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An overview to research on education technology based on constructivist learning approach

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Abstract

The aim of this research is to determine the trends of education technology researches on Constructivist Learning Approach, which were published on database of ScienceDirect between 2010 and 2016. It also aims to guide researchers who will do studies in this field. After scanning the database, 81 articles published on ScienceDirect's data base from January 2010 to December 2016 were examined considering the following criteria in order to serve the purpose of the study; the concepts they deal with, instruments, software, education techniques used in the research, research methods, research designs, data collection instruments, types and sizes of samples, data analysis, the country where it takes place, number of authors, common studies done by researchers from different countries and number of sources. According to the research results, computer-supported education was the most addressed subject in the articles. It was found out that the most frequently used tool was the computer and the most frequently used software was learning management systems in the studies. Cooperative learning technique was the most preferred in terms of the used educational techniques. Quantitative method and survey design came into prominence in the studies. It was figured out about the data collection procedures that questionnaire as a data-collecting tool, university students as the subjects or the participants and descriptive analysis as data analysis method were mostly preferred. It is thought that results obtained will lead other future studies.

Keywords: Constructivist learning, constructivist approach, education technology, content analysis.

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1. Introduction

Constructivist Approach, which supports the idea that a better learning happens when students take an active part in the learning environment, has become very popular because it focuses on student-centered learning and forms an effective learning environment by increasing student motivation. According to this approach, information cannot be received directly. Having based on the experiences of the learners, it is accepted that information is constructed in a meaningful way individually and socially (Atasoy & Akdeniz, 2006; Fosnot & Perry, 2005). Therefore, an individual is the one who makes sense of the world, not the one who is attributed a meaning to. The main aim for the learners in constructivism is to construct the information themselves (Karagiorgi, 2005). In this approach, learners are active in the learning process and there is such an environment, where the classroom is not just a place where information is transferred, but also a place where questioning and research are also done, problems are solved, and working together is attained. Classroom activities are organized in a way to give an opportunity to students for extensive learning experiences (Psycharis, 2008).

In constructivist learning approach, students are the focus of the education and take an active part in learning period. For this reason, the role of technology is significant when the students produce new learning products and communicate during the learning-teaching period. Technology can be used to facilitate students' understanding during the learning period. Using technology in learning environments provides students with a richer learning environment, attracts their attention, increases their motivation and helps them remember the previous information about the subject. Information construction does not only happen with the learner interactions in their physical environments, it is also constructed with the interactions in social and technological environments in an active way. For this reason, it has become an obligation for contemporary education systems to merge the integration of education with technology and the concept of social constructivism (Sadik, 2008; Simsekli, 2014). In addition to this, as technology has a facilitative effect on constructing information, technological integration of education is based on the social constructivist approach (Yang, Zhao, Wu & Wang, 2008).

Computers and the Internet have an important place in the field of education because of the increase in the amount of information (Bijedic & Hamulic, 2009; Boukas, Kambourakis & Gritzalis, 2009; Caglar & Demirok, 2010; Girgin, Kurt & Odabasi, 2011; Hursen & Ceker, 2012; Jedlikowska, 2014; Kanbul & Uzunboylu, 2017; Keser, Uzunboylu & Ozdamli, 2011; Wurst, Smarkola & Gaffney, 2008). Using computer technologies in education helps students not to get bored, increases their motivation with the interactive environment and it also helps them pay attention to the lesson. In technology-based learning environments, students and teachers can express themselves much better compared to the traditional learning applications. Examples of the used media are; social networks, Wikispaces, Wiki, Skype, learning management system (LMS), blog, discussion boards, electronic conferences and chat rooms (Jiang, 2014). People from different locations can share their knowledge and thoughts with each other through internet-based education. It also gives a chance for constructivist learning, individual learning and cooperative learning (Ghaderi, Rigi & Salimi, 2014; Hursen, 2016; Shrestha & Shrestha, 2014). Using technology in the constructivist approach also accelerates the construction of information for students (Hancer & Yalcın, 2009). Advantages obtained from the integration of constructivist learning approach and educational technology has obtained the researchers' attention and these advantages have become a subject in their studies. These studies (Akdemir, Bicer & Parmaksız, 2015; Azizinezhad & Hashemi, 2011; Fridin, 2014; Gul & Yesilyurt, 2011; Koohang, Riley & Smith, 2009; Ozabacı & Olgun, 2011; Sejzi & Aris, 2012; Uzunboylu, Hursen, Ozuturk & Demirok, 2015) have shown that this integration had a positive contribution to students' success, attitudes and motivation and plays a part for them to enjoy learning. This situation increases the importance of conducting studies in different features in the area of education technology, identifying study types that are needed in the area and finding studies which would lead to future studies. For this reason, studies conducted in the area of education technology, and results obtained from these studies, should be followed closely (Goktas et al., 2011). As a result, most researchers are interested in the trends in the area of education technologies (Costa, 2007; Kilic-Cakmak, Cebi, Mihci, Gunbatar & Akcayir, 2013; Ross, Morrison & Lowther, 2010). In their studies about the trends in education technologies, Alper and Gulbahar (2009) analyzed articles published in

the last three years in Turkey, found out that researchers focused on e-learning and distance education subjects. Ustundag (2013) analyzed master's thesis done in the field of education technology, and found out that trends towards distance learning have increased. This result correlates with the study of Gulbahar and Alper (2009). Erdogmus and Cagiltay (2009) analyzed theses that were published in universities in Turkey which have master's and PhD programs in the field of computer and education technologies and found out that media, media comparisons and student variables were the most frequently preferred subjects. Ross, Morrison and Lowther, (2010) analyzed articles published in the Journal of Educational Technology Research and Development (ETR&D) and they concluded that media research as a subject and qualitative method were mostly used. This result is parallel to the results of the content analysis of Latchem (2006) applied to articles published in the British Journal of Educational Technology (BJET) between 2000 and 2005. In their master's thesis, Ustundag (2009) analyzed master's theses completed in this field and like Gulbahar & Alper (2009) they concluded that the importance given to distance education has increased.

As mentioned above, although there are content analysis studies conducted in the field of education technologies, the conclusion is; there are not any content analysis studies that belong to education technology based on constructivist approach. However, after constructivist learning and student-centered education approach became popular, research on educational technologies started focusing on these subjects (Erdogmus & Cagiltay, 2013). Thereby, it is thought that studies that help scientific generalizing by getting studies together, which use educational technologies based on constructivist approach, would have an important role in the field.

In the light of this information, the aim of this study is to determine trends of educational technology studies within the framework of constructivist approach published in the database of ScienceDirect in the last years (2010-2016) for the researchers, who want to do a research in the field of educational technologies within the framework of constructivist approach. It also aims to guide academics, educators and researchers who will study in this field in the future.

For the purpose of the study, answers to the following research questions about the articles analyzed within the framework of the study were sought:

1. What is the distribution of the articles according to subjects they deal with?
2. What is the distribution of the devices used in the articles?
3. What is the distribution of the softwares used in the articles?
4. What is the distribution of the educational techniques used in the articles?
5. What is the distribution of the methods used in articles?
6. What is the distribution of the research designs in the articles?
7. What data collecting instruments were used in the articles and, what are their distributions?
8. What is the distribution of the sample types in the articles?
9. What is the distribution of the sample sizes in the articles?
10. What data analysis methods were used in the articles?
11 In which countries were the researches conducted?
12 What is the distribution of the articles according to the number of co-authors?
13. What is the distribution of the common studies done by researchers from different countries according to the number of countries in the articles?
14. What is the distribution of the number of the sources used in the articles?

2. Method

In this study, content analysis, which was considered to be suitable for our purpose, was conducted. Content analysis can be applied to find out new trends by examining researches periodically in order to fulfill the functions mentioned in literature and it also guides researchers for their future researches (Cohen, Manion & Morrison, 2007). For the data of this study, the articles, which were published in ScienceDirect between January 2010 and December 2016, based on constructivist learning approach in the field of educational technologies, were analyzed. These articles have been published in peer-reviewed journals, indexed by Science Direct. Scanning process

was limited to the years 2010, 2011, 2012, 2013, 2014, 2015 and 2016 and also to the key words "education technology", "teaching technology", "constructivist approach", "constructivist learning" through the research. After completing the search for the key words, the educational technology or instructional technology studies based on constructivist approach were included in the study by examining their summary sections. This study has some limitations, like every other study. The first of these limitations is the database, which is only Science Direct, and the other is that only the last seven years' studies were included. As a full-texted and open accessed database, ScienceDirect contains more than 25 per cent of peer-reviewed scientific journals in the world and these were the effective reasons of choosing this database. The last years were chosen for the research in order to find out the latest trends of the educational technologies research based on the constructivist approach.Table 1. shows yearly percentages and frequencies of the articles examined within the framework of the research.

Table 1. Distribution of the Studies by Years

Years	Frequency (f)	Percentage (%)
2010	4	4.93
2011	9	11.11
2012	19	23.45
2013	12	14.81
2014	14	17.28
2015	10	12.34
2016	13	16.04
Total	81	100

2.1. Data Collection Instrument

For the research data and for the analysis of the articles found from ScienceDirect's database, researchers used "publication classification form of educational technologies" which is developed by Sozbilir & Kutu (2008) with some changes. The researchers primarily examined the form through the adaptation process and created a draft form by adding new necessary categories, and then they exchanged views on this form and made necessary implementations. Three experts in the field of educational technology with a doctoral degree made necessary changes after checking out the form. In the first section of the form, which is used as a data collection tool, descriptive features like article name and authors are found. In other sections, the subject of the article, the devices used in this study, the software used in the study, education techniques, the article's method, the article's framework, data collection tools, sample type and size, data analysis methods, in which countries it was done, the number of co-authors, researcher's countries, the number of references take place respectively.

Researchers classified six randomly chosen articles that were published in ScienceDirect's database. They classified four randomly chosen articles separately and then gathered later to reach a common solution for the issues that were not agreed on for the reliability of the study. The rest of the articles were later classified according to one of the author. In order to increase the reliability, the other author of this paper, who was more experienced and had more knowledge in the area of education technology controlled by re-analyzing. At the end of the comparisons, it was identified that the analyses were very close to each other. By the means of the analysis, it was seen that the results are very close (%96.5) to each other. The last two articles were classified after reanalyzing and making a common decision.

2.2. Analysis of Data

Content analysis period of the articles found from ScienceDirect's database consists of four steps: Coding, determining criteria, validity and reliability. Articles were analyzed and classified under some types of criteria. These are: concepts discussed, instruments used, software used, education

techniques, research methods, research design, data collection instruments, sample type, size of sample, data analysis methods, location, number of authors, common studies done by researchers from different countries, number of references used in research. Analysis of the articles was done in accordance with both researchers' views for validity and reliability. During data digitizing, if a study consists of two or more dimensions, for given property, frequencies were calculated addressing each dimension separately.

Table 2. Distribution of Concepts the Examined Studies Discussed

Research Concepts	Frequency (f)	Percentage (%)
Computer-Supported Education	21	25.92
Web-Based Education	19	23.45
Mobile Education/Learning	10	12.34
Distance Education/Learning	6	7.40
Mixed Learning	5	6.17
Virtual School/Classroom/Laboratory	5	6.17
Simulation/Animation Systems	3	3.70
Multimedia	3	3.70
Video Conferences	2	2.46
Software Development	2	2.46
Computer-Supported Educational Games	1	1.23
Others	4	4.93
Total	81	100

3. Results

In this section, considering the purpose of the study, findings, which were obtained from the studies based on constructivist learning approach in educational technologies, are interpreted parallel to the research criteria and they are presented with tables.

Table 3. Distribution of Instruments Used in the Studies Examined

Instruments	Frequencies (f)	Percentage (%)
Computer	25	30.86
Tablet PC	18	22.22
Mobile Phone	9	11.11
Voice Recorder	5	6.17
Projection	4	4.93
Video	2	2.46
Smart Board	2	2.46
KindSAR Robot Nao	1	1.23

Articles within the framework of the research were categorized after examining their concepts. As it is seen from Table 2., researchers focused on computer-supported education (21) the most. This is followed by web-based education (19) and mobile education (10). The least used subjects are computer-supported educational games (1) and other concepts (4) under the others category

Concepts such as attitudes towards education technology, problems about distance education, teaching-learning methods, smart education systems, that could not be put in any categories were gathered under the "others" category. As it is seen from Table 4., the most preferred software in the researches is "Learning Management Systems-LMS". It is followed by Simulation (15), 3D Software (8) and Web 2.0 (8) respectively. E-toys, SW Lego Mindstorms Education, Geography Teaching Module are put under the "others" (3) category.

Distribution of the educational techniques used in the studies examined within the framework of the research was given in Table 5. As it is seen from the table, cooperative learning (24) and group work (17) were the most commonly used techniques with constructivist learning approach. There are also studies (9) which do not specify what techniques are employed. It is seen that in some of the researches, two or more techniques were used in analyzing techniques used in the articles. However, each technique was dealt with separately and their frequencies were calculated.

Table 4. Distribution of Software Used in Studies Examined

Software	Frequency (f)	Percentage (%)
Learning Management Systems (LMS)	21	25.92
Simulation	15	18.51
Three Dimensions Software(3D)	8	9.87
Web 2.0	8	9.87
Educational Discussion forums	6	7.40
Educational Website	5	6.17
Social Network	3	3.70
Gamification	3	3.70
Presentation Software	3	3.70
Online Dictionary	3	3.70
Storytelling Software	3	3.70
Others	3	3.70
Total	81	100

As it is seen from Table 4., the most preferred software in the researches is “Learning Management Systems-LMS”. It is followed by Simulation (15), 3D Software (8) and Web 2.0 (8) respectively. E-toys, SW Lego Mindstorms Education, Geography Teaching Module are put under the “others” (3) category.

Table 5. Distribution of the Educational Techniques Used in the Studies Examined

Educational Techniques	Frequencies (f)	Percentage (%)
Cooperative Learning	24	29.62
Group Work	17	20.98
Question-Answer	16	19.75
Discussion	8	9.87
Acting	5	6.17
Game Based Learning	2	2.46
Unspecified	9	11.11
Total	81	100

Distribution of the educational techniques used in the studies examined within the framework of the research was given in Table 5. As it is seen from the table, cooperative learning (24) and group work (17) were the most commonly used techniques with constructivist learning approach. There are also studies (9) which do not specify what techniques are employed. It is seen that in some of the researches, two or more techniques were used in analyzing techniques used in the articles. However, each technique was dealt with separately and their frequencies were calculated.

Table 6. Distribution of the Studies by Research Methods

Research Methods	Frequencies (f)	Percentage (%)
Quantitative	41	50.61
Qualitative	25	30.86
Mixed	15	18.51
Total	81	100

Table 6. shows information about research methods of educational technologies based on constructivist approach, which were found in ScienceDirect database and were published between 2010 and 2014. From the findings it is seen that the most commonly used method was quantitative (41) method. It is followed by qualitative (25) method and the least commonly used one is the mixed (15) method. In the aforementioned mixed studies, it was found out that only fifteen of them used mixed method. The other two is mixed method study as well after the researchers analyzing the data.

Table 7. Distribution of Studies by Research Designs

Research Design	Frequencies (f)	Percentage (%)
Scanning	27	33.33
Semi -Experimental	22	27.16
Fully-Experimental	9	9.87
Case -Study	8	8.64
Literature	7	7.40
Culture Analysis	2	2.46
Unspecified	6	4.93
Total	81	100

Table 7. shows findings about research design of articles examined within the framework of research. It is determined that research subjects that used quantitative, qualitative and mixed methods were generally conducted with experimental, quasi-experimental, survey, case study, culture analysis, explanatory and literature designs. From the findings, it can be said that the survey design was the most commonly used quantitative research method (27). Researchers did not prefer using culture analysis (2). Also, there are studies that do not specify (6) their research designs.

Table 8. Distribution of Data Collection Instruments in the Studies Examined

Data Collecting Instruments		Frequencies (f)	Percentage (%)
Questionnaire	Likert Type Scale	24	29.62
	Online Questionnaire	7	8.64
Achievement Test	Open-Ended	6	7.40
	Multiple Choice	8	9.87
	Open-Ended	7	8.64
Interview	Structured	4	4.93
	Semi Structured	6	7.40
	Online Interview	3	3.70
Assessment Form		8	9.87
Documents		10	12.34
Observation		1	1.23

Table 8. shows the findings about the data collection instruments used in the studies examined within the framework of the research. While examining the data collection instruments used for the articles, it was seen that in some studies more than one data collection instrument was used (for example, achievement test and interview). Each data instrument was dealt separately and frequencies were identified. According to the findings researchers focused on questionnaire (37) and achievement test (15) the most. The other most commonly used instruments in data collection are interview (13), documents (10) and assessment forms (8) respectively. However it is revealed that observation (1) is not used much for the purpose of collecting data.

Table 9. Distribution of the Sample Types Used in the Studies Examined

Sample Types	Frequencies (f)	Percentage (%)
University Students	31	38.27
Teachers	23	28.39
High School Students	13	16.04
Secondary School Students	7	8.64
Families	5	6.17
Elementary School Students	4	4.93
Master's Degree	2	2.46
Kindergarten Students	1	1.23

Table 9. shows descriptive findings about the sample types in the studies examined within the framework of the research. It is mentioned that in some studies only one type of sample was used while in others more than one kind of sample group was used. When examining the articles that contained more than one type of sample, each sample type was analyzed separately. Hence, the number of collected data was taken into consideration instead of the number of publication examined. It is indicated that university students (31) and teachers (23) attended the studies the most. It is seen that master's degree students (2) and kindergarten students (1) were not used much as sample types.

Table 10. Size of Samples Used in the Studies Examined

Size of Samples	Frequencies (f)	Percentage (%)
Between 1-10	1	1.23
Between 11-30	9	11.11
Between 31-100	36	44.44
Between 101-300	28	34.56
Between 301-1000	7	8.64
More than 1000	-	-

Descriptive findings about the sample numbers in the studies examined are seen in Table 10. It is revealed that researchers work with sample groups that contain 31-100 people (36) the most. It is also mentioned that they did not prefer to work with more than 1000 people. Information about methods and techniques of the data analysis of the studies is given in Table 11. When examining the data analysis methods of the studies, the most commonly used one was quantitative data analysis (48). It was also determined that descriptive analysis (26) was used more than the inferential analysis (22). According to the findings, the most commonly used quantitative data analysis methods are frequency/percentage/table (14) and average/standard deviation (10) among descriptive data analysis techniques. It is pointed out that the most commonly used inferential techniques are t-test (8) and ANOVA/ANCOVA (5). Descriptive analysis (13)is the most commonly employed analysis method among qualitative data analysis.

Table 11. Distribution of Data Analysis Methods and Techniques Used in the Studies Examined

Data Analysis Methods and Techniques			Frequencies (f)	Percentage (%)
QUANTITATIVE	Descriptive	Frequency/Percentage/Table	24	21.5
		Average/Standard Deviation	15	15.4
		Representing with graphics	2	3.1
	Forecasting	T-test	18	12.3
		ANOVA/ANCOVA	5	7.7
		Correlation	4	6.2
		Factor Analysis	2	2.46
		Non-parametric Tests	1	1.5
		Regression	1	1.5
		MANOVA/MANCOVA	1	1.5
QUALITATIVE	Qualitative	Descriptive Analysis	13	20.0
		Content Analysis	4	6.2

Table 12. Distribution of the Studies Examined According to the Countries They Are Conducted

Countries	Frequency (f)	Percentage (%)
Taiwan	18	12.30
Thailand	16	19.75
The USA	14	17.28
Turkey	9	11.11
Malaysia	7	8.64
Iran	4	4.32
Singapore	2	2.46
Belgium	2	2.46
Spain	2	2.46
Others	14	17.28

Table 12. reveals the analysis results in order to identify the countries in which educational technology researches based on constructivist learning approach are conducted. According to the findings, it was detected that the highest number of research were done in Taiwan (18) and Thailand (16). They are followed by the USA (14) and Turkey (9). Each country under the "others" category has only done one study. These countries are; Netherlands, Israel, Switzerland, Romania, Italy, England, South Africa, Mexico, Czech Republic, Oman, Hong Kong, China, Korea and Portugal. There have not been any studies done about the subject in Cyprus in the scanned studies of the database of ScienceDirect.

Table 13. Distribution of the Studies Examined According to the Number of Authors

Number of Authors	Frequency (f)	Percentage (%)
1	20	24.69
2	34	41.97
3	17	20.98
4 or more	10	12.34

Table 13. presents the findings about the number of authors of the studies examined within the framework of the research. It was mentioned that the total number of authors of the studies examined is 120. It was also determined that number of articles with two authors (34) was the highest followed by number of articles with only one author (20). It was revealed that number of articles with three authors (17) and four authors (10) or more were fewer.

Table14. Common Studies Conducted By Researchers from Different Countries

Number of Countries	Frequency (f)	Percentage (%)
1	55	67.90
2	18	12.30
3 or more	8	9.87

Table 14. demonstrates the results of the analysis conducted to find out the common study trends of researchers from different countries. According to the findings, researchers mostly preferred to work with colleagues from their own country (55). It is followed by the common studies conducted by researchers from two different countries (18). The minimum number of studies was the ones conducted by researchers from three or more countries (8).

Table 15. Distribution of the Articles According to the Number of Sources

Number of Sources	Frequency (f)	Percentage (%)
1-30 sources	16	19.75
31-60 sources	39	48.75
61-100 sources	20	24.69
101-300 sources	6	6.40

Findings obtained from the result of the analysis according to the number of sources used in the studies examined are given in Table 15. It is pointed out that sources between 31 and 60 (39) were used the most and sources between 101 and 300 (6) were used the least in the articles.

3. Discussion and Conclusion

Looking at the subjects of the articles within the framework of the research, it is seen that the highest number belongs to computer-supported education, web-based education, mobile education and distance education respectively. Likewise, Gulbahar and Alper (2009) analyzed studies that were conducted between 2005 and 2007 in the field of educational technology and determined that they focused on computer-supported education and web-based education. Computer-based educational games have not become widespread at schools and this might be a reason why the subject, computer-based educational games is not preferred in the articles.

Technological tools are important, educational tools that facilitate the construction of information (Yang, Zhao, Wu & Wang, 2008) can be thought as a reason why technological tools and softwares are used in the research of educational technologies based on the constructivist approach. In the content analysis, it is determined that computers and Tablet PCs were the most commonly used devices in the studies. Erdogmus and Cagiltay (2009) also mentioned that computers were the most commonly used devices in the learning environment in educational technologies research. This situation can be explained by computers and tablet PCs success in increasing students' attention and motivation towards lessons and supplying a rich education-teaching environment. It is also indicated that smart boards were preferred only in two studies. It might be because of the reason that smart boards are not available in every school. In the analysis of the softwares used in the articles examined during the research period; it is revealed that Learning Management Systems (LMS) and Simulations were preferred the most. Simulations have lots of advantages in learning and teaching (Ozdamli & Tavukcu, 2016; Smetana & Bell, 2012; Rotimi, Ajogbeje & Akeju, 2012). For this reason it can be said that their use in teaching environment will be increased.

As a result of examining educational techniques used in the studies analyzed within the framework of the research, it was determined that the most commonly used techniques with the constructivist learning approach were cooperative learning and group techniques. The main reason for this, as

mentioned is that it is crucial for learners to interact with each other in the education environment based on the constructivist approach. Moreover, information according to the constructivist theory is not just conveyed by the teacher to the student. With physical, social and technical environmental interaction it is actively configured by students or student groups (Fosnot & Perry, 2005).

According to another finding by looking at the methods used in the articles, it is seen that the quantitative research method was preferred in most studies and the number of qualitative studies are almost half of the quantitative studies. It was determined that the mixed method was not preferred much. Parallel to the result of the research, there are studies mentioning that quantitative methods are mainly used in educational technologies research (Alper & Gulbahar, 2009; Ross et al., 2010).

Considering the research designs and subjects which were dealt with quantitative, qualitative and mixed methods were generally analyzed with experimental, quasi-experimental, survey, case analysis, culture analysis, explanatory and literature. According to the findings, the survey is the most commonly used design. Ross et al., (2010) support the result of this study. It is also mentioned that researchers did not prefer culture analysis.

According to the findings of the research, when examining the data collection instruments used in the articles in question, it was seen that the most commonly used instrument was the questionnaire followed by the second most popular data collection instrument, achievement tests. Studies based on questionnaire type scales were common because they are economic in time and cost and they are easily applicable (Buyukozturk, Akgun, Karadeniz, Demirel, & Kılıc, 2009; Hew, Kale, & Kim, 2006). These findings corresponds with the studies of Simsek et al., (2009) and Ustundag, (2013). As there is only one study that employed observation in the qualitative methods, it can be interpreted that researchers prefer interviews instead of observation.

In the articles examined, it was determined that studies were most commonly conducted with university students and teachers as sample groups. Researchers can reach these sample types more easily and this is why these groups were used more. In their studies Ustundag, (2013) said that teachers and students of the Faculty of Education were most commonly used in educational technologies research. Also in their studies, Aypay et al., (2010) mentioned that the most commonly analyzed school type in the education research were universities and the most commonly researched sample group was university students from these institutions. Considering the sizes of the sample, studies that contained 31 to 100 people are more common and there has not been any size of sample that contained more than 1000 people. This may be related to the fact that data can be obtained in a shorter time when small groups are used. Findings of the research about choosing a sample and the size of a sample, supports the findings of Goktas et al., (2011) and Ciltas, (2012).

Examining the data analyzing methods of the studies, it was determined that quantitative data analysis methods were used more than qualitative data analysis methods. Also, out of the statistical data analysis techniques, descriptive statistics, t-test and one-way ANOVA were mainly used in the research. This finding is similar to the findings of Selcuk, Palancı, Kandemir and Dundar, (2014). It is indicated that data analysis methods used in some of the studies were not suitable for the method of the study.

The results of the research show that educational technology studies based on the constructivist learning approach are very few in Turkey. For this reason, there is not a content analysis study, which identifies the trends of the educational technology research based on the constructivist approach. It is thought that combining the constructivist approach with the education-technology integration is very important for the contemporary education systems and it is significant that the researchers should focus on the studies in order to correct the deficiencies in the area.

When analyzing the studies examined in terms of the number of co-authors, it was seen that the number of the studies with one or two authors were a more than the number of the studies with three or more author. This shows that research was not done in a cooperative environment and it matches up with the results of the research done by Aypay et al., (2010). According to another finding of the research, it was shown that researchers mostly have a tendency to make common studies with colleagues from their own country.

Looking at the number of sources used in the articles, it is pointed out that sources between the numbers 31 and 60 used the most and sources between 101 and 300 used the least in the articles. This gives a thought that researchers do not review the literature enough. One of the main differences between scientific writing and non-scientific writing is the use of domestic and foreign contemporary sources. Using contemporary and adequate number of sources is a sign of having an understanding over the literature and it is important for the validity and reliability of the study (Sahin, Kana & Varisoglu, 2013).

4. Recommendations

The importance of technological integration at schools has been increasing with the effect of the constructivist approach in the last years. As a result, it is recommended that the number of educational technology research based on the constructivist approach should increase.

To make computer-supported educational games common in education, researchers can focus on studies about the use and progress of computer-supported educational games. It is also suggested that more studies towards the use of smart boards should be done considering their advantages such as; increased student concentration, progressed learning, increased success rate and minimized misconceptions.

It would bring the field studies depth to use quantitative and qualitative methods together in a way by supporting each other. It is also thought that it might be effective in meeting the deficiencies in the field if less used research designs (culture analysis) are used instead of the ones that are always used.

Observation is a less controlled method compared to the interviews for the participants. It is thought that research results should give a weight on observations in research and diversifies data collecting instruments.

At the end of the research, it was seen that as they can be easily accessed, the same type of sample was used in the studies. It is important to choose a suitable sample for the study design in the research and to increase the number of samples in order to carry out more qualified studies.

As a result of the content analysis, it is pointed out that data analysis methods used in some of the studies were not suitable for the method of the study. Researchers need to be further informed about the data analyzing methods and more suitable and diverse techniques should be used in the studies. These are significant for the quality of the studies.

In order to increase the reliability of the studies, they should be carried out with more than two co-authors. It is also suggested that they should make cooperative studies with authors from different countries in order to be informed of developments and to head for new concepts.

It is considered that a review of the literature in a detailed way and using contemporary sources in the studies are important to follow up the developments in the field.

ScienceDirect database was the only source of this study. In the next study, the last ten years' studies in Web of Science will be analyzed.

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