

## Research Trends and Issues in Educational Technology: Content Analysis of TOJET (2012–2018)

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### ABSTRACT

The overall aim of this study was to review research trends and issues in the field of educational technology specifically focused on the articles published in the Turkish Online Journal of Educational Technology (TOJET) from 2012 to 2018. Content analysis was used to examine (a) general characteristics of studies; (b) research themes and issues; and (c) research design in TOJET for the period of study. The data was collected from the website TOJET to establish publication characteristics and compare current trends with the previous patterns in the field of educational technology. The findings show that for the period of last 7 years a total of 560 articles were published in the TOJET.

**Keywords:** Educational Technology, Research Trends, Content Analysis

### INTRODUCTION

The field of educational technology deals with design, development, implementation and evaluation of learning and teaching processes (Alkan & Kurt, 1998). Advances in technology provided new dimensions for efforts to make learning processes more effective and efficient. As a result, we came across many more studies focus on how these new dimensions effect the leaners, instructors, learning environments, and processes in the literature. Due to the fact that educational technology is an everchanging field of study that has constantly been influenced by these new trends, discoveries, technologies, etc. (Reiser & Dempsey, 2007), it is important to review the up-to-date studies to be able to identity the areas needing more research and to lead the future research. These periodically conducted systematic reviews do not only provide an insight about how deep and widely the chosen topic has been investigated but also presents a big picture about the field and help the researchers see the future trends. In the educational technology literature, there are a number of important reviews (Bodily, Leary&Richard, 2019; Marin, Duart, Galvis & Zawacki-Richter, 2018; Zawacki-Richter & Latchem, 2018) that reveals very important hints for researchers and practitioners. This study covers the results of a follow-up study that intended to analyze the articles published in The Turkish Online Journal of Educational Technology (TOJET) between 2012 and 2018. So, the purpose of this study was to update the previous one that covered the articles published between 2008 and 2011. During the analyses, number of authors, country(ries) the study conducted, topic focused, instructional mode, research method employed including participants and instruments (data collection) were among the major variables we focused.

The study has revealed that a great deal of articles published in TOJDE during 2012-2018 was written by mostly international (live outside Turkey) multiple authors (co-authorship). The studies focused more on higher education and learners than other levels of education and groups. The study has also shown that studies mostly deal with instructional media, design and development, evaluation, learning and teaching approaches. Especially, instructional design, technology integration into education, educational games, mobile learning and collaborative learning are among the most frequently investigated topics in these research studies. Moreover, face-to-face learning mode, quantitative methods, and survey design preferred more than their alternatives.

The results of this study support some of the previous studies. For instance, Kılıç-Çakmak, et al (2015) reviewed 617 articles published in 6 educational technology journals (AJET, BJET, C&E, ETR&D, ET&S, L&I) indexed by SSCI, and found out that instructional design was the most frequently examined topic in those articles. They also observed that quantitative method was also employed way more than qualitative and use of questionnaires to collect data was widely preferred. The study also revealed that those studies mostly focused on undergraduate

students. The same researchers repeated their study in 2016 covering two more journals. This time they conducted the content analysis of 583 articles and reached almost the same results (Kılıç-Çakmak, et al, 2016).

In another study, Baydas, Küçük, Yılmaz, Aydemir and Göktaş (2015) examined some other journals of educational technology and uncovered that online learning, learning approaches and learning environments as the most frequently studies topics. Similarly, Zawacki-Richter and Latchem (2018), and Marin et al. (2018) also stated that pedagogy behind use of technology, and instructional design are the topics mostly investigated; and Perez-Sanagustin et al. (2017) noted the high preferability of quantitative methods in the research studies. On the other hand, Bond and Bunstins (2018) conducted another content analysis of the articles published in the Australian Journal of Education Technology (AJET) during 2013-2017 and observed a trend in research methods preferred after 2015: more mixed method studies were spotted. Bodily et al. (2019) analyzed the keywords included in the articles published in 65 journals related to the field of educational technology indexed by Scopus Database. They found out that in 2014, MOOCs and Social Network Analysis were the most frequently noted keywords while in 2015 and 2016, MOOCs, gamification, flipped classroom, and open education were the ones. In the same study, the authors also observed a shift in the targeted populations (participants): from K12 in 2009 to learners in MOOCs, Wikis, and Blogs.

In the light of the available systematic reviews in the literature, it wouldn't be wrong to state that the research studies related to educational technology conducted during 2012-2018 show similarities especially regarding the research trends and methods, and these are influenced by the advances in technology.

## **METHODOLOGY**

### ***Research Method***

Similar to the previous study, we conducted a content analysis study reviewing articles published in the Turkish Journal of Online Education Technologies (TOJET) between 2012-2018. Content analysis is a research method that can be used to make valid inferences by coding and interpreting different types of data. By systematically evaluating a meaningful pieces of contents in verbal communication materials, written texts, visual materials (e.g., graphics, icons), qualitative data can be converted into quantitative data. Generally, researchers develop a coding sheet to collect data on the frequency and intensity of coding unites and themes in the research articles. However, in this study, the coding scheme developed in the previous study (Bozkaya, Erdem Aydın, & Genç Kumtepe, 2012) was used in order to compare earlier results and patterns with those from this current data set.

### ***Data Source***

The main purpose of this content analysis study, which is the continuation of the previous two studies (Alper & Gülbahar, 2009; Bozkaya et al., 2012), is to evaluate the general research tendency in the articles published in TOJET and compare the findings. The Turkish Online Journal of Educational Technology established in 2002 is a multidisciplinary peer-reviewed journal in the field of educational technology. It is a quarterly electronic journal indexed/abstracted in many databases including Education Research, EBSCO and ERIC. In addition, TOJET has been indexed in the Social Science Citation Index (SSCI) between January 2007 and December 2012, Volume 6 Issue 1 - Volume 11 Issue 4. Therefore, it is believed that examining past and present research actions and agendas depending on years and periods will provide an significant contribution to the field of education technology.

Similar objectives of both studies, the first review work by Alper and Gülbahar (2009) covered the articles published between 2003-2007 in TOJET and the following study conducted by Bozkaya et al. (2012) between 2008 and 2011 were to examine the trends and issues in the field of educational technology. As emphasized above, research and practices trends have been examined through similar variables in the current study. The major themes in the coding sheet includes research topics, instructional mode, the number of authors, target population, educational (school) level, academic subject taught, research method, research theories, data collection technique, and sample size. A total number of 560 articles were published in TOJET between 2012 to 2018 capturing 7 volumes and 28 issues. All these articles were extracted and used as the main dataset for the current study. The characteristics of the data source are presented in Table 1.

**Table 1:** Information about Data Source (n=560 articles)

Journal	Publication Frequency (issues/year)	Abstracted/Indexed in	Publication Volumes/Issues & Years included in this study	Number of articles in each volume & issue between 2012 – 2018
TOJET	2012: 1 issue 2003-2011: 4 issues	21 Databases ie., ERI, ERIC, EBSCO	Vol. 1–4: 2012	20; 28; 37; 45
			Vol. 1–4: 2013	21; 34; 15; 23
			Vol. 1–4: 2014	22; 21; 23; 10
			Vol. 1–4: 2015	17; 27; 15; 17
			Vol. 1–4: 2016	14; 14; 19; 14
			Vol. 1–4: 2017	19; 13; 15; 18
			Vol. 1–4: 2018	23; 18; 12; 6
<b>Total</b>			<b>560</b>	

**Coding Procedure and Data Analysis**

Previously developed coding system was used to systematically review and compare studies within the similar conceptual framework. This coding scheme includes variables in the following main areas (I) general characteristics; (II) research themes and issues; and (III) research design of studies. The area of “general characteristics” contains variables as total number of publications, authorship contribution (solo studies vs. the presence of collaboration), the affiliated countries of authors who contributed to TOJET, educational/school level, target population, and academic subject area. The second area reflects “research themes and issues” including variables as research topics and theories, instructional modes, and type of media in articles. The last area "research design" involves variables as research research methods and strategies, data collection methods and sample size.

Each article was coded by two field experts, specializing in educational technology and communication and open and distance education. Each coder worked separately on a subset of articles and then they replicated each other's work for these studies. The third author performed random cross-checks to verify the accuracy of the information and also to ensure results are reliable. The third researcher reviewed about 100 articles to check and validate the actions of the two initial coders. Inter-coder agreement/reliability was measured using Cohen’s Kappa statistics ( $\kappa$ ) (1960). Rietveld and van Hout (1993) suggest Kappa values and the related reliability levels as .00 – .20 slight, .21- .40 fair, .41-.60 moderate, and .61-.80 substantial agreement. According to this scale, inter-coder agreement scores in this study ranged from .70 to .82, indicating moderate to relatively high agreement for each variable.

**RESULT**

**General Characteristics of Research Studies**

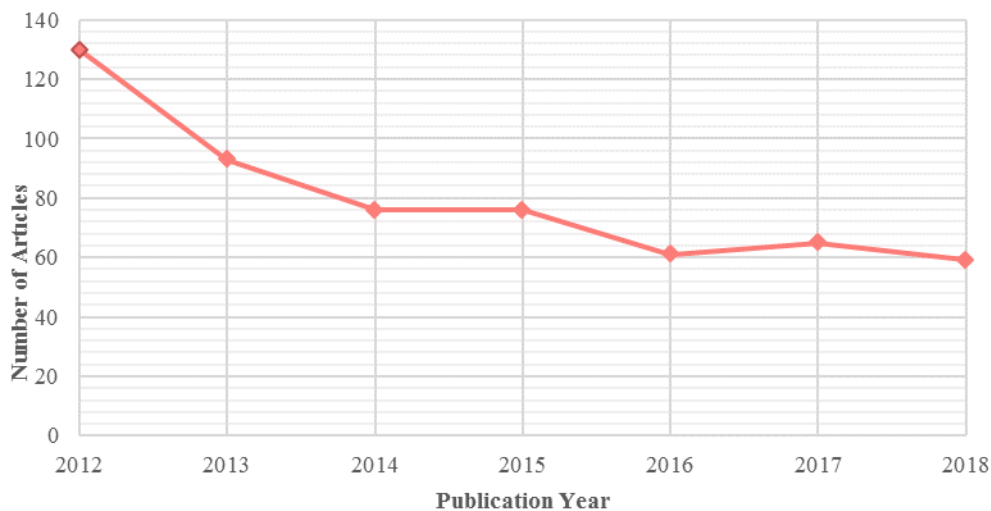
**Number of Articles Published**

Table 2 shows the number of articles published from 2012 through 2018. The publication frequency of TOJET is not stable although it was stated that the journal produces for volumes per year. During this period of time, the highest publication rate was observed in 2012 with 130 articles and 23.2 percent. After that year, the total number of published articles has been declined gradually.

**Table 2:** Number of Articles Published from 2012 to 2018 (n=560)

Year	Frequency (f)	Percent (%)
2012	130	23.2
2013	93	16.6
2014	76	13.6
2015	76	13.6
2016	61	10.9
2017	65	11.6
2018	59	10.5
Total	560	100.0

As emphasized in the findings of our previous study (Bozkaya et al., 2012), since TOJET was in the SSCI index between 2007 and 2012, the number of articles in each volume and issue was quite high. However, as shown in Figure 1, a remarkable decrease was observed in the number of articles after 2012. Such decline may also be related to the decrease in the acceptance rates of the journal during the referee process.



**Figure 1:** Year wise distribution of articles

**Presence of Research Collaboration**

Research is actually a collaborative effort. There are many actors in this process such as researcher, data collector and analysis, editor so on. The field of educational technology may require an interdisciplinary methodological approach to perform a research enterprise. Multi-author and multi-disciplinary studies are important in terms of their potential to bring different perspectives to the field.

Authorship patterns per year of period are presented in Table 3 & 4. The findings illustrate that for the period of seven years TOJET formed 560 articles with various authorship patterns. The maximum number of author per paper in TOJET was found to be 16. In general, the number of authors in this period was observed as 6 or less researchers per paper.

**Table 3.** Distribution of Number of Authors

Number of Authors	f	%
1	189	33.8
2	160	28.6
3	103	18.4
4	75	13.4
5	21	3.8
6	7	1.3
7	3	0.5
8	1	0.2
16	1	0.2
Total	560	100.0

The distribution of authorship shows that for years of 2012 (74%), 2013 (70%), 2017 (69%), and 2018 (69%), multi-authored articles were higher than solo studies. That gap narrows down during 2014 (43%), 2015 (43%) and 2016 (38%) and single authored papers were more than multiple authored papers. Overall, the total number of single-authored papers contributed to 189 (34 %) articles while a total of 371 (66%) multi-authored papers in this seven-year period of TOJET.

**Table 4.** Distribution of Number of Authors

Number of Authors	Year							Total
	2012	2013	2014	2015	2016	2017	2018	
1	34 (26)	28 (30)	33 (43)	33 (43)	23 (38)	20 (31)	18 (31)	189 (34)
2	31 (24)	33 (36)	26 (34)	17 (22)	16 (26)	20 (31)	17 (29)	160 (29)
2-5*	65 (50)	32 (34)	17 (23)	26 (35)	25 (36)	25 (38)	24 (40)	211 (37)

Total	130	93	76	76	61	65	59	560 (100)
Degree of collaboration (DC)**	0.74	0.70	0.57	0.57	0.67	0.69	0.69	0.66

\*\* Indicates number of authors 5 or more

\*\* DC=Nm/Nm+Ns e.g., for 2012 C= (31+65)/130

Subramanyam (1983) suggests a measure to determine the the degree of collaboration in research studies in a discipline. That index was calculated using the following formula;

$$DC = Nm / (Nm + Ns)$$

Where; DC is the degree of collaboration, Nm is the number of multi-authored papers, and Ns is the number of single authored papers. This equation is simply expressed by DC = (number of multi-authored papers) / (total number of papers). The results revealed that the overall degree of collaboration in the articles published in the TOJET from 2012 to 2018 was 0.66, indicating that multi-authored studies (371 articles out of 560) have dominated this journal. The findings of this study on the authorship pattern yielded similar outcomes with the previous content analysis study covering the years 2008-2011 (Bozkaya et al., 2012). The degree of collaboration over the four-year period for the previous study is calculated to be 0.64.

### Country-Wise Distribution of Articles

The content analysis for the period of 7 years from 2012 to 2018 revealed that the TOJDE reached a very wide audience of authors located in 52 countries. In some collaborative studies among these articles, it was observed that the authors of different countries came together to carried out a study whereas some other studies were conducted in countries different than where the authors live. However, the top five countries with highest authorship contribution are Turkey, Taiwan, Malaysia, Saudi Arabia, and USA. In the previous content analysis, the studies were from 28 countries in total and similar trend was observed in distribution of countries in TOJET (Bozkaya et al., 2012). The list of affiliated countries of authors who contributed to TOJET from 2012 to 2018 are presented in Table 5.

**Table 5:** Country-Wise Distribution of Articles (n=560)

Country	Year (f)							Total n (%)
	2012	2013	2014	2015	2016	2017	2018	
Turkey	35	25	28	15	21	15	13	152 (27)
Taiwan	57	24	10	7	-	-	-	98 (18)
Malaysia	12	19	12	8	9	5	8	73 (13)
Saudi Arabia	4	2	2	6	2	4	9	28 (5)
USA	2	1	0	5	3	5	1	17 (3)
Others	20	22	24	35	26	36	28	194 (34)
Total	130	93	76	76	61	65	59	560 (100)

*\*Including Australia, Bahrain, Belgium, Canada, China, Colombia, Cyprus, Czech Republic, Denmark, Germany, Ghana, Greece, Hong Kong, Hungary, India, Indonesia, Iran, Italy, Japan, Jordan, Korea, Kuwait, Kyrgyzstan, Lithuania, Malaya, México, Mozambique, Netherland, Norway, Oman, Palestine, Philippines, Poland, Portugal, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sudan, Sweden, Thailand, Turkish Republic of Northern Cyprus, UK, United Arab Emirates.*

Of these, 152 (27%) of the 560 research studies were conducted in Turkey (Table 5). As previously highlighted that the most important reason for this more publications, the TOJET is the best known journal in the field of educational technology in Turkey. Similar to the previous study, many articles were published by the researchers in Taiwan (18%) and Malaysia (13%). Unlike the previous study, Saudi Arabia (5%) took the 4th place instead of the Turkish Republic of Northern Cyprus. The studies in the United States have a rate of 3% in all publications which is similar to the earlier finding (4%). The remaining 52 countries accounted for 34 percent in total studies. Compared to previous content analyses, researchers in different countries have contributed to the journal over the years.

**Target Groups by Educational Level**

Target groups per year were summarized by educational level in Table 6 and Figure 2. Similar to the results of the previous study (Bozkaya et al., 2012), more than one third of the studies (n=170) reviewed focused on the subjects at K-12 while the majority of studies targeted participants in higher education (n=370). At both levels, most studies were conducted on students (n=377). This is followed by teachers / instructors (n=109) and other groups (n=54).

**Table 6: Distribution of Articles by Educational Levels and Target Groups**

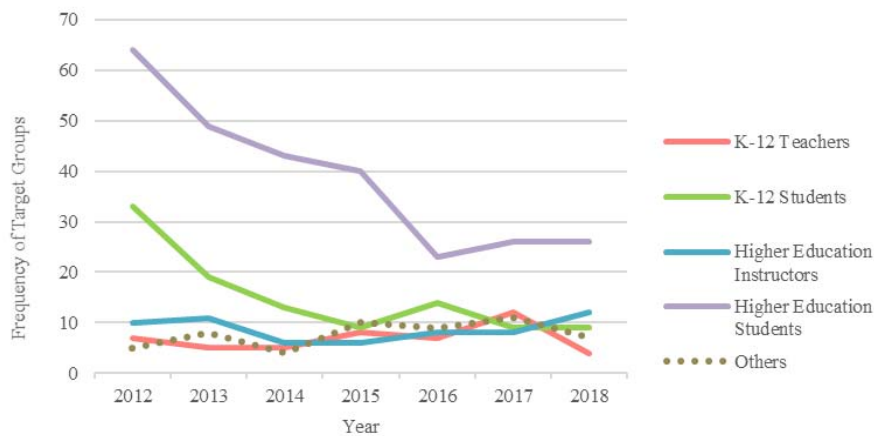
Educational Level	Target Group	Year (f)								Total n	Grand Total n(%)
		2012	2013	2014	2015	2016	2017	2018			
K-12	Teachers	7	5	5	8	7	12	4	48	170 (30)	
	Students	33	19	13	9	14	9	9	106		
	Others <sup>1</sup>	2	1	1	2	3	5	2	16		
Higher Education	Instructors	10	11	6	6	8	8	12	61	370 (70)	
	Students	64	49	43	40	23	26	26	271		
	Others <sup>2</sup>	3	7	3	8	6	6	5	38		

<sup>1</sup> Others refer to Administrators/Principals, Adults, Parents, Field Experts, ICT Coordinators.

<sup>2</sup> Others refer to Administrators, Authorities, Field Experts, Designers, Employees, Trainees.

Note: Some articles include more than one target group

The group called the “others” at the K-12 level refer to administrators or principals, adults, parents, field experts, and ICT staff. Correspondingly, “others” as the target group in higher education level consist of administrators, authorities, field experts, designers, employees, and trainees for this content analysis.



**Figure 2: Distribution of target groups by educational level**

**Academic Subject**

Subject area/disciplines were grouped based on the former study’s classification as social sciences, language, mathematics, science and engineering, and physical education. It should be noted that some studies are based on more than one subject area. Table 7 illustrates that similar to the previous study between 2008 and 2011, the focus from 2012 to 2018 was still on social sciences (n=298).

**Table 7: Distribution of Subject Area**

Area	Year (f)								Total n(%)
	2012	2013	2014	2015	2016	2017	2018		
Social Sciences <sup>1</sup>	83	66	44	28	11	31	35	298 (53)	
Language	18	12	16	18	12	9	9	94 (17)	
Mathematics	10	7	2	4	6	1	2	32 (6)	
Science & Engineering <sup>2</sup>	12	8	13	16	17	17	8	91 (16)	
Physical Education	2	-	-	-	2	-	1	5 (1)	

<sup>1</sup> Including education, educational technology, distance education, literature, commerce, ethics, music education, and early childhood education

<sup>2</sup> Including biology, chemistry, physics, computer science, information technology and architecture

Note: Some articles addressed more than one subject area

In this period of time, an increase was observed in the studies conducted in the field of language (17%). In addition to common languages such as English, Malay, Japanese, Korean, Arabic, Dutch, Italian language studies also came to the fore during this period. Another popular field in these years was science and engineering (n=91). Especially, with the spread of STEM education, which deals with the fields of science, mathematics, technology and engineering as a whole, integrated studies in these areas are notable. Physical education is an area of health sciences. In this period, a decrease was observed in the studies carried out in this field (n=5).

## II- Research Themes and Issues

### Research Topics

First of all, all studies were categorized based on research themes in our earlier study (Bozkaya et al., 2012). In addition, two new themes that did not fall into the prior categories were developed as culture and review studies. Both preset and emergent themes were described as below:

1. *Media Study* – This theme refers to media comparison studies such as F2F and other media forms. Specifically, media studies on the effects of teaching-learning process, learning characteristics and variables (attitudes of learners and educators towards the media, academic performance, technology perception, familiarity, self-efficacy, satisfaction, motivation, social presence and age related studies, learning styles, interaction types/levels, use of technology) were placed in this theme.
2. *Design & Development* – This theme refers to the studies on instructional design, software development or modeling technology to enhance the effectiveness and efficiency of teaching and learning process.
3. *Evaluation* – This theme refers to assessment and evaluation-based studies on teaching and learning process.
4. *Teaching & Learning Approaches* – This theme refers to the studies used in teaching-learning theories and approaches (constructive learning, cooperative learning, problem based learning, blended learning, distributed learning, project-based learning, media richness, social network analysis).
5. *Culture* – This theme includes cultural studies in the field of educational technology. Topics such as classroom culture, learner culture and learning community are covered in this theme.
6. *Review Studies* – This theme includes meta-analysis, literature review and content analysis.
7. *Others* – This theme covers studies that cannot be included in any of the above topics. For example, social responsibility of higher education, cyberbullying tendency, action plan, folklore, disabilities etc.

Table 8 shows research themes extracted from articles in TOJET published 2012 through 2018. All research themes except *Teaching and Learning Approaches* showed similar distributions from the previous study. As observed in previous years, *Media Studies* have been the most studied research theme (57%) in this period. In both content analysis periods (2008-2011 and the 2012-2018), media studies had 57% of all studies. Similarly, the research in the context of *Design & Development* and *Evaluation* had a share of 20% and 18% in 2008-2011 and 19% and 11% in 2012-2018. On the other hand, in the previous period, the theme of *Teaching and Learning Approaches* had a rate of 19%, while this ratio decreased to 6% in this period (see Table 8).

**Table 8:** Research Themes

Theme	Year (f)							Total n(%)
	2012	2013	2014	2015	2016	2017	2018	
Media Study	72	64	49	37	31	34	29	317 (57)
Design & Development	31	17	16	9	8	8	19	108 (19)
Evaluation	10	4	5	9	16	14	2	60 (11)
Teaching & Learning Approaches	11	3	2	13	3	2	1	35 (6)
Culture	2	1	1	-	-	-	1	5 (1)
Review Studies	3	4	3	1	1	4	6	22 (4)
Others	-	-	-	7	2	3	1	13 (2)

Note: Some studies focused on more than one theme

Two new research themes “Culture and Review Studies” that were not included in the previous classification were observed in a total of 26 studies between 2012 and 2018. In terms of research theme “Culture, the results of the current study (n = 5 studies; 1%) were similar to those of Zawacki-Richter's research in 2009. He pointed out in his study on Research Areas in Distance Education: A Delphi Study, culture and cultural differences have been the most neglected field in distance education. However, especially in recent years, meta-analysis and content analysis studies have emerged as a research theme not only in this field but also in many other areas. From 2012 through 2018, only 13 studies did not fit into any existing research theme and coded as others in this stage.

**Research Theories**

Research theories incorporated in the studies are classified into four academic fields as Learning Theories, Psychological Theories, Sociological Theories, and Communication and Media Theories. Table 8 presents the frequency distribution of the theories used in articles. Moreover, Figure 3 illustrates a packed bubble chart of research theories to present data in a cluster of circles. Theories in this chart defined as individual bubbles, and the size of the bubbles shows sum of frequencies in the related category.

Similar to the results of our previous study (Bozkaya et al., 2012), learning theories (n=149) have been more subject to research in this 7-year period than other theories. Within this category, the most commonly used theories are Constructivist Learning Theory (n=32), Technology Acceptance Model (n = 17), and Cognitive Learning & Load Theory (n = 16). In addition, Collaborative Learning Theory (n = 11), Problem Based Learning Theory (n = 11), Mobile Learning (n = 10) and Game-based Learning Theory (n = 10) are among the prominent learning theories in this group. Unlike the previous content analysis study, it has been observed that approaches such as flipped classroom, Ubiquitous Learning, and STEM education, which have become popular in recent years, were also included in the studies.

Following the theories of learning, the most commonly used theories and approaches in this period originated from the psychological (n=30) and sociological (n=28) fields. While it was determined that Self Efficacy Theory (n=17) in the field of psychology was mostly preferred, Social Network Theory (n=18) which is one of the sociology theories was found to be widely used in the studies. Social Presence Theory and Diffusion of Innovations Theory in Communication and Media Theories formed the theoretical framework of the studies as in the previous period (2008-2011).

**Table 9:** Research Theories

Learning Theories/Models/Approaches	f
Constructivist Theory	32
Social Learning Theory	6
Collaborative Learning Theory	11
Blended Learning Theory	8
Active Learning Theory	3
Behaviorist Learning Theory	3
Problem Based Learning Theory	11
Project Based Learning	1
Critical Thinking Theory	2
Cooperative Learning	5
Community of Inquiry	5
Competency Theory	3
Cognitive Learning & Load Theory	16
Technology Acceptance Model	17
Game-Based Learning	9
Ubiquitous Learning	4
Flipped Classroom	2
Mobile Learning	10
STEM Education	1
<b>Total</b>	<b>149</b>
<b>Psychological Theories</b>	
Neural Networks	1
Schema Theory	2
Self-Efficacy	17
Self-Regulated Learning	5
Motivation Theory	4



Mental Memory Theory	1
<b>Total</b>	<b>30</b>
<b>Sociological Theories</b>	
Social Network Theory	18
Digital Divide/Digital Learning	4
Cultural Theory	2
Knowledge Management & Building Theories	2
Social Inclusion Theory	1
Universal Design	1
<b>Total</b>	<b>28</b>
<b>Communication &amp; Media Theories</b>	
Social Presence Theory	3
Diffusion of Innovations Theory	2
<b>Total</b>	<b>5</b>

*Note: Some articles used more than one approach*



**Figure 3:** Frequency Distribution of Research Theories

### ***Instructional Mode***

The instructional mode of the studies is presented in Table 10. A total of 62 studies' research modes were not specified. The remaining 498 studies were examined in three main groups as traditional mode (face-to-face), distance mode, and the combined strategies.

**Table 10: Studies Classified by Instructional Mode (n=498)**

Instructional Mode	Year (f)							Total n(%)
	2012	2013	2014	2015	2016	2017	2018	
Traditional Mode (F2F)	104	80	66	46	35	52	45	428 (86)
Distance Mode	11	5	2	8	5	4	4	39 (8)
Combined Strategy								
a-F2F with Distance mode*	-	1	2	6	11	2	2	24(5)
b- F2F vs. Distance mode**	1	-	-	1	2	1	2	7 (1)
Total	116	86	70	61	53	59	53	498

\*Blended or hybrid models

\*\*Comparative studies

As indicated in the previous content analysis between 2008 and 2011 (Bozkaya et al., 2012), the combined group was dealt with in two groups as blended and/or mixed teaching methods mode and comparative research. While the studies in traditional mode were 58% between 2008 and 2011, the research using this instructional mode increased to 86% in this period. However, distance mode, which was 33% in the earlier period, decreased to 8% between 2012-2018. One of the combined strategies using both face to face and distance instructional mode in the previous period (6%) showed similarity with the current period of time (5%). On the other side, research comparing two different instructional strategies decreased from 4% to 1%.

### Type of Media

Table 11 provides the types of media used in some articles published in the TOJET during 2012-2018 period. Among these, the most preferred learning environments are web-related media. Media such as blogs, wiki, second life, interactive animation, electronic book, social networking sites, interactive whiteboard, and discussion forums are categorized as Web 2.0 tools.

**Table 11: Type of Media**

Teaching & Learning Media	f
Computer-based instruction	48
Web-based instruction	112
Video & visual media*	37
Web 2.0 tools**	125
Instructional TV	5
Mobile tools***	28

\* Videogames, caricature, animations, videoconference, augmented and virtual reality applications, robotics learning activities.

\*\*Blogs, wiki, second life, interactive animation, electronic book, social networking sites, interactive whiteboard, discussion forums.

\*\*\*Mobile tools included PDA, mobile phones, tablets etc.

Note: Some studies included more than one type of media.

Environments containing visual content and animations such as videogames, caricature, animations, videoconference, augmented and virtual reality applications, robotics learning activities are grouped as video & visual media. On the other hand, devices such as PDAs, mobile phones and tablets are categorized under Mobile Tools. As can be seen from the table, interactive TV was the least preferred media among these environments.

### III- Research Design

#### Research Methods

The research methods were examined in three categories as quantitative, qualitative and mixed methods. The studies outside these 3 groups were classified as others. As it appeared in the previous study (62%), 73% of these are the most preferred quantitative research methods (see Table 12).

**Table 12: Research Methods (n=560)**

Method	Year (f)							Total n(%)
	2012	2013	2014	2015	2016	2017	2018	
Quantitative	90	61	45	41	37	37	30	341 (73)
Qualitative	21	14	13	10	7	8	10	83 (18)

Mixed	1	0	1	2	3	2	1	10 (2)
Others*	7	4	6	5	6	3	5	36 (8)
<b>Total</b>	<b>119</b>	<b>79</b>	<b>65</b>	<b>58</b>	<b>53</b>	<b>50</b>	<b>46</b>	<b>470</b>

\* Including review and program introduction studies

The ratio of qualitative studies conducted in this period (18%) showed a very similar trend with the 2008-2011 period (17%) (Bozkaya et al., 2012). On the other hand, the rate of mixed method studies which were around 14% in the previous period decreased to around 2% in this period. The studies grouped as Others (8%) included review and program introduction studies.

### Strategies of Inquiry

Similar to the content analysis conducted for research strategies in 2008-2011 (58%), descriptive studies (53%) were the most observed quantitative methods among all strategies in this period. Following this, true and semi-experimental designs continued to be popular in this period. Studies with true experimental design showed a similar rate compared to the previous content analysis period of TOJET (7% and 8% respectively), while semi-experimental studies showed a 3% increase in the 2012-2018 period of time. Other quantitative research strategies such as meta-analysis, pattern analysis, correlational design, and causal models had a 5% rate over a 7-year period.

**Table 13: Strategies of Research Inquiry**

Strategies of Inquiry	Year (f)							Total n(%)
	2012	2013	2014	2015	2016	2017	2018	
Experimental	9	8	4	4	6	3	3	37 (8)
Quasi-Experimental	7	8	1	6	4	2	2	30 (6)
Descriptive	65	32	41	28	22	32	30	250 (53)
Other Quantitative Strategies <sup>1</sup>	5	4	1	5	2	6	1	24 (5)
Exploratory Case Study	8	9	5	6	5	5	4	42 (9)
Other Qualitative Strategies <sup>2</sup>	6	7	3	5	8	7	5	41 (9)
Mixed Method Strategies <sup>3</sup>	1	0	1	2	3	2	1	10 (2)
Others*	7	4	6	5	6	3	5	36 (8)
<b>Total</b>	<b>119</b>	<b>79</b>	<b>65</b>	<b>58</b>	<b>53</b>	<b>50</b>	<b>46</b>	<b>470</b>

<sup>1</sup> Meta-analysis, pattern analysis, correlational design, causal models

<sup>2</sup> Phenomenology, grounded theory, action research, ethnography, narrative inquiry, heuristic evaluation

<sup>3</sup> Sequential methods, content analysis, Delphi study

\*Include theoretical inquiry, design-based research, eye-tracking research.

Note: Some articles included more than one strategy

Although the exploratory case study ratio, which is one of the qualitative research designs in 2012-2018 period (9%), decreased by 5% compared to the previous period (14%), the interest towards qualitative research showed a similar trend with 18 percent. In this period, research strategies such as sequential mixed methods, content analysis and Delphi study were included under the mixed method. Finally, others included other strategies such as theoretical inquiry, review studies, design-based research, eye-tracking research.

### Data Collection Methods

In most of the studies, multiple data collection methods were used together to validate the results. In 560 researches, survey (n = 260) was used most among the data collection techniques and methods in 2012-2018. This was followed by interview (n = 149), achievement tests (n = 83), scale (n = 78), documents (n = 72), observation (n = 42) and field notes (n = 17).

**Table 14: Data Collection Techniques**

Techniques	Year (f)							Total n(%)
	2012	2013	2014	2015	2016	2017	2018	
Survey / Questionnaire	62	47	46	30	21	30	24	260 (37)
Interview <sup>1</sup>	30	24	21	24	16	15	19	149 (21)
Achievement Test	15	16	12	17	9	7	7	83 (12)
Scale	28	7	5	15	10	8	5	78 (11)

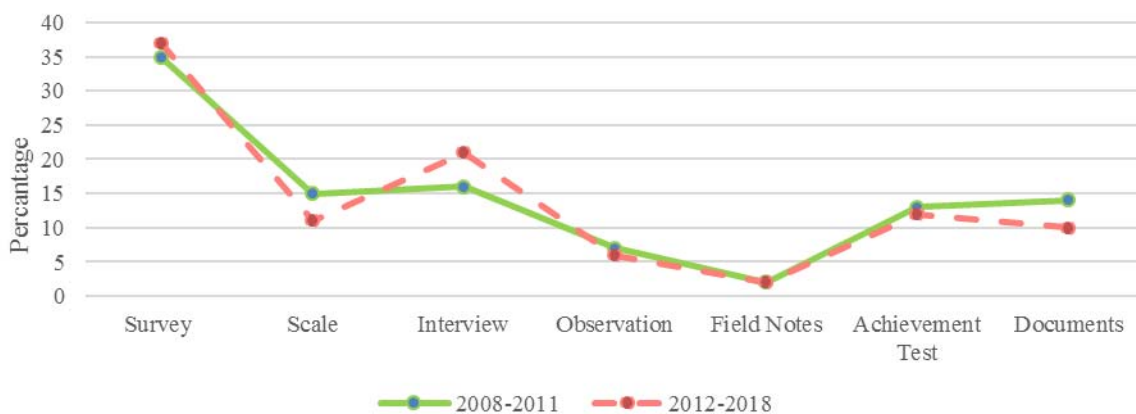
Documents <sup>2</sup>	10	13	3	10	12	14	10	72 (10)
Observation	12	8	2	6	3	4	7	42 (6)
Field Notes	7	2	0	5	2	0	1	17 (2)
Logs	1	1	-	1	-	1	-	4 (1)

<sup>1</sup>Including one-to-one and focus group interviews

<sup>2</sup>Including articles, emails, written artifacts, assignments, postings, journals/diary, autobiography, portfolio, audio/video files, essays

Note: Most of the studies integrated more than one type of data collection techniques

Documents data includes articles, emails, written artifacts, assignments, postings, journals / diary, autobiography, portfolio, audio / video files, essays. In addition to these data collection techniques, we should say that because of learning environments such as MOOCs and learning management systems, learner logs are being defined as data.



**Figure 4:** Distribution of Data Collection Techniques in 2008-2011 and 2012-2018 Periods

In Figure 4, data collection techniques are given in comparison with the results of the previous period content analysis. As can be seen from the figure, almost all data types have similar rates in both periods. The most preferred data collection methods are still based on survey studies such as survey, scale, questionnaire.

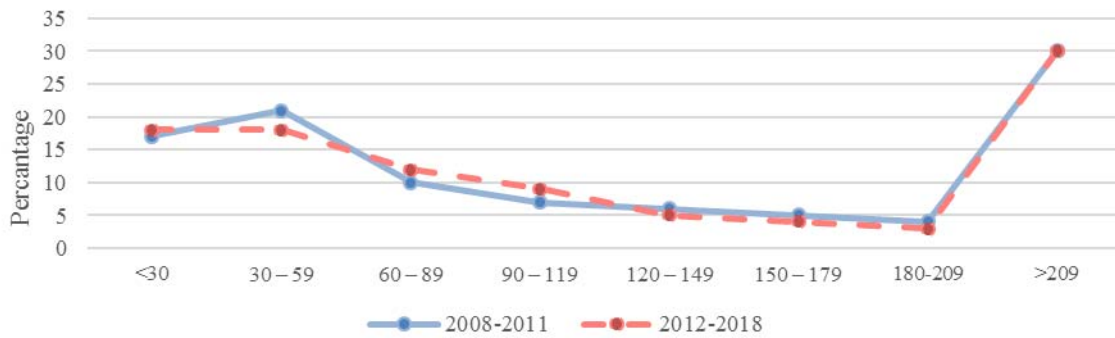
### Sample Size

Finally, the samples used in these research were classified as in Table 15. As in the previous content analysis period 2008-2011, approximately 18% of all studies constituted the small sample group. A total of 88 small sample studies (n <30) were predominantly involved in qualitative studies.

**Table 15:** Sample Size (n=498)

Range of samples	Year (f)							Total n(%)
	2012	2013	2014	2015	2016	2017	2018	
<30	13	15	9	12	13	16	10	<b>88 (18)</b>
30 – 59	20	20	12	13	12	10	5	<b>92 (18)</b>
60 – 89	20	9	6	10	5	2	8	<b>60 (12)</b>
90 – 119	9	12	7	4	8	4	3	<b>47 (9)</b>
120 – 149	6	5	4	4	0	3	3	<b>25 (5)</b>
150 – 179	4	3	3	2	2	2	4	<b>20 (4)</b>
180-209	4	4	3	2	0	0	4	<b>17(3)</b>
>209	42	21	21	16	15	22	12	<b>149(30)</b>
<b>Total</b>	<b>118</b>	<b>89</b>	<b>65</b>	<b>63</b>	<b>55</b>	<b>59</b>	<b>49</b>	<b>498</b>

Figure 5 compares the sample size distributions between 2008-2011 and 2012-2018. As seen in both periods, similar distributions were observed in the sample sizes.



**Figure 5:** Distributions of Sample Sizes in 2008-2011 and 2012-2018 Periods

Studies on large sample groups have emerged at a high rate in recent years due to studies that require substantially large participants such as massive open online courses (MOOCs) and social networking theory.

## DISCUSSION AND CONCLUSION

Research trends and topics are influenced by the advancements and changes in technology. In this study, same as the previous one, the findings were discussed under three categories: (1) general characteristics of studies; (2) research themes and issues; and (3) research method and design. The study covered analysis of total 560 articles published during 2012-2018 in 28 volumes. These articles are analyzed by topics covered, educational level focused, instructional mode preferred, instructional approach and design employed, theoretical or conceptual background used.

### 1. General Characteristics of the Studies

Analysis has shown that of the 560 total articles, 189 have single and 160 have two authors. In other words, same as the previous study 63 percent of the articles were written by either one or two authors. Although the majority of the articles were from those collectivistic cultures, such as Turkey, Malaysia and Taiwan, this result might seem interesting. Most probably it may be explained with the academic culture of these countries, where academicians are usually evaluated by individualistic measures. On the other hand, still if we consider the percent of articles with two or more authors (66 percent), it can be concluded that among researchers of educational technology there is a tendency toward teamwork as observed in analysis of the publications in the similar international journals of educational technology (Bozkaya et al., 2012).

A similar result with the previous study was about the educational level and the target population of the studies published in TOJET. Around 70 percent of the articles conducted with participation of higher education students. Working with higher education settings and students does not require as strict regulation as other groups and education levels, easy accessibility and controllability might be the main drivers of this tendency. This result is, also, very consistent with the results of other systematic reviews in the literature (Bozkurt et al., 2015; Babur, et al., 2016). Another similarity was observed regarding the domain of the field preferred: same as the former one, this study also uncovered that around half of the articles analyzed was related to social sciences. However, unlike the previous study, during 2012-2018 time period, more studies concerning language learning were conducted. This might be related to easy integration of technology into language learning.

A dissimilar result with the previous study was about country origin of the articles. In the previous study, more than half of the articles (52 percent) were from Turkey while the current study included only 27 percent from Turkey and the remaining were from almost all around the world. One may infer this result as that recognition and diffusion of the journal has increased quite well.

### 2. Research Themes and Issues

The study has shown that respectively different media and design-development were the themes most frequently studied during 2012-2018 time period. This is also quite similar to the findings of the previous study. In a great number of these media studies, the researchers sought to identify the participants' knowledge, skills, and attitudes about the media used as well as learners' satisfaction and achievement levels in these implementations. Additionally, in many studies, the researchers tried to reveal the relationship between these variables and the participants' age, gender, learning strategies and motivation. Along with these media studies, there were quite a number of studies in which design and development of artifact or programs that intended to increase the effectiveness, efficacy and appeal of the learning processes in various settings were also conducted. This result is

also consistent with the related previous reviews in the literature (Kılıç-Çakmak et al., 2016; Zawacki-Richter & Latchem, 2018; Marin et al., 2018). On the other hand, unlike the previous study, the current one presented that the studies focused on evaluation aspect of the field has shown a significant increase in 2012-2018 time period.

In terms of theoretical or conceptual background of the studies, a similar result was found that constructivism was frequently used to establish a theoretical base in these studies. It supports the previous studies: For instance, Bozkurt et al. (2015) analyzed 861 research articles published in various journals and found the constructivist approach and related theories as the most frequently used background in the studies. Since a big majority of the articles focused on Web or Internet-based learning environments and these environments support two of the major offerings of the constructivism, interactive and collaborative learning, one might easily infer this result as a natural consequence.

Moreover, the analysis has shown that in terms of technologies focused, the studies during 2012-2018 mostly dealt with respectively Web 2.0 tools and Web-based learning environments. In the previous study, the computer-based learning was the top technology used in a big majority of the studies conducted during 2008-2011 and Web-based learning environments was the second. So, it seems Web-based learning environments kept its position and another Web-based technology, Web 2.0 tools replaced the computer-based learning. One can easily relate this result with the advancement in technology, especially widespread diffusion and development of Web 2.0 tools. In fact, the figures show that the quality and quantity of Web 2.0 tools have been increased dramatically during 2013-2016. This development created a great interest in integrating these tools into educational settings. Allowing easy interaction among learners, and learners and other stakeholders (instructors, experts, etc.), fostering teamwork, and advancing access to the information anytime anywhere the users want are listed among the major drivers of the raise of Web 2.0 tools. This raise grasped the attention of the educators and maybe that was why there were quite a number of studies in the field focused on use of Web 2.0 tools. A similar inference was indicated by Baydas et al. (2015) and Bodily et al. (2019). Especially in these references the authors noted that 2013-2016 time period was the time use of the online tools heavily examined in various educational settings.

### 3. Research Method and Design

The study has revealed no significant difference in research methods employed in the studies of education technology during 2008-2011 and 2012-2018 time periods. The current review similar the previous one presented that quantitative method was the one mostly preferred during both time periods. In the other studies, respectively qualitative and mixed methods were employed. This result was also similar to the previous systematic review of research studies, such as Kılıç-Çakmak et al. (2015, 2016), Baydas et al. (2015), and Perez-Sanagustin et al. (2017). This may be related to the familiarity of the researchers with the quantitative methods and widely acceptance of the quantitative methods over others.

In terms of research designs preferred in the reviewed articles, a very similar situation displayed in the previous study as well as the literature (Babur et al., 2016; Bozkurt et al., 2015; Durak et al., 2017) was observed: survey (descriptive) design in the quantitative studies, and case study in the qualitative studies were the most frequently employed designs. Survey designs, especially cross-sectional surveys, usually utilize questionnaires to ask about a particular topic at one point in time, require considerably less time and effort to collect data. This must be considered as natural since in almost all fields of social sciences survey method is the most popular method due to its versatility, efficiency, and generalizability (Check & Schutt, 2012). On the other hand, case studies are considered as studies that require systematic in-depth investigation of an event or case with multiple data collection tools and methods (Chmiliar, 2013). Since a big majority of the studies in the field of educational technology consists of integration of a technology into an educational setting, it is a must to investigate this integration with all dimensions and stakeholders. So, case study seems one of the appropriate designs fits well into the educational technology studies. This might be why the considerable amount of qualitative studies employed the design.

In terms of data collection tools, questionnaires and interviews were identified as the most commonly used instruments in the studies reviewed in this study. Similar to other results, this trend was same as in the previous study. In other words, the same trend of using questionnaires and interviews in educational technology research has not significantly change and was going on during 2012-2018 time period. Kılıç-Çakmak et al. (2016) also observed the same result in their reviews. The questionnaires require considerably less time, money, and effort to collect data, especially after the advancement in online tools. This might be one reason for preference of this tool. Interviews, on the other hand, help researchers explain, better understand, and explore research subjects' opinions, behavior, experiences, phenomenon. They do allow to collect non-verbal data, too. Also, most of the

qualitative designs require some sort of interviews. So, the advantages and nature of qualitative inquiries might be shown as the main rationale for the result observed in the current study.

The majority of the studies reviewed has also large number of participants same results as the one observed in the previous study. This might be explained with the number of quantitative studies. Since this method requires researchers to reach at least certain number of participants, the articles reviewed had to have large number of participants. In short, no significant change observed in terms of the number of participants reached in the reviewed articles.

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