



Discovering Studies on Nursing Students and Educational Technology by Data Mining

Mübin KIYICI , Prof. Dr., Sakarya Üniversitesi Eğitim Fakültesi Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü,
Sakarya/TÜRKİYE, mkiyici@sakarya.edu.tr

Barış ÇUKURBAŞI , Dr. Öğr. Üyesi, Manisa Celal Bayar Üniversitesi Manisa Teknik Bilimler Meslek Yüksekokulu
Bilgisayar Teknolojisi Bölümü, Manisa/TÜRKİYE, baris.cukurbasi@cbu.edu.tr

Emre ÇAM , Dr. Öğr. Üyesi, Tokat Gaziosmanpaşa Üniversitesi Niksar Meslek Yüksekokulu Bilgisayar Teknolojisi
Bölümü, Tokat/TÜRKİYE, emre.cam@gop.edu.tr

Kıycı, M., Çukurbaş, B. ve Çam, E. (2021). Discovering Studies on Nursing Students and Educational Technology by Data Mining. *Batı Anadolu Eğitim Bilimleri Dergisi*, 12 (1), 133-144.

Geliş tarihi: 14.03.2021

Kabul tarihi: 01.05.2021

Yayımlanma tarihi: 28.06.2021

Abstract. This study examines to analyze the studies carried out in the field of nursing students and educational technologies from past to present and reveal the present situation in general by reaching the studies scanned on ERIC database through data mining and analyzing the ones containing Nursing Students descriptors. Data were collected with data mining. In this context, all studies with descriptors "Nursing Students" (NS) indexed in ERIC database until 31.12.2019 have been downloaded with data mining. In addition to this, all studies of "Educational Technology" (ET), "Distance Education" (DE), "Online Courses" (OC), and "Technology Uses in Education" (TUE) descriptors assigned to NS were recorded separately files. Analysis results were analyzed by comparing these four data groups. With data mining, 1167 study data to which NS was assigned was reached. It was determined that 59 of these studies were assigned ET, 42 had DE, 49 had OC and 41 had TUE descriptors. In addition, "Student Attitudes" was found to be the common-most frequently used descriptor for all data sets. With the research, it was found that there are few studies on NS on ET, DE, OC and TUE. In this context, the review highlights the need for research on ET-in-NS, DE-in-NS, OC-in-Ns and TUE-in-NS and serves as a guide.

Keywords: Nursing Students, Educational Technology, Distance Education, Online Courses, Technology Uses in Education, Data Mining, ERIC.

Introduction

In the 21st century, the process of accessing information with rapidly developing science and technology, conveying and disseminating it to large masses have been easier thanks to today's technology. Technology, affecting every aspect of our life, has gained ground for itself in education as well. There is an interrelated process between education and technology. With the development of education and training processes, technology has become qualitative and with the development of technology, education has become qualitative. Keeping up with the developing technology and integrating these technologies in educational environments have been obligatory to raise the individuals needed in this age. In this way, it will be possible to provide students with more qualitative educational processes.

Technology is a must in the field of education and, education and technology are interactive concepts. Education technology helps individuals benefit from the information they have acquired through education in a more active and efficient way and put them into practice in a more systematic or conscious way. Therefore, the use of education technologies in the department of nursing education actively and efficiently, creating rich and permanent educational environments, increasing students' learning pace are quite significant in order to facilitate high quality and effective learning. Considering this importance, nowadays, it is seen that the use of technology in education has become more widespread day by day in order to help nursing students gain information, skills, attitudes and behaviors and improve them (Merill, 2015; Raman, 2015).

The use of education technologies in nursing education offers nursing students such opportunities as learning, cooperation, and information sharing (Boz-Yüksekdağ, 2015). Sharing videos, pictures, audible, and written materials in nursing education with distant learning, which is a learning environment on the internet, have gradually increased in recent years (Yu & Yang, 2006). Due to the Covid19 pandemic, nursing education has been carried out with distance education activities by the decision of Higher Education Council with the beginning of the pandemic. Decisions were made as to the fact that internship/practical training of students who would graduate from nursing degrees could be completed in health units by taking protective measures for schools where they can be carried out; and for the schools where they couldn't be carried out in health units for various reasons, they could be completed by distance education with activities such as simulation training, project, case analysis, etc. (YÖK, 2020) (Higher Education Council, 2020). While the process of distance education carried out compulsorily in nursing education at present bears difficulties, it has stirred discussions on new teaching methods and techniques accompanied by innovations and creativity. On the other hand, it is stated that technology-enhanced experiences and discussions on teaching methods experienced throughout the Covid19 pandemic are beneficial for teachers and students (Bezerra, 2020).

Distance education offers nursing students various options, enables them to enroll in university, a distance program by overcoming obstacles of geography and time and improve their professional qualifications. Farrell et al. (2007), in a study they carried out, revealed that they stated use of distance education for the education of undergraduate and graduate nursing students living and working in different geographical areas was significant due to such reasons as the globalization of information, increasing emphasis on lifelong learning, etc. In the study of Koch et al. (2010) through which he searched the perceptions of nursing students on web-based distance education, %81 of the participants supported web-based distance education and that it helped them throughout learning processes. In a similar study carried out in the United States of America, web-based video education was performed for senior nursing students and %91 of them stated that video education facilitated better learning and that they were pleased with the education provided (Bennet & Glover, 2008). Mancuso (2009), in a study he carried out in North America among nursing academicians to detect their perceptions on distance education, stated that students successful at distance education were

motivated, were liable to self-direct, and become independent and active and that these students analyzed course contents elaborately and thoroughly.

As understood from the studies, many institutions and communities related to nursing pointed out the importance of technology for the nursing profession and education. American National Association of Nurses made a call for action in 2015 as to increase information on technological practices among nurses and prepare nursing care services better for the future (NLN, 2015). Non-governmental organizations related to nursing also emphasized the necessity of using technology for the education of nurses working in health care services which continuously undergo changes in terms of science and human sources. National Nurses Associations – NNAs stresses that it is essential to integrate technology into nursing education programs in today's clinical practice settings where it is a must to reach information to ensure evidence-based patient care, create opportunities for the use of novel technologies and acknowledges technology as the basis for nursing education and practices (Senyuva, 2019).

Studies on the use of technology and its efficiency in nursing research have been increasing day by day. Costa et al. (2020), by analyzing 46 articles in a study of his in which he studied the articles in the fields of nursing and technology detected that information technologies were used for support, the field of administration along with vocational and health education. Krick et al (2019), in a study of his in which he analyzed 715 publications carried on digital technology and effectiveness of nursing care and efficiency, revealed that effectiveness studies were mostly carried out for information technologies, robots, and sensors yet efficiency studies were carried out rarely. Dominick et al. (2009) searched for a systematic analysis of computer literacy as relevant to preventive health education. Within the scope of the study, 464 articles were analyzed between the years of 1994-2007 and they concluded that computer literacy on computer-based preventive intervention was limited in the literature. In spite of that, Veneri and Zdanis (2018), in the study of meta-analysis that carried out analyzed 24 articles published between the years 2006-2016 on Proquest Health Management, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Proquest Nursing & Allied Health, PubMed, Medline and Academic Search databases containing education technologies, videos, DVDs, web sites, and other computer-based educational programs. Considering the results of the meta-analysis, it was concluded that traditional education was carried out in a stronger way when compared to technology-driven education.

In conclusion, the fact that almost every field of educational technology is a phenomenon well accepted by the discipline of nursing, continuing to develop rapidly and technology's being used as an important tool in education could be seen in the studies, as well. In this study, it was aimed to analyze the studies carried out in the field of nursing students and educational technologies from past to present and reveal the present situation in general by reaching the studies scanned on ERIC database through data mining and analyzing the ones containing Nursing Students descriptors. In line with this objective, one or several of the studies for which the descriptors of Educational Technology, Distance Education, Online Courses and Technology Uses in Education, related to the field of educational technologies and assigned along with Nursing Students descriptors on ERIC database, were analyzed and saved through data mining. Studies reached were analyzed in the context of exercise type, year released, study titles, study abstracts, and descriptors assigned by ERIC for the studies.

The Aim and Significance of the Study

In this study, it was aimed to analyze the studies carried out in the field of nursing students and educational technologies from past to present and reveal the present situation in general by reaching the studies scanned on ERIC database through data mining and analyzing the ones containing Nursing Students descriptors. In line with this objective, one or several of the studies for which the descriptors of Educational Technology, Distance Education, Online Courses and Technology Uses in

Education, related to the field of educational technologies and assigned along with Nursing Students descriptors on ERIC database, were analyzed and saved through data mining.

Method

In order to acquire data in the study, data mining, one of the methods of big data analysis, was used. Through data mining, data acquired by reaching big amounts of text data sources which were not configured appropriately for the objective of the study was analyzed. For acquiring and analyzing the data, scripts developed by benefiting from Python and Pandas libraries were used. Processes such as acquisition data from data sources, preparation of data for the process of analysis and carrying out data analysis were performed with the scripts prepared for data mining. In this sense, a total of 1,783,418 studies scanned on ERIC database from 1965 to January 2020 formed the target population of the study.

Data downloaded from ERIC database through data mining was edited with the scripts prepared, names of the tables were standardized, unnecessary and extra data was deleted. In this way, only data columns to be analyzed were revealed. ERIC database assigns descriptors for each study scanned and categorizes the studies in accordance with this descriptor. Since the focus of the study was nursing students, in all the data saved to be analyzed, Nursing Students (NS) descriptor was searched firstly, and the data (year of the study, descriptors assigned, study abstract and title) that possessed this qualification was written in a separate data frame. Next, descriptors of Educational Technology (ET), Distance Education (DE), Online Courses (OC), and Technology Uses in Education (TEU) which could be related to the field, were each searched separately, and appropriate studies were saved on different data frames. The results obtained following these processes were converted to Microsoft Excel file format. Punctuation marks not needed for analysis and recurring, and unnecessary words were removed from the files in Excel format. All of the words were lower cased. After that, plural words were made singular. Data obtained following these processes was analyzed and words/expressions were aligned and tabulated in by their frequency of use.

In line with the objective of the study, 1167 studies were found on ERIC database scanned with NS descriptor. Within these studies, we reached studies 59 of which involved ET, 42 of which involved DE, 49 of which involved OC, and 41 of which involved TEU descriptor. Analyzed data belonging to ET, DE, OC, and TEU descriptors were expressed with word clouds and interpreted by comparing. Frequently used words in the year released, descriptors, abstracts and titles of the studies were analyzed within the scope of the research.

Results

General information on the studies reached

When the scatter (Table 1) regarding the number of the studies reached within the scope of the research was studied, it was seen that the amount of ET, DE, OC, and TUE studies within the studies of NS was quite low.

Table 1.
Scatter of the Studies Analyzed within the Scope of the Research

	Year Range	Count	%
NS	1969-2019	1167	100
ET-in-NS	1996-2019	59	5,06
DE-in-NS	2007-2019	42	3,60
OC-in-NS	1999-2019	49	4,20
TUE-in-NS	2007-2019	41	3,51

Scatter of all of the studies by years in which NS descriptors were assigned is given in Figure 1 and scatter of the studies by years in which other descriptors analyzed in the research were assigned is given in Figure 2. When Figure 1 and Figure are studied together by comparing them, it can be stated that curves on the graphics show similarities in general. Besides, it can be clearly seen that studies on educational technologies were carried out starting from the year 1996 and there has been an apparent upward trend in the number of the studies since the 2010s. However, when the scatter of the studies in the 2010s all across NS is studied, it can be stated that the number of the studies carried out with ET, DE, OC, and TUE was insufficient.

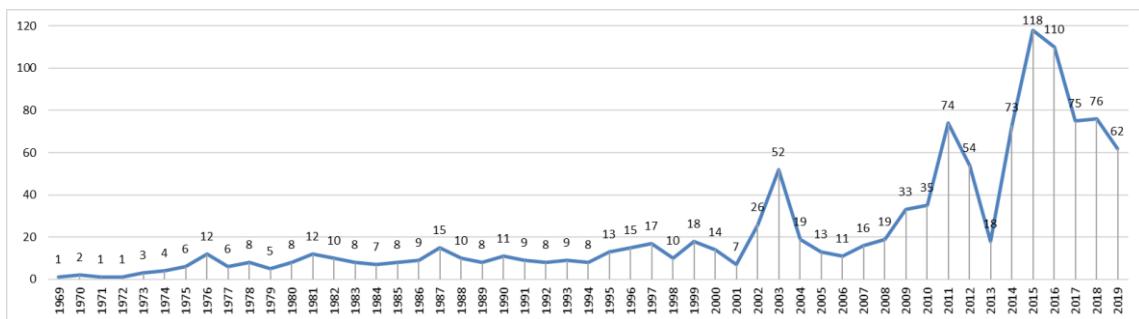


Figure 1. NS publications' Scatter Graph by Years Scanned on ERIC Database

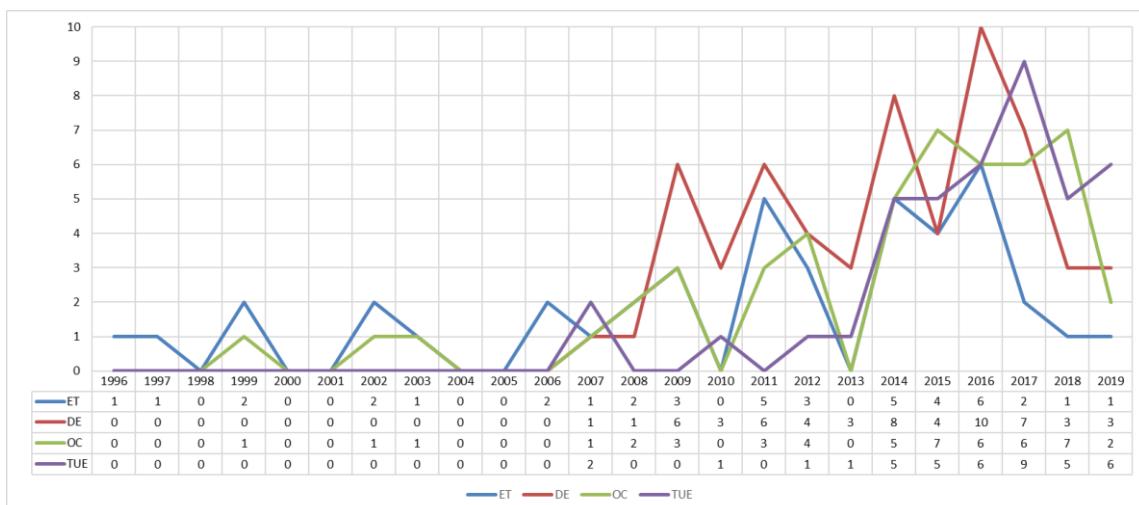


Figure 2. Scatter Graph of the Publications by Years Related to Four Data Group

When Table 1 and Figure 2 are studied together, it is seen that studies on DE and TUE descriptors with NS have been carried out since 2007 and when the number of the studies are compared it is understood that they are quite close to the number of the publications on ET and OC descriptors which were carried out towards the end of the 1990s. In addition to this, it was found that studies of DE-in-NS and TUE-in-NS have been carried out more than that of ET-in-NS and OC-in-NS in recent years. The scatter of the studies according to the types specified by ERIC is in Figure 3. In this

context, it was seen that studies were mostly in the forms of Journal Articles, Reports-Research and Doctoral Dissertation.

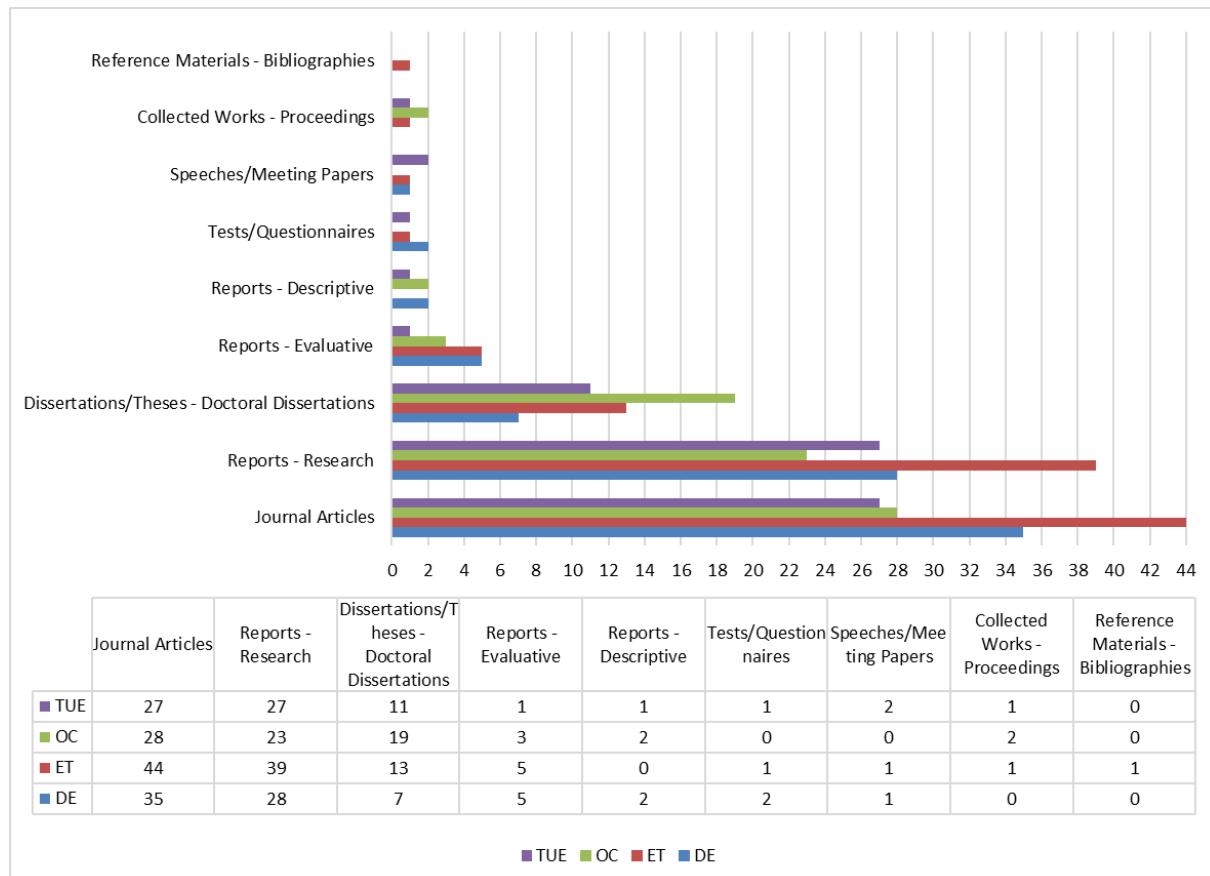


Figure 3. Distribution of publications by types

Analysis of the words used in the titles of the studies

100 most frequently used words in the titles of the studies were revealed by analyzing the titles of the studies for which descriptors of ET, DE, OC, and TUE were assigned within the studies scanned on ERIC database for which NS descriptors were assigned. These words are sorted by frequency and given in Figure 4 as word clouds.

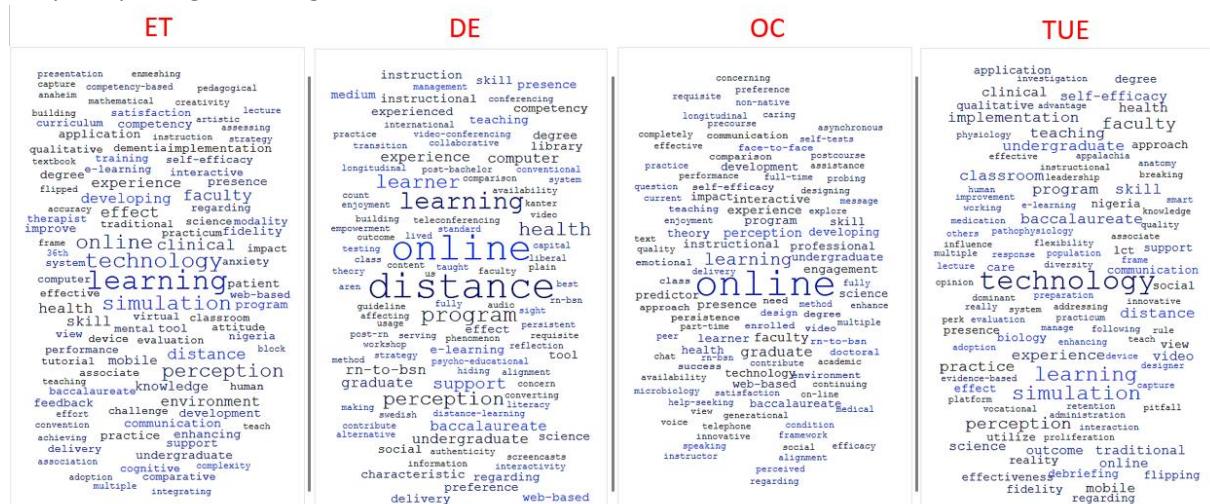


Figure 4. Analysis Results of the Publication Titles Presented as Word Clouds

When Figure 4 is studied, it is seen that the most frequently and commonly used words in the titles of studies for the four data group is learning. Most frequently used words except for the word "learning" are as below:

- ET: Technology, online, simulation, and perception
- DE: Distance, online, program, and learner
- OC: Online, graduate, faculty, and perception
- TUE: Technology, simulation, faculty, and perception

When the most frequently used words are analyzed, it is seen that expressions primarily preferred to be emphasized appear in the studies in each data group. Of the four data groups, it occurs that the five most frequently used words used in the titles of the studies in DE are more unique than the other data groups. On the other hand, words used uniquely in the titles and that are likely to be related to the field are as below:

- ET: Improve, feedback, attitude, curriculum, training, flipped, textbook, pedagogical, and presentation. There are 36 unique words in total.
- DE: Medium, audio, teleconferencing, collaborative, video-conferencing, interactivity, conferencing, information, and distance-learning. There are 51 unique words in total.
- OC: Engagement, face-to-face, design, help-seeking, designing, explore, voice, text, chat, instructor, on-line, asynchronous, peer, assistance, telephone, and message. There are 47 unique words in total.
- TUE: Effectiveness, flipping, reality, smart, administration, flexibility, and designer. There are 44 unique words in total.

Analysis of the words used in the abstract sections of the studies

100 most frequently used words in the abstract sections of the studies were revealed by analyzing the abstracts of the studies for which descriptors of ET, DE, OC, and TUE were assigned within the studies scanned on ERIC database for which NS descriptors were assigned. These words are sorted by frequency and given in Figure 5 as word clouds.

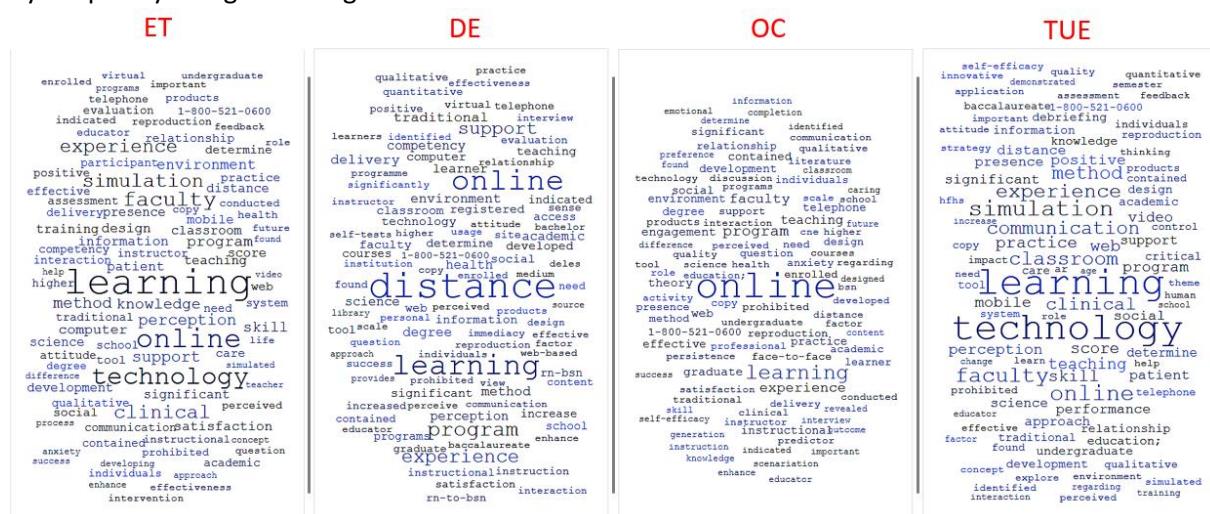


Figure 5. Analysis Results of the Publication Abstracts Presented as Word Clouds

When Figure 5 is studied, it is seen that the most frequently and commonly used words in the titles of studies for the four data group is learning. Most frequently used words related to the field except for the word "learning" are as below:

- ET: Online, technology, faculty, and simulation
- DE: Distance, online, program, and experience
- OC: Online, program, faculty, and experience
- TUE: Technology, simulation, online, and faculty

When the most frequently used expressions were analyzed, expressions of faculty and experience appear to be quite prominent in the abstracts of the studies being different from the titles. On the other hand, in the four data group, words used uniquely in the titles and are likely to be related to the field are as below:

- ET: Participant, questionnaire, implementation, process, developing, and teacher. There are 10 unique words in total.
- DE: access, site, learners, web-based, medium, usage, programme, source, and provide. There are 24 unique words in total.
- OC: Engagement, face-to-face, discussion, persistence, activity, and designed. There are 20 unique words in total.
- TUE: Impact, AR, application, explore, learn, theme, m-learning, and recordings. There are 21 unique words in total.

Analysis of the descriptors assigned for the studies

Of the studies scanned on ERIC database and for which the descriptors of NS were assigned, other descriptors assigned by ERIC on the studies with the descriptors of ET, DE, OC, and TUE were analyzed. Digital information on the descriptors assigned for the four data group is given in Table 2:

Table 2.

The Distribution of the Descriptors Assigned to the Publications

Main Descriptor	ET-in-NS	DE-in-NS	OC-in-NS	TUE-in-NS
Count	376	248	447	335

In order to facilitate better reading, word clouds (Figure 6) were formed by taking out 25 of the most frequently assigned words from the descriptors whose quantities are given in Table 2. Frequency of most frequently assigned 25 descriptors except for NS and ET in ET studies form %72,07 of all the descriptors assigned. Similarly, descriptors in Figure 6 form %72,18 of DE studies, %47,20 of OC studies, and %55,62 of TUE studies.

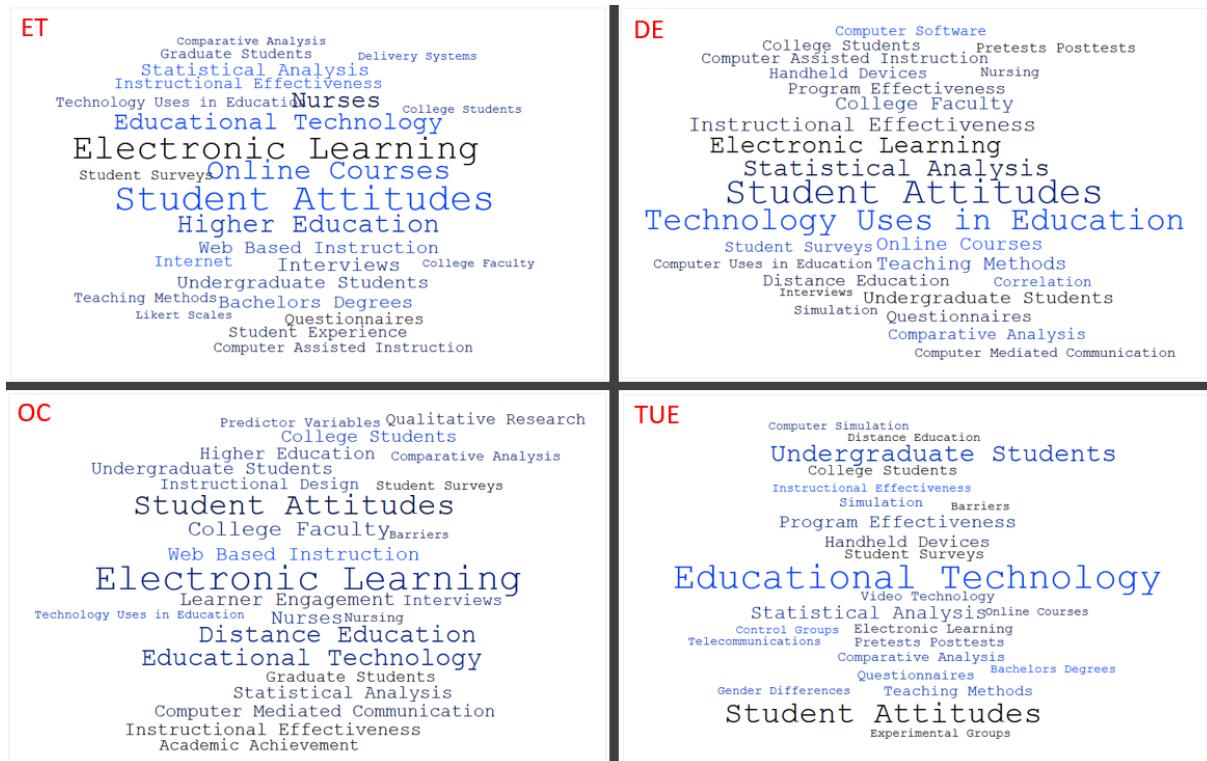


Figure 6. Analysis Results of the Representation of Descriptors Presented as Word Clouds

When Figure 6 is analyzed it can be seen that descriptors of ET, DE, OC, and TUE are among the most frequently used 25 descriptors in each data group. However, other TUE and OC studies in ET, OC and ET in DE studies, DE and ET in OC studies, and ET in TUE studies were among the 10 most frequently assigned descriptors. Particularly, TUE descriptors in OC and DE studies and OC and DE descriptors in TUE studies were less frequently assigned. When the other findings were analyzed, Student Attitudes stands out as the most commonly and frequently used descriptors for all data groups. Besides, The Electronic Learning descriptor for ET, DE, and OC was used frequently along with Student Attitudes.

78 descriptors in ET studies, 58 descriptors in DE studies, 56 descriptors in OC studies, and 38 descriptors in TUE studies were assigned as unique compared to other data groups. The frequently used descriptors that are assigned as unique and related to the field are as below:

- ET: Training Methods, Visual Learning, Student Evaluation of Teacher Performance, Teaching Skills, Computer Graphics, Educational Administration, Curriculum Development, Achievement, and Learning Activities.
- DE: Teleconferencing, Tutors, Online Searching, Student Adjustment, Student Empowerment, Research Tool, Search Strategies, Educational Cooperation, Educational Opportunities, and Educational Resources.
- OC: Educational Research, Peer Relationship, Role Playing, Small Group Instruction, Usability, Baby Boomers, Student Centered Learning, College Curriculum, Study Skills, Student Research, Instructional Improvement, Educational Principles, and Educational Attainment.
- TUE: Communications Skills, Video Equipment, Videotape Recordings, Screening Tests, Self- Management, Curriculum Implementation, Audience Response Systems, Class Activities, Large Group Instruction, and Measurement Techniques

Conclusion (From Past to Present and the Future)

With the outbreak of the COVID19 pandemic in 2020, the use of technology in education and training processes all over the world has become more significant. Especially at a period when face to face training cannot be carried out in educational institutions, distant or online education applications have been used actively. Within this period, nearly all the courses either theoretical or applied have been carried out in a distant or online way. Undoubtedly, Health Education comes up as one of the fields in which health care providers who take on important duties during the Pandemic are trained, and also it stands out as a field highly affected by the current situation. In this field that is directly concerned with human life and where there is a lot of applied training, it is a necessity to carry out distant or online training activities in a well-founded manner. In this sense, by addressing Nursing Students in the field of Health Education in the research, the present situation is revealed and analyzed through data mining by analyzing the studies carried out within the studies that are related to ET, DE, OC, and TUE and scanned on ERIC database before the outbreak of the pandemic.

When the number of the publications was analyzed, it was seen that number of the studies carried out on ET, DE, OC, and TUE within the publications of NS was quite low. Thus, carrying out more studies in which NS and educational technologies are integrated will be beneficial with regards to the field of Health Education. It is advised that more comprehensive studies should be carried out particularly in the period of Pandemic when teaching in different environments and teachers' and learners' interactions are quite high. On the other hand, when the fact that studies on DE and TUE have been carried out since 2007 and the number of the publications were considered, it was found that there were more up to date subjects in NS publications with respect to ET and OC studies. This fact can be proved with the scatter of the publications by years, and it shows that topics of DE-in-NS and TUE-in-NS are searched more when compared to ET-in-NS and OC-in-NS.

When the frequently used words in the titles of the studies were considered, it was found out that all of the studies put an emphasis on the word "learning". Along with learning, other frequently used words give us ideas about the tendencies of the studies related to the field of study. In this sense, it was concluded that ET studies focused on education such as improving, feedback, attitude, curriculum, and training, DE studies focused on tools and characteristics of the tools that are mostly related with distant education such as multimedia, videoconference-teleconference, cooperation, and interaction, OC studies focused more on the design and back-up issues of online courses such as motivation, design, search-research-back up, synchronous-asynchronous and communication and TUE studies focused on various dimensions of technology use such as efficiency, reality, flexibility, and administration. Moreover, it was seen that studies of TUE were more related to ET and OC studies as compared to DE.

When the findings on the abstract sections of studies were analyzed, it was found that learning was the commonly and frequently used word for all data groups in a similar way to the results of study titles analysis. When the other data except for learning was studied, more in-depth results came up as compared to study titles. In this context, firstly, when data of ET was compared with the data in other data groups, it was seen that it substantially included other subject fields. Secondly, the distance education system was emphasized more in DE studies. Thirdly, there were expressions on the efficiency of online courses in OC studies. And finally, it was seen that TUE studies focused on a variety of educational technologies such as augmented reality, mobile learning, applications, effect, and learning. Analysis results of title and abstract sections for four data groups offer significant data for the researchers who are going to carry out studies in these subject fields.

It was found out that ET included the other 3 data groups as was in the analysis results of abstract sections of the studies as a result of the descriptors analysis assigned for the studies by ERIC. It was also seen that DE and OC were more related to one another as compared to other data groups.

On the other hand, it was revealed that different issues were searched in TUE studies as compared to DE and OC studies. Depending on the number of the descriptors assigned, it appeared that OC was a subject that was searched in more distinct fields-formats with NS as compared to other data groups. As a result of this, the exact opposite situation can be noted for DE descriptor. Though having been seen in studies of NS only since 2007, the number of descriptors assigned for the studies in TUE asserts that this subject field has been tackled in a multidimensional way with regard to other data groups.

Student attitude and electronic learning are the two frequently searched subjects in four data groups. In addition to this, it was found that ET studies differed from the other data groups with such subjects as teaching methods, skills, activities and success, virtual learning, instructional administration; DE studies differed from the other data groups with such subjects as student adjustment and empowerment, research tools and strategies, educational cooperation, opportunities, and sources and conference systems; OC studies differed from the other data groups with such subjects as educational research, principles and achievements, peer relations, student-centered teaching and research, group study; and finally, TUE studies differed from the other data groups with such subjects as communication skills, video equipment and processes, self-management, curriculum implementation, audience response systems and measurement techniques. When the sample groups as regards to the descriptors assigned were analyzed, it was found that university, university students and nurses groups for ET; higher education degree, universities, undergraduate students and nurses groups for DE; undergraduate students, university students, nurses, higher education degree and teachers groups for OC; bachelor degrees, undergraduate students and university students groups for TUE appeared frequently.

Limitations

Three limitations are identified in this study. Firstly, the research was carried out on the articles indexed in the ERIC database with data mining. Since more publications are covered compared to other databases, the ERIC database was preferred. Secondly, years, types, title, abstract and ERIC descriptors sections of publications were analyzed. Lastly, covered publications in the ERIC database were not included in the study in 2020 due to the transfer of learning environments to online environments due to the COVID-19 pandemic and the shaping of scientific research in this direction. It is recommended to examine the publications made as of the pandemic period separately and reveal their differences with the studies published in previous years, considering the possible contribution to the field.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

This study was not funded by any organization or institution.

Kaynakça

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