

METHOD

This study aims to examine the studies that were conducted between 2011 and 2015 concerning interaction in distance education via the trend analysis method according to the qualitative research model. Trend analysis was performed based on descriptive analysis. In the descriptive analysis technique, which is a qualitative data analysis technique, the data acquired are summarized and interpreted according to categories that are previously determined (Yıldırım & Şimşek, 2013). Articles in this study were also examined on the basis of previously formed categories according to the subgoals of the study.

Databases such as EBSCO, Scopus, and Web of Science were selected for conducting a review concerning interaction in distance education. These databases were selected as they were considered reliable and valid, involved high-quality studies in all educational fields including distance education (Karataş, Özcan, Polat, Yılmaz, & Topuz, 2014), and were available for online access at the library of Gazi University, where the researchers were based. Reviews were conducted based on full texts of articles that had been published in refereed and/or academic journals. In the abstract (in databases that could not be reviewed in the abstract, in the subjects and keywords), authors looked for the words "distance education," "distance learning," "online education," "online learning," "e-learning," "mobile learning," "m-learning," "blended learning," and "ubiqitous learning." As the title of this study is "distance education," all education types involved in distance education were included

in the study. A total of 1,218 articles was found between 2011 and 2015, but only 867 remained after excluding duplicative and inaccessible articles. During examination, unrelated or duplicative articles were also excluded and the study proceeded with 544 articles. Considering that the number was 48 in 2006 (Wanstreet, 2006), it can be seen that there has been a large increase in the number of studies concerning interaction in distance education.

In the study, the Fleiss' Kappa reliability coefficient was used as base in determining reliability between coders. As the coding was carried out by four researchers, a total of 20 articles (four articles from each year) were selected in order both to provide the homogenous distribution according to researchers and to represent each year sufficiently. Particular attention was paid to having articles that had been published in various journals. The 20 articles selected were examined separately by four researchers and the reliability between coders was calculated by using the Fleiss' kappa formula. While Cohen's kappa coefficient and Cohen's weighted kappa coefficient are simply used in calculating the reliability between two coders, Fleiss' kappa coefficient could be used in calculating the reliability of two and more coders (Fleiss, 1971). As a result of the first coding in this study, the Fleiss' kappa coefficient was determined as 0.69. Following this, the researchers discussed categorizing the articles to build consensus and reapplied the examination. The Fleiss' kappa coefficient was calculated as 0.807 after the consensus. Fleiss (2003) stated that a conformity of 0.75 and above was excellent conformity. Thus, it can be suggested that the reliability between the coders was very good.

Classification

In the study, three types of classification were used: discipline, research model, and subject area. Information regarding these classifications is as follows.

Classification of Discipline

In the articles examined, samples and subject disciplines were classified separately by using the classification method developed by Wu et al. (2012). While the study field of the sample was used as a base for the sample discipline, the discipline the study was conducted was used as base in the subject area discipline. Table 1 shows the classification of disciplines established by Wu et al. (2012), based on the studies of Franklin (1999) and Wanner, Lewis and Gregorio (1981).

Classification of Method

The models and forms of studies were classified by using the Educational Technologies Publication Classification Form (ETPCF-Eğitim Teknolojileri Yayın Sınıflama Formu), which was developed by Göktaş et al. (2012). This form examines the study models under four main headings: quantitative, qualitative, mixed, and literature review. Quantitative studies are separated into two groups: experimental and nonexperimental. While experimental studies are separated into four sections—fully experimental, quasi-experimental, weakly experimental, and single-subject, nonexperimental studies are separated into six sections: descriptive, comparative, correlational, survey, ex post facto, and secondary data analysis. Qualitative forms are ordered into cultural analysis, phenomenology, grounded theory, critical study, case study, historical analysis, and conceptual analysis. While mixed model studies are considered explanatory, exploratory or triangulation studies, literature reviews involve meta-analysis or literature reviews.

Classification of Subject

In the study, the classification of subject was made by using a classification system (Table 2) developed by Lee, Driscoll, and Nelson (2004) based on the classification methods of Sherry (1995), Phipps and Mer-

TABLE 1
Disciplines and Subdisciplines Used as a Base in the Classification of Discipline

Discipline	*Subdiscipline*
Human sciences	History, languages and linguistics, literature, performing arts, philosophy, religion, visual arts
Social sciences	Anthropology, archaeology, area/regional studies, cultural and ethnic studies, economics, social studies, gender and sexuality studies, geography, politics, psychology and sociology
Natural sciences	Space sciences, earth sciences, life sciences, chemistry, physics
Formal sciences	Computer sciences, logic, maths, statistics and system sciences
Professional and applied sciences	Agriculture, architecture and design, business studies, theology, education, engineering, environmental studies and forestry, family and consumer sciences, health sciences, human physical performance and recreation studies, journalism, media studies and communication, law, library and museum studies, military sciences, public administration, social service and transportation

Source: Wu et al. (2012).

TABLE 2
Classification of Subject

Subject	*Explanation*
Subjects about design	Needs analysis, lesson programming, lesson design, educational strategy development, lesson material design, and visual design.
Subjects about development	Lesson support system and material development, formation of web-based learning administration system, development of online devices, development of online exam system.
Subjects about administration	Administration of learning sources, problem-solving, depreciation rate, instructor and personnel support, student support, technical support.
Subjects about evaluation	Program quality control, evaluation of learning outputs, cost-benefit analysis, investment gainings, evaluation of support system.
Institutional and operational subjects	Administration, academic issues, accreditation, certification, politics, payment, budgeting.
Subjects about theory and research	Setting distance education theory/model, literature review, introduction to new research methods, issues of culture and gender, learning style, history of distance education, copyright law.
Combination of subjects	Study synthesizing two or more subject areas.

Sources: Lee et al. (2004) and Karataş (2008).

isotis (1999), and Khan (1997). This classification involved six categories. However, it became a classification of seven categories after Karataş (2008) added the category "combination of subjects."

FINDINGS AND INTERPRETATION

This section involves findings about studies concerning interaction in distance education such as distribution according to year and

country of publication, sample size and educational level, research models and patterns being used, data collection tools, data analysis techniques and technologies, dependent and independent variables, interaction types embraced, and the base theories being used.

Distribution of Studies According to Years and the Countries in Which First Authors Work

Studies concerning interaction in distance education were examined according to publication year and the countries of the first authors. Statistics regarding the distribution according to publication year and country are presented in Table 3 and countries with a total number of articles below 10 are specified as "other." [Those countries are Germany, Austria, Belgium, UAE, Brazil, Algeria, Czechia, Denmark, Indonesia, Morocco, Finland, France, India, the Netherlands, Iran, Scotland, Israel, Sweden, Italy, Japan, Northern Cyprus, Colombia, Hungary, Mexico, Egypt, Nepal, Norway, Pakistan, Romania, Russia, Singapore, Slovenia, Saudi Arabia, Tanzania, Thailand, Oman, Uruguay, Jordan, and New Zealand.]

Examining Table 3, it can be observed that distribution of studies shows a difference according to year. There is an increase in studies from 2011 to 2013, a decrease in studies from 2013 to 2015, and the highest number of studies is observed in 2013 (f = 136), which is associated with many devices offered by developing technology that can be used by researchers in the educational environment, as well as similar interactive devices that might be developed by themselves. As a matter of fact, the studies examined show that researchers did try to integrate numerous devices (discussion forums, wikis, blogs, LMS's, Facebook groups, etc.), especially those brought about by Web 2.0, into educational environments and observe their results. The decrease of studies in the course of time may signify that there has been a gradual satisfaction regarding this issue.

Table 3 shows that the countries of the first authors in the study are mainly as follows:

TABLE 3
Distribution of Studies According to Years and the Countries of First Authors

Country	*2011*	*2012*	*2013*	*2014*	*2015*	*Total*
USA	25	31	52	29	12	149
Taiwan	5	11	12	9	9	46
Australia	4	9	10	14	7	44
Great Britain	2	12	6	9	6	35
Spain	4	7	8	10	5	34
Turkey	4	5	10	3	5	27
China	2	4	1	6	8	21
Canada	6	3	5	6	1	21
Malaysia	3	4	2	2	3	14
Greece	6	1	3	1	2	13
South Africa	1	1	1	4	4	11
South Korea	0	1	2	2	5	10
Other	27	17	24	20	31	102
Total	89	106	136	115	98	544

USA (*f* = 149), Taiwan (*f* = 46), Australia (*f* = 44), Great Britain (*f* = 35), and Spain (*f* = 34). Similarly, the order was determined to be the USA, Great Britain, Taiwan, and Australia in the study of Hwang and Wu (2012) concerning digital game-based learning, and in the study of Hwang and Tsai (2011) concerning mobile and ubiquitous learning. Thus, it could be suggested that these countries make the greatest contribution to studies in the field. In addition to this, it is observed that Germany, which certainly has a significant position in terms of distance education universities (Holmberg, 2005; Moore & Kearsley, 2011), and is mentioned as the place where the concept of distance education (Moore, 2013) and correspondence learning (Simonson, Smaldino, & Zvacek, 2015) arose, does not have a noteworthy role in studies concerning interaction in distance education. India, which has a mega university, is in the same situation (Indira Gandhi National Open University, 2016). Moreover, the study of Zawacki-Richter, Bäcker, and Vogt (2009) concerning distance education show that the number of studies being conducted in countries like Germany, Indonesia, and India is fewer than that of studies being conducted in other countries, which supports these findings.

Distribution of Studies According to Country

Studies concerning interaction in distance education were examined by country, and statistics for the distribution of publications according to country are presented in Figure 1. Countries with fewer than 10 studies are labeled "other," whereas studies that are conducted in more than one country are labeled 'international' and studies not mentioning the country are labeled "unspecified."

Examining Figure 1, it can be observed that the USA (*f* = 119) ranks first by a wide margin in terms of conducting studies and is followed by Taiwan (*f* = 38), Australia (*f* = 37), and Turkey (*f* = 25). In addition to this, there is a limited number of international studies (*f* = 11) and the majority of studies do not specify countries (*f* = 89). These findings show a parallelism with the data in Table 3. It can be further observed that Turkey has risen here from the sixth rank to the fourth rank, and that both South Korea and North Korea are in the category "other," which means they have fewer than 10 studies.

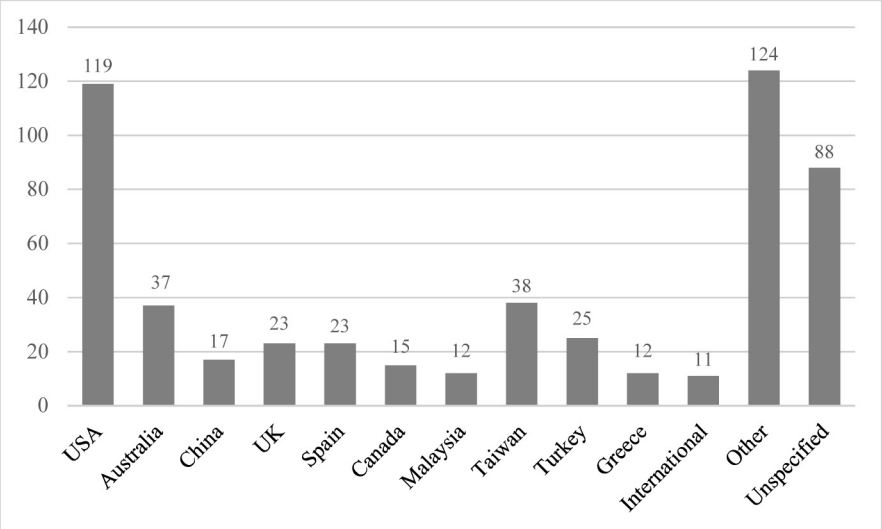

FIGURE 1
Distribution of Studies According to Country

TABLE 4
Distribution of Studies According to the Number of Authors

Number of Authors	*f*	*Percent*
1	148	27.21
2	148	27.21
3	128	23.53
4	66	12.13
5 or more	54	9.93
Total	544	100

TABLE 5
Distribution of Studies According to Subject Areas

Subject Area	*f*	*Percent*
Evaluation	317	40.59
Design	260	33.29
Theory and research	100	12.80
Development	76	9.73
Administration	24	3.07
Institution and business	4	0.51
Total	781	100

Number of Authors of Studies

The number of authors of studies concerning interaction in distance education was examined and descriptive statistics regarding the number of authors of studies are presented in Table 4.

Examining Table 4, it can be observed that studies with 1 author (f = 148) and 2 authors (f = 148) are more prevalent than studies with 3 authors (f = 128), 4 authors (f = 66), or 5 or more authors (f = 54). The study of Zawacki-Richter, Bäcker and Vogt (2009) examining distance education also showed that there was a higher number of studies with one author and two authors than studies with multiple authors. Looking at the table from another perspective, it can be clearly observed that studies with multiple authors (73%) are generally more prevalent than studies with one author (27%). As a matter of fact, scientists from all around the world also prefer studies with multiple authors (King, 2013).

Subject Areas of Studies

Studies concerning interaction in distance education were examined according to subject areas and descriptive statistics regarding the subject areas of studies are presented in Table 5.

Examining Table 5, it can be observed that interaction in distance education investigates subjects concerning evaluation (f = 317), design (f = 260), and theory and research (f = 100) more than subjects concerning development (f = 76), administration (f = 24), and institution and business (f = 4). These data show that interaction in distance education empha-

sizes the dimensions of design and evaluation, as well as theoretical studies. We see a similar view regarding interaction based on this classification (Karataş, 2008) and distance education in general (Karataş et al., 2014). Thus, there is obviously a necessity for more studies examining the dimensions of interaction in the areas of distance education like development, administration, institution, and business. In a similar study that was conducted in the area of mobile learning (Wu et al., 2012), it was determined that researchers were generally tending to evaluate the effects of mobile learning, which supports the findings of this study.

Disciplines of Samples and Subject Areas in Studies

The disciplines of samples and subject areas were investigated in the studies concerning interaction in distance education and descriptive statistics regarding samples and subject areas in studies are presented in Table 6. Disciplines with fewer than 10 studies concerning sample disciplines are labeled "other."

Examining Table 6, it can be observed that the samples of education (19.03%), health sciences (9.87%) and computer sciences (7.87%) and the subjects of education (23.19%), computer sciences (11.37%) and health sciences (9.9%) are those mostly studied in interaction in distance education. It is also observed that the disciplines of the sample (28.33%) and subject area (21.71%) are not specified in a significant number of studies. Bozkurt et al. (2015) suggest that distance education studies in Turkey are mainly conducted in the discipline of education. Similarly, Wu et al. (2012) suggests that studies in mobile learning are prevalent in the field of professional and applied sciences. The reason for mainly choosing students in the field of education is associated with the accessibility of the sample. Researchers may have preferred convenience sampling techniques, based on time, cost, location and availability of respondents (Merriam, 2015; Patton, 2014).

Sample Sizes in Studies

The sample sizes in studies concerning interaction in distance education were investigated and descriptive statistics regarding sample sizes in studies are presented in Table 7.

Examining Table 7, it can be observed that studies with a sample size of 31–100 (31.1%) and 1–30 (20.6%) are more prevalent than other studies. Kılıç-Çakmak et al. (2015, 2016) also suggest that the field of educational technology generally prefers a sample size of 31-100. The reason for the primacy of these groups as a sample size is associated with the possibility of reaching samples involving fewer than 100 people than reaching larger sample groups. This condition may also be associated with the frequent use of case studies and experimental patterns in the aforementioned studies. As a matter of fact, smaller samples are preferred for examining subjects in greater depth in case studies and experimental studies (Miles & Huberman, 1994).

Educational Level of Sample in Studies

Among the 544 studies concerning interaction in distance education, the 490 studies with a sample were investigated according to the educational level of the sample and descriptive statistics regarding sample stages in studies are presented in Table 8.

Examining Table 8, it can be observed that studies concerning interaction in distance education are mainly aimed at undergraduate (55.31%) and postgraduate (24.49%) students and other sample stages are less prevalent in the studies. Wu et al. (2012) determined that studies of mobile learning were generally conducted with higher education students. Drysdale, Graham, Spring, and Halverson (2013) reached a similar finding in blended learning. The reason for conducting studies mainly aimed at undergraduate and postgraduate students is associated not only with generally applying distance education at these levels, but also having the studies conducted by academics, who could reach undergraduate

TABLE 6
Distribution of Studies According to Disciplines

	Sample		*Subject Area*	
Discipline	*f*	*%*	*f*	*%*
Education	133	19.03	157	23.19
Health sciences	69	9.87	67	9.90
Computer sciences	55	7.87	77	11.37
Business studies	48	6.87	37	5.47
Engineering	42	6.01	37	5.47
Languages and linguistics	34	4.86	49	7.24
Visual arts	17	2.43	11	1.62
Psychology and sociology	16	2.29	9	1.33
Life sciences	11	1.57	12	1.77
Mathematics	8	1.14	11	1.62
Other	68	9.73	63	9.31
Unspecified	198	28.33	147	21.71
Total	699	100.00	677	100.00

TABLE 7
Distribution of Studies According to Sample Sizes

Sample Size	*f*	*%*
31-100	169	31.1
1-30	112	20.6
101-300	107	19.7
301-500	31	5.7
501-1000	23	4.2
1001 or more	23	4.2
Studies without a sample	79	14.5
Total	544	100

TABLE 8
Distribution of Studies According to Sample Educational Level

Sample Stage	*f*	*%*
Undergraduate	271	55.31
Postgraduate	120	24.49
Practitioners	50	10.20
K–12	46	9.39
Associate degree	3	0.61
Total	490	100

students more easily (Karataş et al., 2014). In addition to this, the number of studies aimed at practitioners (doctors, nurses, engineers, etc.) in various disciplines is fewer (10.2%) than studies aimed at students, which shows that there is a greater need for studies aimed at interaction in in-service distance education.

Research Models and Patterns Used in Studies

Table 9 shows descriptive statistics regarding research models and patterns used in studies concerning interaction in distance education.

Examining Table 9, it can be observed that studies concerning interaction in distance education prefer quantitative study models (f = 376) to qualitative (f = 187), literature review (f = 76) and mixed models. It is also observed that comparative (f = 97) and descriptive (f = 91) patterns are used in quantitative studies at a higher rate than other. Case studies are more prevalent than other patterns (f = 165) in qualitative studies; triangulation (f = 17) and explanatory (f = 15) patterns more prevalent than exploratory patterns in mixed studies, and literature review (f = 72) studies to meta-analysis (f = 4) studies. In the literature, it is observed that the quantitative model is preferred in studies concerning distance education (Bozkurt et al., 2015; Zwacki-Richter et al., 2009), blended learning (Drysdale et al., 2013), mobile learning (Wu et al., 2012), and educational technology (Baydaş, Kucuk, Yilmaz, Aydemir, & Goktas, 2015; Kılıç-Çakmak et al.,

TABLE 9
Distribution of Studies According to Research Models and Patterns

Research Model	*Research Pattern*	*f*
Quantitative	Comparative	97
	Descriptive	91
	Correlational	70
	Quasi-experimental	56
	Survey	26
	Weakly experimental	20
	Fully experimental	14
	Ex post facto	1
	Single-subject	1
	Total	376
Qualitative	Case study	165
	Grounded theory	10
	Concept analysis	4
	Culture analysis	4
	Phenomenology	4
	Total	187
Literature review	Literature review	72
	Meta analysis	4
	Total	76
Mixed	Triangulation	17
	Explanatory	15
	Exploratory	5
	Total	37

Source: Göktaş et al. (2012).

2015; Kılıç-Çakmak et al., 2016), compared to other models. Considering the data collection tools in Table 11, it could be suggested that researchers prefer models that enable them to collect and analyze data more easily. In addition to this, it should be remembered that the most commonly used pattern is the case study, which may be associated with researchers' attempt of applying distance education to a specific group with a new method and observing them. As a matter of fact, the "learning environment" is the most commonly used independent variable in studies and researchers are trying to understand conditions by conducting some applications in either their own learning environment or current platforms such as Moodle and Blackboard.

Interaction Types Examined in Studies

Studies concerning interaction in distance education were examined according to interaction types and descriptive statistics regarding the interaction types in studies are presented in Table 10.

Examining Table 10, it can be observed that studies concerning interaction in distance education mainly examine learner-learner ($f = 218$), learner-instructor ($f = 189$), social ($f = 99$), and learner-content ($f = 96$) interactions. Similarly, distance education studies mainly involve learner-learner and learner-instructor interactions (Wanstreet, 2006). Compared to Karataş' study (2008), it can be observed that while the first four interaction types are the same, social interaction, which is found in the first rank there, is in the third rank here. There are also studies that suggest that the quantity and influence of learner-learner and learner-content interactions is greater than those of learner-instructor interaction (Bernard et al., 2009). Furthermore, when some studies in the literature are examined, it is seen that the learners are more interested in learner-content interaction than learner-learner interaction (Bağrıacık, 2015).

Data Collection Tools Used in Studies

Studies concerning interaction in distance education were examined according to their data collection tools and descriptive statistics regarding data collection tools are presented in Table 11.

Examining Table 11, it can be observed that questionnaire (37.41%) and interview form (17.35%) are among the most commonly used data collection tools in studies concerning interaction in distance education. The reason for mainly preferring the questionnaire and interview form as data collection tools is associated with their usefulness (quickness, economy) for collecting data (Thomas, 1998). As a matter of fact, Wu et al. (2012), Karataş et al. (2014), and Bozkurt et al. (2015) also suggest that the most commonly used data collection tools in studies are questionnaires and inter-

TABLE 10
Interaction Types Examined in Studies

Interaction Type	*f*	*%*	*Interaction Type*	*f*	*%*
Learner–learner	221	26.50	Learner–system	4	0.48
Learner–instructor	189	22.66	Written interaction	3	0.36
Social interaction	99	11.87	Learner–interface	2	0.24
Learner–content	96	11.51	Learner–learning agent	2	0.24
Learner interactions	32	3.84	Vicarious interaction	1	0.12
Virtual interaction	20	2.40	No classification	141	16.91
Bidirectional	10	1.20	Other	10	1.20
Multidirectional	4	0.48	Total	834	100

TABLE 11
Data Collection Tools Used in Studies

Data Collection Tool	*f*	*%*	*Data Collection Tool*	*f*	*%*
Questionnaire	263	37.41	Group discussions	23	3.27
Interview form	122	17.35	Learning outputs	17	2.42
Log records	81	11.52	Scale	15	2.13
Achievement test	56	7.97	Blog posts	7	1.00
Online messages	46	6.54	Focus group interview	3	0.43
Document	40	5.69	Video records	1	0.14
Observation form	29	4.13	Total	703	

TABLE 12
Data Analysis Techniques Used in Studies

Data Analysis Technique	*f*	*%*	*Data Analysis Technique*	*f*	*%*
Frequency	252	23.5	Regression	35	3.3
Percentage	231	21.6	Structural equation modeling	22	2.1
Mean	134	12.5	Chi-square test	9	0.8
Content analysis	106	9.9	Factor analysis	8	0.7
T test	84	7.8	Mann–Whitney U	8	0.7
Variance analysis	67	6.2	Social network analysis	6	0.6
Correlation	66	6.2	Other	43	4.00
			Total	1,071	100

view forms. In addition to this, log records have recently started to be commonly used as well.

Data Analysis Techniques Used in Studies

Table 12 shows the most commonly used data analysis techniques in studies concerning interaction in distance education. Data analysis techniques with a frequency below 5 (Cohen's *D* test, Cronbach's Alpha, *F* test, Heat Maps, Kruskal-Wallis, Levene's test, Sequential Analysis, Wilcoxon, Signed Ranks test, *Z* Score, Chi Square test, *Z* test, Conan's Index Coefficient, Multiple Regression Analysis, Interaction Analysis, Meta Analysis, Ridit Analysis, Rodger's Method, Discourse Analysis, Spearman) are analyzed under the heading "other."

In studies that were conducted between 2011 and 2015 concerning interaction in distance education, the most commonly used data analysis techniques were "Frequency" (45.9%), "Percentage" (42.1%), "Mean" (24.4%), "Content Analysis" (19.3%), and "*T* Test" (15.3%). On the other hand, the analysis techniques that are analyzed under the heading "other" and used fewer than five times in the studies constitute 4% of the analysis techniques being used. Moreover, no data analysis technique had been used in 71 of the studies that were examined. The reason for frequency, percentage, and mean, which are among quantitative data analysis techniques, and content analysis, which is a qualitative data analysis technique, to rank first could be associated with using the questionnaire and interview as the most common data collection tools. This

situation can also be explained by commonly preferring the quantitative model in distance education studies (Bozkurt et al., 2015; Karataş, 2008; Karataş et al., 2014; Zawacki-Richter et al., 2009).

Dependent Variables Featured in Studies

Table 13 shows dependent variables that are commonly featured in studies concerning interaction in distance education. Dependent variables with a frequency below 10 (academic sense of self, cognitive readiness, number of feedbacks, student behaviors, student attention, accessibility, time and difficulty) are analyzed under the heading "other."

A total of 115 different dependent variables were featured in studies concerning interaction in distance education conducted between 2011 and 2015. The most commonly appearing dependent variables were "interaction" (14.3%), "academic achievement" (12.5%), "satisfaction" (7.0%), "students' views" (5.9%) and "Participation" (4.5%). Dependent variables that are analyzed under the heading "other" and used fewer than 10 times in the studies constitute 28.2% of all dependent variables. Similarly, Bozkurt et al. (2015) suggest that the first three variables featured in distance education are attitude, academic performance, and satisfaction. Considering as the power of interaction increases the achievement increases (Bernard et al., 2009), it is natural for academic achievement to rank among the first ones.

Independent Variables Featured in Studies

Table 14 shows the independent variables that are commonly featured in studies concerning interaction in distance education. Independent variables with a frequency below 10 (readiness, lesson discipline, communication, motivation, attitude, talent, social readiness) are analyzed under the heading "other."

A total of 151 different independent variables were featured in studies concerning interaction in distance education conducted between 2011 and 2015. The most commonly featured independent variables were "learning environment" (16.0%), "interaction" (7.8%), "gender" (7.0%), "educational method" (6.0%), "tools being used" (4.7%), and "age" (4.7%). Independent variables analyzed under the heading "other" and used fewer than 10 times in the studies constitute 36.4% of all independent variables. It can be observed that the variable of "learning environment" is used more than other variables to a remarkable extent, which is associated with researchers' efforts to create a unique learning environment

TABLE 13
Dependent Variables Featured in Studies

Dependent Variable	*f*	*%*	*Dependent Variable*	*f*	*%*
Interaction	117	14.3	Motivation	17	2.4
Academic achievement	89	12.5	Learning outputs	17	2.4
Satisfaction	50	7	Attitude	17	2.4
Students' views	42	5.9	Social readiness	13	2.1
Participation	32	4.5	Readiness	10	1.8
Participants' views	26	3.6	Communication	10	1.4
Cooperation	22	3.1	Teacher performance	10	1.4
Availability	21	2.9	Other	201	28.2
Efficiency	19	2.7	Total	713	100

TABLE 14
Independent Variables Featured in Studies

Independent Variable	*f*	*%*	*Independent Variable*	*f*	*%*
Learning environment	109	16.0	Participation	17	2.5
Interaction	53	7.8	Experience	15	2.2
Gender	48	7.0	Class level	15	2.2
Educational method	41	6.0	Availability	13	1.9
Tools being used	32	4.7	Academic achievement	12	1.8
Age	32	4.7	Country	11	1.6
Participants' views	19	2.8	Other (137 variables)	248	36.4
Satisfaction	17	2.5	Total	682	100.0

TABLE 15
Base Theories and Models in Studies

Theory/Model	*f*	*%*	*Theory/Model*	*f*	*%*
Technology acceptance model	14	2.57	Social constructivist approach	3	0.55
Community of inquiry framework	7	1.29	Care theory	2	0.37
Activity theory	6	1.10	Multiple intelligence theory	2	0.37
Sociocultural theory	6	1.10	Community of practice	2	0.37
Transactional distance theory	6	1.10	Information system success model	2	0.37
Constructivism	6	1.10	Social cognitive theory	2	0.37
Game-based learning	4	0.74	Social learning theory	2	0.37
Theory of interaction equation	3	0.55	Other	57	10.48
Social readiness theory	3	0.55	Unspecified	417	76.65
			Total	544	100

and examine the effects of this environment on some variables.

Base Theories in Studies

Table 15 shows descriptive statistics regarding theories and models used in studies concerning interaction in distance education. Theories and models with a frequency below 2 are analyzed under the heading "other."

Examining Table 15, it can be observed that a great majority of studies (76.65%) are not grounded on any theory or model. The most commonly used theories and models are the technology acceptance model (2.57%), community of inquiry framework (1.29%), activity theory (1.10%), sociocultural theory (1.10%), transactional distance theory (1.10%), and constructivism (1.10%). Theories and models that are used only once are analyzed under the heading "other." As transactional distance theory (Moore, 1993) could be expected to be used most frequently, as it provides the theoretical basis for interaction in distance education, it is noteworthy that the technology acceptance model ranks first. This situation may be associated with studies' examination of the effects of a new technology on interaction and other variables. As a matter of fact, models, such as the technology acceptance

model, that are grounded on human behavior are commonly used for examining changes in individuals' behaviors (Lau, 2011). Considering the fact that the most commonly embraced interaction type is learner-learner interaction, it could be expected that the community of inquiry framework (Garrison, 2007) would rank second as it is based on examining the student community.

Technologies Used in Studies

Table 16 shows descriptive data regarding technologies used in studies concerning interaction in distance education.

Examining Table 16, it can be observed that the most commonly used technologies in studies are LMS (19.50%), Facebook (4.20%), discussion forum (3.70%), platform designed by researcher (2.72%), and Second Life (2.72%). In addition, among the studies examined, no technology was used in 215, a study was conducted on one technology in 285, and on two and more technologies in 44. It can be suggested that Moodle and Blackboard had become more popular over the time period involved, because the technologies being used in Karataş's study (2008) do not involve Moodle, and Blackboard was used in only two studies. Compared with the same study, it can also be observed that researchers had started to create their own technology platforms since 2008, which is associated with the ample opportunities provided by Web 2.0 technologies to users.

CONCLUSION AND SUGGESTIONS

In this study, the full texts of 544 articles concerning interaction in distance education found in the databases of EBSCO, Scopus, and Web of Science between 2011 and 2015 were examined using the trend analysis technique. The study analyzes the present situation regarding interaction in distance education in detail and presents findings that may help to clarify future developments.

According to the results, there was an increase in the number of articles concerning interaction in distance education between 2011 and 2013. A decrease in number began from 2013. As a result of their study, Zawacki-Richter et al. (2009) determined that the majority of studies on distance education that were conducted in 2008 involved interaction and communication in learning communities. They also determined that studies on interaction showed an increase between 2000 and 2004 and started to decrease towards 2008. In the study of Karataş (2008), a decrease in studies on interaction was found between 2003 and 2008. Taking all these findings into consideration, it can be suggested that studies on interaction proceed in a kind of zigzag fashion. Zawacki-Richter and Naidu (2016) also determined that researchers focused on the dimen-

TABLE 16
Distribution of Technologies Used in Studies

Name of Technology	*f*	*%*
LMS (Blackboard, Moodle)	79	19.50
Facebook	17	4.20
Discussion forum	15	3.70
Platform designed by researcher	11	2.72
Second Life	11	2.72
Blog	10	2.47
Other	262	64.69
Total	405	100

sions of collaborative learning and online interaction in distance education between 2005 and 2009. However, massively open online courses and open educational resources were also found between 2011 and 2014. Considered from this point of view, it could be suggested that, after these times, interaction was either replaced by other concepts or researchers were involved in other projects.

Examining all the findings from a broad perspective, it can be suggested that researchers have a tendency to integrate new technologies into online learning environments and even to develop these technologies themselves if required, observing their effects upon interaction and many other variables and revealing their relationships. The rapid development of technologies and willingness of researchers to test these technologies should be noted at this point (Wu et al., 2012). Besides, the most commonly used form of the studies is the case study, a form that tends to support this situation. As a matter of fact, in case studies, factors concerning a case are investigated with an integrated approach and particular attention is paid to how they affect the situation at hand and are affected by that situation (Yıldırım & Şimşek, 2013). Moreover, the technology acceptance model, which is among the models used as a base, ranks first and the studies are mainly conducted in the fields of evaluation and design, which explains this tendency of integrating new technologies into online learning environments.

The greatest contribution to the field of interaction in distance education comes from the USA, Taiwan, and Australia. Similar studies (Hwang & Tsai, 2011; Hwang & Wu, 2012) also suggest that the aforementioned countries rank first in terms of contributing to the field. In addition to this, it can be observed that there are many studies with multiple authors, which may signify that authors have a tendency to conduct collaborative studies. At this point, it should also be noted that many studies are not grounded on any theories or models. However, researchers' efforts in creating new models inspire hope, as there is a need for theoretical infrastructure to organize studies in the field of education (Garrison, 2007).

In line with the nature of distance education, studies are mainly conducted within the field of education. As the majority of researchers are academics, they generally prefer easily accessible undergraduate students and to work with smaller samples. The reason for preferring smaller samples may be associated with the desire to examine the situation in greater depth. It can also be seen that log records that contain data about all the actions of the students who are the sources of data have started to be used more frequently by researchers over the course of time. Additionally, the data techniques of frequency, percentage and mean have been the most commonly used since 2008 (Karataş, 2008). This is not that surprising considering that the quantitative model and the questionnaire form are most prevalent in the studies examined.

In conclusion, it can be suggested that new technologies open up new horizons for researchers in terms of interaction and that, even though there has been a decrease in the number of studies over time, researchers are still trying to seek ways to offer and increase the possibilities for interaction. This is extremely positive in terms of interaction in distance education. This study shows that researchers mainly examined learner-learner interaction. It is recommended that the relationship between this trend on the part of researchers, and the expectations and perceptions of students, be investigated. As certain countries always tend to occupy the first places in studies on interaction, it is also recommended that the distance education systems of these countries be examined in order to find out whether the number of studies and the quality of interaction are directly proportional.

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