

Investigation of the factors affecting the e-learning process in occupational therapy education during the pandemic with principal component analysis

British Journal of Occupational Therapy
2022, Vol. 85(9) 694–703
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DOI: 10.1177/03080226211070472
journals.sagepub.com/home/bjot


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Abstract

Introduction: The aim of this study is to examine the factors affecting the e-learning process in occupational therapy education in the COVID-19 period.

Method: In the study, a form containing personal information and questions about the e-learning process, the International Physical Activity Questionnaire, the Academic Self-Efficacy Scale, the Perceived Stress Scale, and the Rosenberg Self-Esteem Scale were applied to 253 occupational therapy students via the Google form. Principal component analysis was used to evaluate the data.

Results: A large number of questionnaires were applied in the study, and principal component analysis, an advanced statistical method that enables the interpretation of this type of big data more effectively, was used. 13 components were determined, and a variance of 88% was explained. The main components were listed as students' self-perception about the education system, learning methods, home and university environment, information technologies, physical activity level, and academic performance/participation.

Conclusion: We hope that the results of our study will provide a perspective on what innovations can be made for quality improvement in occupational therapy education. It would be beneficial to increase student feedback by applying similar studies in other education programs.

Keywords

E-learning, COVID-19, occupational therapy, principal component analysis

Received: 19 August 2021; accepted: 8 December 2021

Introduction

Due to the COVID-19 pandemic, education systems around the world have faced unprecedented challenges. An estimated 1.4 billion students in more than 156 countries were reported out of school during this period. To reduce the negative effects of the pandemic in the field of education, colleges and universities have implemented different online education models with varying degrees of success (World Bank, 2020).

E-learning is defined as “an educational method that facilitates learning through the application of information and communication technologies that enable students to access all necessary learning resources” (Golband et al., 2014). The term e-learning can be defined as web-based learning, online learning or education, computer-assisted or assisted instruction, computer-based instruction, internet-based learning, multimedia learning, technology-enhanced learning, and virtual learning (Cook et al., 2008).

Although online education is not a completely new concept, it has brought a sudden and great change, unlike the traditional face-to-face learning model. This progression initially presented many challenges to both educators and students. During the pandemic, negative factors such as social isolation, changes in routines, increased stay at home, and fear of infection also affected the education process. Other

difficulties faced by students during the pandemic can be listed as the change in the socio-economic status of their families, the illness or death of their relatives due to the pandemic, the unsuitability of the home environment for study, and the inadequacies in technological resources (internet connection problems and lack of personal computer) (Shahrvini et al., 2021; Tempiski et al., 2020; Zhang et al., 2020).

As e-learning is a process that needs to be adapted quickly for both academics and students due to the pandemic, it inevitably includes weaknesses and risks. Students stated that at the beginning they felt more distant from their instructors and classmates than ever before, and they had difficulty focusing on learning in the virtual environment (Tempiski et al., 2020).

The negative effects of online education were predominantly related to loss of practical professional experience,

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internet connection problems, limited technical possibilities of e-learning platforms, being away from school and friends, and anxiety related to isolation (Olum et al., 2020). On the other hand, the positive aspects of online education include opportunities to explore different learning resources, increased flexibility, and self-learning time (Shahrivini et al., 2021).

During the pandemic, the practical applications of most of the courses in the occupational therapy curriculum have been postponed or rearranged in an online format. Internet-based projects; online clinical case studies; and online meetings between lecturers, supervisors, and students on pandemic-related topics have been part of the structured online education. Clinical internship studies were postponed until the epidemic was brought under control and were carried out when the number of COVID-19 cases began to decrease (Samelli et al., 2020).

Considering all these difficulties created by the COVID-19 pandemic in the education system, there are still many issues that need to be investigated and questioned by both students and faculty members. The comparison of online education with face-to-face learning and the satisfaction rates of students and academicians is one of the topics that arouse interest. While there is limited evidence for the effectiveness of e-learning applications in health education, some systematic reviews are suggesting that they have equally effective results with traditional learning methods (Cook et al., 2008; Du et al., 2013; Lahti et al., 2014; Vaona et al., 2018).

It will be useful to apply advanced statistical methods for the analysis of this issue related to education, which is multidimensional and contains too much data. Principal component analysis (PCA) is an important multivariate statistical method for calculating principal components and performing a fundamental change on data using a few highly explanatory major components and ignoring the rest. PCA best explains the variance in a single dataset with the components it defines.

The principal component analysis is recommended when the researcher is to determine the minimum number of principal components to account for the maximum variance in the data used in a particular multivariate analysis.

The widespread use of the e-learning model in occupational therapy education, which is one of the innovations that emerged as a necessity during the pandemic, revealed the necessity of analyzing the factors affecting students in this process. However, big data emerges as a large number of evaluations are required to fully analyze the process. For the correct analysis of this data, it is necessary to evaluate them over the components that systematically bring together the variables related to each other. This study aims to examine the factors affecting the e-learning process in occupational therapy training during the COVID-19 pandemic by applying the PCA.

Methods

An online descriptive and cross-sectional survey was conducted from May 2021 to August 2021.

Study population

The sample of this research consists of the students who participated in the e-learning process during the pandemic in the 2020–2021 academic year from occupational therapy departments of various universities in Turkey. The students included in the study received online education for a total of 14 weeks in the spring semester.

Selection criteria

Inclusion criteria were being a student of the occupational therapy department and participating in the e-learning process during the COVID-19 pandemic. Students who had never attended courses and watched online education videos were excluded from the study.

Preliminary information about the study was given by reaching the student representatives who are studying undergraduate education in occupational therapy schools in Turkey. Afterward, the lists of students who agreed to participate in the study were sent to us. Students who did not attend the classes regularly during the 14-week semester were excluded from the study by checking the student information system and the database where the courses are held online.

Sample size Based on the literature, considering the averages of 28.47 ± 54.17 and 30.66 ± 30.94 in the International Physical Activity Questionnaire, it was concluded that the minimum sample size should be 216 people according to 80% power (12). Within the scope of the study, an online questionnaire was applied to 253 occupational therapy students via a Google form.

Data collection procedures

Research data were collected with an evaluation form consisting of six parts. In the first part, students' personal information (age, gender, number of siblings, parent's level of education) is included. In addition, similar studies were examined, and unique questions were designed for students about the e-learning process. Other five parts are Approaches to Learning and Studying Inventory (Topkaya et al., 2011), International Physical Activity Questionnaire (Saglam et al., 2010), Perceived Stress Scale (Eskin et al., 2013), Academic Self-Efficacy Scale (Yilmaz et al., 2007), and Rosenberg Self-Esteem Scale (Cuhadaroglu, 1986; Rosenberg, 1965).

Class representatives were contacted at universities with occupational therapy departments, and questionnaires were applied to volunteer students via WhatsApp and email.

Demographic information form

In this form, in addition to the sociodemographic characteristics of participants, there were also questions specifically prepared about the e-learning process. The first five questions included the sociodemographic information of the students. In the continuation of the section, there were 26 open-ended and multiple-choice questions that evaluated students' experiences and opinions about online education.

Approaches to Learning and Studying Inventory

Approaches to Learning and Studying Inventory (ALSI) consisted of five subscales and 18 items in total: surface approach (four items), deep approach (six items), monitoring of studying (four items), effort management (two items), and organized studying (two items). The deep learning approach included the ability to relate ideas and use evidence. The follow-up study subscale described the meta-cognitive aspects of learning. The monitoring of the study subscale described the meta-cognitive aspects of learning. Participants gave scores ranging from (1) “strongly disagree” to (5) “strongly agree” for each question. A high score from each learning approach section indicated that the participant prefers to use that learning approach more, while a low score indicated that he/she prefers to use it less. It was concluded that participants with the highest scores from the three learning approach dimensions adopt the said learning approach more. The lowest score that could be obtained from the deep learning approach is 10, and the highest score is 50; the lowest score from the strategic approach is 4, and the highest score is 20; and the lowest score from the surface approach is 4, and the highest score is 20 (Topkaya et al., 2011).

The International Physical Activity Questionnaire

The International Physical Activity Questionnaires (IPAQ) comprised a set of four questionnaires. Long (five activity domains asked independently) and short (four generic items) versions for use by either telephone or self-administered methods were available. The purpose of the questionnaires was to provide common instruments that could be used to obtain internationally comparable data on health-related physical activity. This measure assessed the types of the intensity of physical activity and sitting time that people have as part of their daily lives is considered to estimate total physical activity in MET-min/week (1 MET = 3.5 ml/kg/min) and time spent sitting (Saglam et al., 2010).

Perceived Stress Scale

The Perceived Stress Scale (PSS) was a classic stress assessment instrument. The questions in this scale were about feelings and thoughts during the last month. It consisted of 14 questions in total. In each case, it was desirable to indicate how often one feels or thinks in a particular way. Participants evaluated each item on a 5-point Likert-type scale ranging from “Never (0)” to “Very often (4).” PSS scores ranged from 0 to 16. A high score revealed the excess of a person’s perception of stress (Eskin et al., 2013).

Academic Self-Efficacy Scale

The scale was based on the idea that students’ proficiency in each dimension of academic study will contribute to overall academic self-efficacy. Selected dimensions of the academic study were “Learning process,” “Reading,” “Comprehension,” “Memory,” “Curriculum Activities,” “Time Management,” “Teacher-Student Relationship,” “Peer Relationships,” “Utilization of

Resources,” “Goal Orientation,” “Adaptation,” and “Examination.” The scale was 4-point Likert type (1 = completely agrees with me, 4 = does not suit me at all) and consisted of seven items in total. The lowest score that can be obtained from the scale is seven, and the highest score is 28. The high score obtained indicates high self-efficacy (Yılmaz et al., 2007).

Rosenberg Self-Esteem Scale

The Rosenberg Self-Esteem Scale (RSES) was a tool used to assess global self-esteem. RSES, developed by Rosenberg (1965), consists of 63 questions in 12 sub-categories (18). The first 10 items of the scale, which was adapted into Turkish by Cuhadaroğlu (1986), measured self-esteem. In this study, 10 items belonging to the Self-Esteem sub-dimension of the scale were used to determine the students’ self-esteem levels (19). A four-point scale ranging from “strongly agree” to “strongly disagree” was used. The items were selected as a Guttman Scale with seven “contrived items.” The scale ranged from 0 to 30. Scores between 15 and 25 were in the normal range; scores below 15 indicated low self-esteem.

Rosenberg (1965) determined that the test-retest reliability coefficient for the sub-dimensions of RSES ranged between 0.82–0.88, and the internal consistency coefficient (Cronbach alpha) ranged between 0.77 and 0.88 (Rosenberg, 1965). In the reliability study conducted by Cuhadaroğlu (1986) for the Turkish form of RSES, the test-retest reliability coefficient was found to vary between 0.48 and 0.79. In this study, the Cronbach alpha internal consistency coefficient of the self-esteem sub-dimension was 0.88 (Cuhadaroğlu, 1986).

Statistical analysis

It was planned to use multivariate statistical methods instead of univariate statistical methods to increase internal validity and the accuracy of the analysis in the evaluation of the data. Principal component analysis was used to explain the multivariate complex structure of variables with fewer components. Two-sided p values were considered statistically significant at $p \leq 0.05$. All statistical analyses were carried out by using R programming (version 3.6.2 (2019-12-12) – Comprehensive R Archive Network (CRAN)).

Results

A total of 253 students, 116 first-grade, 49 second-grade, 50 third-grade, and 38 fourth-grade students, who were studying occupational therapy participated in our research. The vast majority of these students were female (88%). The academic performance of the majority of the students in the online education process was considered successful. While the overall academic performance of 153 students was between 3 and 4, only five students had an average of 1.5–2.0, which was considered unsuccessful.

As a result of the evaluations made with the online questionnaire method, the findings including the demographic information of the participants (Table 1) and their answers to the education process were obtained (Table 2).

In the current research, a total of 13 components were defined by PCA. When the findings were examined, our study showed a variance of 88.35%. Factor loadings of the components are mentioned in Table 3.

In the first component (PC1) with a variance value of 15.49%, the students stated that it became easier to ask questions during the online education process (33%), finding themselves sufficient in terms of time management (48.2%), they could maintain their schoollife balance (40.3%) and find new activities for themselves (63%) (Figure 1). In addition, it was observed that students could not communicate with their classmates face-to-face, could not perform group work, their study discipline decreased compared to traditional education, and they experienced professional competence concerns during the pandemic. The education system choice of students in PC1 was that 40% of occupational therapy students in Turkey preferred face-to-face, 37% online, and 23% hybrid models (Figure 2). In this component, it was also observed that the sitting time of the students in the online education process increased.

Table 1. Demographic features of the occupational therapy students.

	N	Percent	Mean	SD
Age			20.84	2.50
Gender				
Male	30	11.86		
Female	223	88.14		
OT classroom				
1	116	46		
2	49	19		
3	50	20		
4	38	15		
GPA				
1.5-2.0	5	2		
2.0-2.5	17	7		
2.5-3.0	78	31		
3.0-3.5	106	42		
3.5-4.0	47	18		

OT: occupational therapy, GPA: grade point average.

Table 2. Response rates of students to survey questions about education.

	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	N	P	N	P	N	P	N	P	N	P
I think that the instructors are helpful and they try to support and facilitate the process	48	19.0	100	39.5	31	12.3	42	16.6	32	12.6
I watch replays of course recordings at different times of the day	92	36.4	84	33.20	21	8.3	24	9.5	32	12.6
Asking questions during the courses is easier for me	39	15.4	45	17.8	64	25.3	31	12.3	74	29.2
I think that my opportunity to study with my classmates has decreased	140	55.3	51	20.2	19	7.5	17	6.7	26	10.3
My study hours have become more flexible during the day	91	36	79	31.2	43	17	17	6.7	23	9.1
I was able to work more disciplined in face-to-face education compared to online education	91	36	45	17.8	41	16.2	31	12.3	45	17.8
I get enough support from my family and close circle in online education	109	43.1	59	23.3	36	14.2	24	9.5	25	9.9
The study environment at home is peaceful for me	85	33.6	64	25.3	45	17.8	21	8.3	38	15
I am worried about gaining professional competence during the online education process	134	53	47	18.6	33	13	21	8.3	18	7.1
I find myself sufficient in time management throughout the online education process	54	21.3	68	26.9	44	17.4	34	13.4	53	20.9
I get adequate IT support from my university	44	17.4	78	30.8	54	21.3	48	19	29	11.5
I can maintain schoollife balance	47	18.6	55	21.7	49	19.4	44	17.4	58	22.9

N: number, P: percent.

In PC2 (10.47%), it was concluded that the repetition of online training videos could be watched at different times of the day and the independent study time of the students increased compared to before the pandemic (69.6%). It has been also observed that there is a relationship between adopting deep learning and strategic approach principles and self-esteem in this component.

In PC3 (9.38%), the majority of students stated that during the pandemic, the faculty members facilitated the process by being tolerant (58.5%), they received sufficient support from their families and friends (66.4%), the home environment was suitable in terms of studying (58.9%) and the information technologies support of the university was sufficient (48.2%).

In PC4, it was revealed that some of the students had problems with internet connection (Figure 3), and this situation was negatively correlated with the number of siblings in the house.

When the results were examined in terms of flexibility, the variables such as students' being able to find new activities (PC1), being able to watch course repetitions at different times of the day (PC2), and the fact that study hours became more flexible (67.2%) during the day (PC4) came into prominence.

In PC5, there was a positive correlation between course participation rates (88.5%), grade point averages, and self-assessments of study performances in the e-learning process. It was observed that the students' moderate physical activity and walking levels in PC6 and vigorous physical activity scores in PC7 were high. According to the IPAQ results of the students, it was determined that "70" of them were at a light activity level, "102" at a moderate activity level, and "81" at a high-intensity activity level.

All components and related variables were included in the table (Table 4).

Discussion

Within the scope of this research, a comprehensive questionnaire about online education during the pandemic was applied to the occupational therapy students from different



Figure 1. Finding new activities.

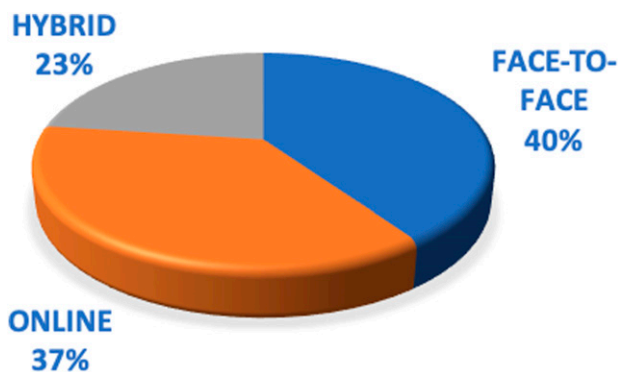


Figure 2. Selection of education system.

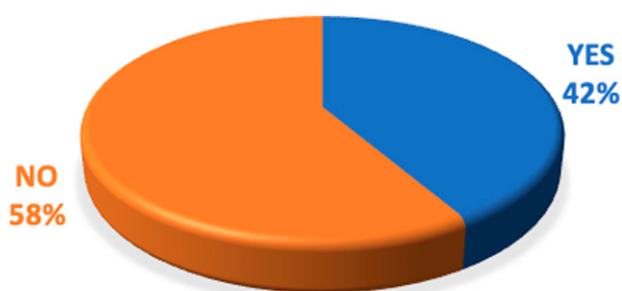


Figure 3. Have you experienced internet connection problems during online education?

problems and also deficiencies in group dynamics. (Hammarlund et al., 2015; Kitching et al., 2015). Occupational therapists are expected to be well-equipped in areas such as being able to communicate well, expressing themselves adequately, adapting to teamwork, having strong social relations, being friendly, and respecting personal differences. (Mason and Mathieson, 2018). For this reason, the development of time management, organization, and self-management skills of occupational therapy students is important in terms of creating a professional identity. (Brown et al., 2020; Lebedeva et al., 2016). So, it is necessary to carry out studies to develop this new learning approach, which is new for our country, in a way that will reduce concerns.

Nearly half of the students included in our study had difficulties in time management during the pandemic. In this sense, the relationship between the variables “I have difficulty

in maintaining school-life balance during the COVID-19 process” and “I do not find myself competent in time management during online education” in PC1 was remarkable. Especially time management is an important skill in meeting occupational therapy program requirements and productivity standards (Miller et al., 2021). (Brown et al., 2020; Gagnon et al., 2007; Hammarlund et al., 2015; Lebedeva et al., 2016; Wallingford et al., 2016). According to the correlated variables in PC1, the students stated that the opportunity to study with their friends decreased in the pandemic; they had professional competence concerns for the future, and face-to-face communication is very important. In our study, 71% of the students reported concerns about gaining professional competence. However, some studies have concluded that faster and easier access to quality learning resources, the rapid and flexible application of contemporary strategies, self-assessment opportunities, and flexibility are important factors that will increase students’ interest in learning and enabling professional development (Golband et al., 2014; Hammarlund et al., 2015; Kokol et al., 2006). The pandemic also prevented students from getting together and doing face-to-face individual and group studies. It was of great importance that occupational therapy students learn to act as a team with their colleagues in their education process. However, during this process where communication was provided through online platforms, it was thought that the basic parameters of communication such as gestures, mimics, and voice tones cannot be fully reflected. When the dynamic style of the occupational therapy profession was taken into account, group study should be included in the education curriculum to develop features such as leadership and management skills. During group activities, students could easily demonstrate their talents. For this reason, the students expected that these applications take place in online education.

Variables in PC1 also showed that there should be solutions to improve the quality of education programs to increase students’ self-management and flexibility skills. To develop resilience and adaptation skills, it is necessary to create proactive support for teaching and learning actions in education programs. Online education should not only consist of lecture notes and course content files. New learning activities should be added to the programs for student-student and student-instructor interaction. Otherwise, it may look like a non-interactive face-to-face training conference.

When the correlated variables in PC2 were examined, it was observed that the deep strategic learning approach and self-esteem average scores of occupational therapy students were correlated. Studies showed that e-learning was a preferred education approach for those who wanted to learn more deeply, when the content, instructor, system, and student components were taken into account (Hammarlund et al., 2015; Ikram et al., 2015). Due to the nature of e-learning, the increase in self-study periods, the ability to watch lecture videos at any time during the day, and the strategic approach to learning were correlated. Currently, e-learning approaches included systematic learning strategies (Morton et al., 2016; Moule et al., 2010). In a study conducted with occupational therapy students, it was stated that it was important for instructors to advise their students to devote time to independent

Table 4. Principal components.

Components	Variances												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Gender	.452	-.048	.000	.008	-.090	.013	.009	-.003	.121	.181	-.011	.696	.136
Age	.212	.045	.049	.001	-.082	.003	-.095	.062	.780	-.001	-.020	.197	-.029
Presence of disability	.046	.045	-.043	.043	.044	.066	-.022	.123	-.122	-.254	.650	.109	.040
Health problems	-.020	.084	.035	.043	-.112	-.051	.069	-.017	.148	.180	.796	-.084	.050
Academic program and degree	-.091	.004	-.085	-.046	.001	-.067	.039	-.010	.836	-.082	.057	-.031	.016
Education system selection	.719	.057	.019	.044	.123	.040	.005	-.038	.032	-.104	-.052	.069	.095
Regular attendance in classes	-.102	-.153	-.063	-.167	-.639	-.046	-.019	.076	.068	.124	.103	.085	.000
Electronic devices for online courses	-.058	.046	.133	.113	.514	.207	-.174	-.071	.145	-.129	.314	.252	-.082
Number of student siblings	-.048	-.085	-.133	-.567	.193	-.115	.283	-.194	-.120	.030	.060	-.209	.200
Internet connection problems	.122	-.058	.131	.672	.029	-.047	-.094	.051	-.152	-.105	.101	-.024	.077
Residence during pandemic	-.003	-.074	.302	-.338	-.088	-.094	.256	-.137	-.101	.325	.022	.116	-.502
Mother's education	-.023	.078	.009	.003	-.044	.015	-.018	.869	-.033	.016	.012	-.068	-.061
Father's education	.001	-.064	.037	.064	.050	.071	.080	.845	.073	.002	.071	.043	.053
Attitude of instructors	-.091	.011	.678	-.001	.078	.004	-.087	.085	-.088	-.232	-.088	.082	.158
Watching lecture video recordings	.205	.521	.014	.502	.029	-.035	.145	-.147	.136	.093	.124	-.064	-.008
Asking questions during the courses	.444	.258	.138	.280	.127	.048	.100	-.134	.205	.124	-.185	-.107	.173
Studying together with classmates	-.732	-.049	.091	-.077	.094	-.051	-.060	-.040	-.004	-.058	.045	-.162	-.025
Flexible study hours	.075	.069	.225	.584	.292	.247	-.181	-.142	.019	.164	.165	.234	-.007
Study discipline	-.416	.005	.119	-.047	.116	.039	.015	-.057	.047	.206	.011	-.028	.521
Support of family and friends	.203	.149	.589	.459	.090	-.028	.230	.058	.010	.125	-.087	-.048	.015
Suitability of the home environment for online education	.278	.227	.541	.528	.025	-.007	.198	.062	.002	.027	-.040	.091	-.007
Professional competence concerns	-.747	-.034	-.111	-.096	.117	-.042	-.090	-.036	-.006	.121	-.029	-.116	.074
Time management	.595	.295	.435	.099	.103	.081	.084	-.088	.068	.014	.058	.003	-.050
University IT support	.235	.154	.712	.121	.058	.062	-.132	-.044	.034	-.015	.116	-.037	-.016
School-life balance	.607	.185	.509	.158	.114	.064	.033	-.004	-.018	.038	.082	.042	-.071
Finding new activities	-.429	-.161	-.138	-.141	-.114	-.050	-.162	.092	.106	.131	.005	-.185	-.361
The importance of face-to-face communication	-.799	-.030	-.122	-.027	-.049	-.140	-.067	.020	-.010	-.009	-.053	.089	-.027
Grade point average (GPA)	-.119	.016	.056	-.188	.718	-.164	-.054	.097	-.079	-.011	-.040	-.019	.076
Study performance self-assessment	.390	.409	.210	.095	.558	.023	.003	.033	.193	-.096	.102	-.064	-.007
Weekly independent study time	.124	.508	-.214	.199	.282	-.065	.023	.174	-.127	.021	-.015	.338	-.252
Surface learning	-.123	-.147	-.079	-.008	-.164	.011	-.078	.016	-.057	.760	-.030	.134	.055
Deep learning	.039	.694	.076	.037	.270	.074	-.015	-.017	.023	-.212	.009	-.038	.151
Strategic approach	.258	.698	.226	.014	.167	-.045	.049	.067	-.095	.079	.121	.028	-.031
Vigorous physical activity	.161	.089	-.060	-.094	-.096	.206	.810	.058	-.033	-.048	.037	.109	.077
Moderate physical activity	.111	-.050	.105	.027	-.075	.676	.091	.029	-.032	.003	-.066	.059	.135
Walking activity	.081	.115	-.042	.006	.047	.794	.026	.043	-.021	.022	.076	-.097	-.096
Increased sitting time	-.427	-.016	-.027	.027	.124	.036	.001	-.064	.026	-.012	-.133	-.153	-.538
Physical activity questionnaire	.163	.112	-.046	-.064	-.062	.669	.665	.068	-.041	-.027	.043	.045	.014
Perceived stress	-.089	.367	-.102	-.092	-.047	.117	-.564	-.016	-.046	.196	.075	.213	.287
Academic self-efficacy	-.001	.180	.195	.025	.013	-.130	.191	-.102	.136	-.453	.140	.495	.014
Self-esteem	.027	.681	.191	.007	-.260	.160	-.026	.012	.118	-.311	-.010	.073	.007
Eigen value	4.302	2.653	2.616	2.290	2.208	2.071	1.812	1.730	1.639	1.480	1.398	1.340	1.227
% Of variance	15.494	10.471	9.380	8.878	6.653	5.563	5.419	5.221	5.997	5.610	3.409	3.268	2.993
Cumulative %	15.494	25.965	35.345	44.223	50.876	56.439	61.858	67.078	73.075	78.685	82.094	85.363	88.356

study and this would improve their effective learning approaches (Bonsaksen et al., 2017).

Self-esteem is also very important for occupational therapists to work more effectively and beneficially for public health. Some studies showed the importance of patience, learning from mistakes, and taking responsibility in client-therapist interaction in the field of occupational therapy (Gura, 2010; Knecht-Sabres et al., 2013). In addition, problem-solving, critical thinking, and solution-finding skills were also stated as necessary features for successful rehabilitation practices and client-therapist trust (Smith, 2017).

Variables of PC3 reflected the importance of learning area. The most frequently reported obstacles in e-learning are the inadequacy of the course structure and learning place.

Therefore, to make a positive difference in learning and practice, it was necessary to integrate e-learning into the health sciences curriculum and locate students at the center of learning, taking into account pedagogical design, learning styles, and expectations (Regmi and Jones, 2020).

In PC4, 67% of occupational therapy students described online education as more flexible in terms of individual study time during the day. However, in terms of student perception, there were differences between countries. For example, while there was a negative perception of 77% in Pakistan (Abbasi et al., 2020), it was stated that health students in Uganda had a negative attitude towards e-learning (Olum et al., 2020). The main factor underlying this situation might be the inadequacy of the internet hardware and the poor connection

quality. Since there was a sudden and rapid transition to the online education model due to the pandemic, this process started with a lack of experience and there are various problems besides the advantages of starting this education model without sufficient evidence about its effectiveness (Internet connection, lack of infrastructure, etc.)

In PC4, the correlation between internet connection problems and the number of siblings studying at home was an important and new finding to our best knowledge, as the quality of internet signal decreases as the number of people connecting to the internet from home increases.

The grade point average of the occupational therapy students included in PC5 is between “3-3.5” which could be considered a high degree during the online education process. When evaluated in terms of academic performance, there was no statistically significant difference between online and face-to-face education in a study conducted on 81 occupational therapy students (Mu et al., 2014).

According to some studies, the e-learning model (Beekman et al., 2008; Gardner et al., 2016; Gagnon et al., 2007; Golband et al., 2014; Hammarlund et al., 2015; Kokol et al., 2006) offered different opportunities for the learning experience. Online education has been defined as an exciting, learning-promoting, interactive, and flexible education model. E-learning was defined as a contemporary approach that allows the rapid transfer of new knowledge. That provided a quick update opportunity for professional development. Education was not only limited to school and course hours but also offered students and educators flexibility that allowed them to stay in education in any environment and condition. It was possible for students to flexibly access learning resources and information outside, of course, hours, regardless of time and place. That provided students with learning autonomy (Gagnon et al., 2007; Golband et al., 2014; Hammarlund et al., 2015; Kokol et al., 2006). Along with that, in PC2, students had statements such as “watching online course videos at different times of the day” and “Increase of independent study time.” In PC5, there was the variable that students regularly attended online courses (88.5%). This situation revealed that students also developed the habit of studying outside of class hours.

In our study, moderate physical activity and walking variables in PC6 and vigorous physical activity variables in PC7 showed that occupational therapy students had the self-awareness to increase their physical activity levels about this situation. Although studies have revealed that students exhibit sedentary behaviors during the pandemic; similar behaviors have been observed in this population in the last 10 years before the pandemic. Despite some advantages, the education process carried out at home without going to university has created significant risks in terms of physical health. A recent study showed that students were spending more time than usual on physical activity during the pandemic, yet still spent most of their daily time sitting (Romero-Blanco et al., 2020).

The problems experienced by the students during the pandemic were having difficulty in maintaining the school-life balance and increased stress levels in PC7. In some studies, students defined online education as insufficient in terms of

factors such as motivation, participation, interaction, and perception. In addition, it was stated that this process caused high levels of anxiety and stress, so they could not maintain their self-discipline and self-efficacy, which remained low (Naidu, 2021). The advantages of online education could be listed as providing learning to learn, having a new and systematic learning dynamic, and the permanent inclusion of this model in education curricula. Its disadvantages were low motivation, not being able to fully meet expectations, not being suitable for all disciplines, and insufficient mutual communication (Regmi and Jones, 2020).

In this study, many factors affecting occupational therapy education from the perspective of students during the pandemic were listed as 13 basic components with PCA. Thus, interrelated variables that should be emphasized in online occupational therapy education have been determined.

The COVID-19 pandemic, unfortunately, may not be the last epidemic in the world. Regardless of pandemics, in a knowledge-based society, globalization and the rapid increase in internet use necessitate the creation of new learning models with the use of technology. The rapid development of digital resources is an indication that online education will be updated in the future and will move toward many different horizons.

Conclusion

It is necessary to provide open access in the education system and to develop learning networks prioritizing quality. This new education model in the digital world necessitates the development of flexibility, self-management, communication, digital learning, and adaptation skills of university administrations, academicians, and students, and gaining new qualifications.

Occupational therapy is a field that improves life adaptations and well-being through life roles and participation in new tasks and activities. As a possible result of this process, it was seen that students were able to find new activities for themselves. However, they need support in many areas to adapt to the new education system, and increase their learning success. Studies should be carried out on how to integrate teaching methods that develop students' socialization, resilience, and time management skills into the online education system.

We hope that the results of our study will provide a new perspective on which innovations should be planned for quality improvement in occupational therapy education. It would be beneficial to increase student feedback by applying similar studies in other education programs. In addition, the application of an advanced statistical method such as PCA in the field of occupational therapy enabled us to approach online occupational therapy education from a different perspective.

Limitations

The fact that the occupational therapy students we included in our research are from different classes means that the education curricula they receive are also different. For example,

we can say that a student in the fourth grade mostly takes clinical studies courses, while a student in the first or second grade takes the majority of the theoretical courses. However, since occupational therapy departments were opened in Turkey recently, we had to include more than first-year students. In future studies, we aim to work with more homogeneous groups.

In our study, no questions were asked in terms of cost effectiveness. New studies can be done on this subject as well.

Since the pandemic is still an ongoing process, future research needs to indicate that a follow-up is required.

Key Findings

- We found 13 PCAs affecting the e-learning process of occupational therapy students.
- The main components were students' self-perception about the education, learning methods, environment, information technologies, physical activity, and academic performance.

What the study has added

Many factors affecting the e-learning process of occupational therapy students were evaluated with PCA, systematically reduced to basic topics, and a new perspective was presented on which variables should be improved.

Authors' contributions

BÖ: Conceptualization, review and editing, and supervision; RA: Conceptualization, investigation, and writing—original draft; HK: Review and editing, and supervision; MYÇ: Methodology and statistical analysis; SEK: Investigation, and review and editing.

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

The authors received no financial support for the research, authorship, and/or publication of this article.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval

Ethics committee approval was received from Biruni University Ethics Committee with the number 2021/56–09.

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