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Sentiments towards Emergency Remote Teaching on Twitter: A Longitudinal Comparative Sentiment Analysis

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Abstract

This longitudinal and comparative study investigated people's sentiments toward emergency remote teaching in tweets posted in two different languages from January 10 to August 16 2021 when mass vaccinations started and continued. The results indicated that English tweets (a) included more positive sentiments towards emergency remote teaching; (b) were more supportive and motivating; and (c) focused on topics related to education, online education, and English as a second or foreign language. However, Turkish tweets (a) included more similar amounts of neutral and positive sentiments; (b) involved politics and government-related content; and (c) touched on topics related to preschool education, ministry of national education and the e-school system used during the pandemic. Lastly, compared to positive and neutral sentiments, there were fewer negative sentiments in tweets in both languages suggesting that people got used to emergency remote teaching over time. In other words, despite any ongoing issues, people's reactions to emergency remote teaching on Twitter improved and became either more neutral or positive in a year or so, which implies that increasing optimism due to vaccinations during sudden health crises may calibrate people's sentiments towards compulsory solutions such as emergency remote teaching.

Key Words

Comparative sentiment analysis • Emergency online education • Emergency remote teaching • Text mining • Topic modeling • Twitter

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Introduction

The COVID-19 pandemic has impacted human life profoundly (Lytridis et al., 2020): The United Nations Educational, Scientific, and Cultural Organization (UNESCO) (2020) predicted that countries closed schools and universities due to COVID-19, which have influenced 1.5 billion students as well as parents and teachers (e.g., Ewing & Cooper, 2021). The impact of the pandemic has been on all aspects of life including teaching and learning as well (e.g., Alan, 2021; Hodges et al., 2020; McFayden et al., 2021; Nazli et al., 2021; Sahin et al., 2021). Needless to say, schools and universities had to close suddenly and, due to various advantages including no time and place dependence (Pregowska et al., 2021), switched to what Hodges et al. (2020) call emergency remote teaching that has come up with challenges that would have decreased student satisfaction. For instance, according to some college students, lack of technological resources has made emergency online education challenging (Aristovnik et al., 2020; Gonzales et al., 2020). Unsurprisingly, then, only 19% of students have been satisfied with online learning experiences while the majority was concerned about their effects on future learning (Means et al., 2020). Accordingly, instructors modified their courses in different ways ranging from switching to a pass or fail grading regime to changing course requirements (Johnson et al., 2020). These challenges and adjustments were similar at different educational levels, including, but not limited to special education (e.g., Parmigiani et al., 2020; Sider, 2020), early childhood education (e.g., Alan, 2021; Campos & Vieira, 2020; Szente, 2020), and primary education and/or secondary education (e.g., Ayda et al., 2020; Calderón-Garrido & Gustems-Carnicer, 2020).

Students' and people's decreased levels of satisfaction would reflect into their online sentiments towards emergency remote teaching. One venue where these sentiments can be addressed is social media that (a) have already become online platforms people use to share insights into their lives (Ozturk & Ayvaz, 2018) as well as presenting their opinions and ideas (Ding et al., 2020); (b) provide quick access to information (Nazli et al., 2021); and (c) house people's comments and changes in their lives. After all, people, civil and government units, and businesses use social media very commonly thus turning them into important communication tools, which has become more common and important during the pandemic when social distancing has become a commonality (Nazli et al., 2021). To illustrate, as it should be clear to anyone who has a Twitter account, using Twitter, which is very popular and widely used (Nazli et al., 2020; Ozturk & Ayvaz, 2018), people post tweets on topics in a way that presents their opinions and emotions. Thus, given that the average number of tweets posted on Twitter daily exceeds 500 million (Crannell et al., 2016), which refers to a large global scope (Ozturk & Ayvaz, 2018), people are very likely to share their sentiments towards topics including emergency remote teaching through tweets. Analyzing these sentiments can provide unique insights into how to enhance such public services as online education during times of disruption.

Consequently, it is reasonable to investigate sentiments towards emergency teaching one year after the pandemic breakout when vaccines started to become highly available to see whether the level of emotional costs had been decreasing. To this end, this study investigates the public's sentiments towards emergency remote teaching one year after the pandemic in Turkish and English tweets to produce comparative insights by addressing the following research questions:

- What were the sentiments in Turkish and English Tweets towards emergency remote teaching when mass vaccinations became available?
- How did the sentiment scores change over time?
- How did the sentiments in Turkish tweets compare to those in English tweets?
- What were the relevant terms and main themes associated with the topics most discussed in Turkish and English tweets?

Review of Related Literature

Emergency Remote Teaching

To prevent COVID-19 from spreading, most schools moved to emergency remote education using different delivery modes (Bozkurt et al., 2020). Hodges et al. (2020) calls it emergency remote teaching and separates it from systematic online learning, and Ewing and Cooper (2021) highlighted that technology adoption promoted by the pandemic is not the same as deliberate technology integration. Specifically, the difference between emergency remote education and distance education is while the former "is about surviving in a time of crisis with all resources available, including offline and/or online", the latter "is a planned activity and its implementation is grounded in theoretical and practical knowledge which is specific to the field and its nature" (Bozkurt et al., 2020, p. 2).

Despite its possible advantages such as collaboration, training and communication (Smith, 2020) and gaining experience in using online technologies and online education itself (Robin et al., 2020), rapid move to emergency online education led to many challenges. Even though teachers regarded remote education as an opportunity to continue education (Ayda et al., 2020), they were mainly concerned about connecting with and engaging their students (Ewing & Cooper, 2021). Namely, students' level of engagement with their teachers was lower, their engagement with their peers had various levels, and emergency online education was difficult and less personalized with social isolation being a major issue (Ewing & Cooper, 2021). Besides social isolation, students faced challenges in emergency online education due to limited access to technology, lack of technology infrastructure, difficulty to focus on the course and course content, increased workload, and concerns about their future professional careers (Aristovnik et al., 2020).

Khlaif et al. (2021) reported that a wide variety of factors impacted students' online engagement during emergency online education ranging from infrastructure to digital inequality. That is, emergency online education also led to enlarged digital inequality and digital privacy issues thereby negatively impacting student engagement, and the lower quality of learning content during the pandemic decreased student engagement as well (Khalif et al., 2021). Armitage and Nellums (2020) claimed that the pandemic caused a high level of learning loss and inequality. According to Lesh (2020), we have been facing two pandemics simultaneously: "racism/inequity and COVID-19" (p. 7). Similarly, Stewart's (2021) thematic review revealed digital divide and huge inequalities are associated with emergency online education in addition to drawbacks, issues, and adjustments made to deal with the challenges of emergency online education.

According to Psacharopoulos et al. (2020), the school closures due to the pandemic may result in losing 18% of future gross domestic product globally. Compared to face-to-face education, student performance may have also deteriorated in emergency online education. For example, senior medical students learning face-to-face performed better compared to their counterparts learning through an online problembased learning tutorial in terms of participation, communication, preparation, critical thinking and group skills (Foo et al., 2021). Interestingly, even though emergency online education would be accepted by students due to the pandemic and they were comfortable with it (e.g., Cicha et al., 2021), students may approach it differently with male students having more positive sentiments (Haider & Yasmin, 2021).

Twitter Sentiment Research During the Pandemic

Eutsler et al. (2021) identified emotional reactions as one of the themes covered in tweets during the pandemic. Accordingly, online microblogging tools including Twitter have become excellent targets for sentiment analysis recently (Silahtaroglu et al., 2020) especially given that social media content including social networks include users' real-life "interests, friendships, and connections" (Mungen et al., 2020, p. 250). According to Nazli et al. (2020), Twitter's "minimalist design, a vast number of users and the consequent broad span of influence" distinguishes it from other social media tools. All these insights strongly suggest that Twitter provides a rich context in which people's sentiments can be detected and analyzed especially when such sentiments can reach a peak point during crises like the COVID-19 pandemic.

Since the official announcement of the first case on March 11, 2020 (Bostan et al., 2020), Turkey has been facing the negative effects of the pandemic too (e.g., Silahtaroglu et al., 2020), which led to analyzing Twitter data to catch trends in people's sentiments or emotions. Silahtaroglu et al. (2020), for instance, analyzed Twitter content (i.e., #Evdekal hashtag) starting in the second week after the first case and checked the following ten weeks. The authors reported an abundance of positive sentiments compared to negative ones, and anticipation and trust followed positive sentiments respectively. According to the authors, Twitter users tended to share positive and encouraging messages in which they supported each other by providing sample activities that can be done at home. The most frequently used words or phrases (i.e., athome, continue, health, lifeathome) aligned with people's tendency to show support in their tweets. However, in a content analysis of tweets posted during the first week after the official announcement of the first case in Turkey, Nazli et al. (2020) reported 13 emotional states of which the most common ones were aggression, gratitude and concern. Likewise, Silahtaroglu et al. (2020) found more negative sentiments in tweets in the 3rd and 4th weeks, which contrasts with the overall picture of the 10-week period they examined. Sahin et al. (2021) also reported that, overall, average sentiment scores of tweets decreased during the pandemic between March 14 and May 14, 2020, which features a trend towards more neutral or negative sentiment scores.

According to Silahtaroglu et al. (2020), the main reason for more negative sentiments in some weeks would be due to launching curfews and other restrictions combined with economic concerns. Likewise, Sariman and Mutaf (2020) reported more positive sentiments towards wearing masks in the first two months of the pandemic, but more negative sentiments towards other policies including lockdowns and digital educational content networks. However, Sahin et al. (2021) provided no sentiment score differences between obligatory and non-obligatory isolation periods. Overall, even though these findings do not align to some extent, they suggest that Twitter content may be sensitive to

major changes in social life. In this respect, Nazli et al. (2020) yielded that most corona-related tweets were about personal thoughts on the pandemic and emotions were the fourth most common category of the tweet content analyzed. Nazli et al. (2020) further claimed that tweets conveyed both personal opinions and emotional expressions throughout the first week after the onset of the pandemic in Turkey. Specifically, the number of tweets with emotional states increased towards the end of the week, which was due to increasing concerns (Nazli et al., 2020). Sahin et al. (2021) similarly found that the period between March 14 and May 14, 2020 included more tweets with higher positive and negative sentiment scores.

Interestingly, the trend of tweeting more positive sentiments at the beginning of the pandemic in Turkey has been observed in sentiment analyses conducted in other countries too. To illustrate, Barkur et al. (2020, p. 1) reported that "positive sentiments stood out" despite "negativity, fear, disgust, and sadness" in India between March 25 and March 28, 2020. Moreover, in line with Silahtaroglu et al. (2020) above, Barkur et al. (2020) found that trust was the second most common sentiment. According to the authors, these findings imply that Indians were positive about the cautions taken. During the following lockdown between March 25 and April 14, 2020 in India, the government asked people to turn off their home lights at 9 pm for 9 minutes and to use an alternative light source such as a candle to show solidarity instead (Vibha et al., 2020). Vibha et al. (2020) examined sentiments in tweets posted during the first day of this task offered by the Indian government. The authors reported that the most common sentiments were positive and trust respectively. From a more global perspective, Roy and Ghosh (2021) reported that even though positive and negative sentiments in tweets are balanced almost perfectly, public sentiments are not related to geographical closeness, and old age and ethnicity predict public sentiments toward the pandemic.

Method

Software Tools

We used the Python programming language for creating scripts that collect and analyze data programmatically. The collected tweets were stored in a MS SQL Server database for further processing and data analysis. For sentiment analysis and data preprocessing, we utilized Natural Language Toolkit (NLTK), a widely known open source package in Python, which processes text data in multiple human languages. The NLTK package is a comprehensive library that provides access to more than 50 corpora and lexicons as well as text data preprocessing features including stemming, stopword elimination, tokenization, tagging, parsing, and sentiment analysis (Bird et al., 2009). For topic modeling analysis, Gensim, which is an open source Python library (Rehurek & Sojka, 2010) was used since Gensim's parallelized implementation of topic modeling algorithms such as word2vec and doc2vec and latent Dirichlet allocation (LDA) algorithms allow for training models using large collections of text data efficiently (Rehurek & Sojka, 2010).

Procedures

Data collection

The research dataset was obtained through Twitter Application Programming Interface (API) that allows for collecting public tweets in real-time, which makes it an ideal venue for global opinion mining. The tweets related to

one of the hashtags below were collected and stored in a relational database. Data collection spanned over 218 days with an average of nearly 750 tweets per day.

Several hashtags for both languages were searched among all the public tweets from January 10, 2021 until August 16, 2021. English tweets were searched using these hashtags: "#onlinelearning","#remotelearning" ,"#distancelearning", "#onlineeducation", "#remoteteaching", "#onlineteaching", "#distanceeducation", "#remoteeducation", "#distanceteaching", "onlineinstruction" ,"remoteinstruction" and "emergencyremoteteaching". In total, 148,968 English tweets were collected. Eliminating the duplicate tweets, tagged with multiple hashtags, resulted in 137,695 English tweets. As for Turkish tweets, the following hashtags were searched: "#uzaktaneğitim", "#onlineeğitim", "#çevrimiçieğitim", "#uzaktanöğrenme" and "#uzaktanöğretim" that are comparable to their English counterparts. A total of 13,920 Turkish tweets were retrieved. After excluding duplicate hashtags, the total number of unique tweets was 13,187 Turkish. Because the NLTK library does not fully support Turkish language, Turkish tweets were first translated to English.

Data preprocessing

The data preprocessing included handling missing values, deletion of duplicates, numbers, punctuation and links, removal of stop-words, and tokenization of text. From a text mining perspective, the sentences were treated as documents in the study. Each document in text mining was considered as a bag of words or terms. No missing values were detected in the dataset. However, there were duplicated records due to retweets and multiple use of hashtags. All duplicates were removed from the dataset and uppercase letters were converted to lowercase characters to prevent duplications. Consequently, sentences were converted to tokens and stop-words were removed from the text.

Sentiment analysis

Sentiment analysis is the process of extracting subjective opinions and sentiments from text data. Sentiments can be categorized into various groups. We classified texts as positive, neutral or negative sentiments with the goal of identifying the dominant opinion of each tweet. The total sentiment score of a tweet was computed by aggregating polarity scores of all positive and negative terms, and individual tweets were labeled based on the total sentiment score. Furthermore, sentiments of Turkish and English tweets were illustrated using visualization libraries of matplotlib and wordcloud in Python language. To verify the validity of automatically calculated sentiment scores and sentiment polarities generated by the NLTK library, a list of randomly selected tweets were manually reviewed by the authors. The programmatically determined sentiments were consistent with the manual review process.

Topic modeling

Topic Modeling is an unsupervised learning method to identify underlying groups of terms and topics in a collection of text (Silge & Robinson, 2017). Many text mining methods were developed for discovering topics in a text automatically including latent semantic analysis (LSA) (Deerwester et al., 1990), probabilistic latent semantic analysis (PLSA) (Hofmann, 1999), and latent Dirichlet allocation (LDA) (Blei et al., 2003). This study used LDA, a widely-known and efficient probabilistic topic modeling technique, for topic modeling (Blei et al., 2003). LDA determines the underlying topics based on co-occurrence of terms. In LDA, terms are considered as the basic units of

topics and a group of terms are associated with latent topics in the documents. It assumes that a document can contain a collection of topics with varying degrees of relevance.

We developed the LDA models by using the Gensim library built in Python (Rehurek & Sojka, 2010). The necessary preprocessing tasks such as term tokenization, term matrix and corpus generation processes were performed on the text data before applying LDA methods. The model parameter of the number of topics was chosen as 10 in the LDA models for both languages. For the visualization of model outputs, we utilized LDAVis which is an interactive tool for displaying the latent topics and associated terms (Sievert & Shirley, 2014). For selection of relevant terms in topics, LDAVis utilizes the measures of saliency (Chuang et. al, 2012) and relevance (Sievert & Shirley, 2014). Salency is estimated by using equation 1 (Chuang et. al, 2012):

$$\text{saliency(term w)} = \text{frequency(w)} * [\, p(t \mid w) * \log(p(t \mid w) / p(t))] \quad (1)$$

t represents topics, p(t) stands for the probability of topic t, and p(t |w) denotes the conditional probability of term w occurring in the topic t (Chuang et. al, 2012). The relevance measure is calculated by using equation 2 (Sievert & Shirley, 2014):

$$\text{relevance(term w} \mid \text{topic t)} = \lambda * p(w \mid t) + (1 - \lambda) * p(w \mid t) / p(w) \quad (2)$$

Lambda λ represents weight, which takes a value between 0 and 1 assigned to the probability of the term w occurring in topic t and the term lift. Optimum lambda value may differ depending on datasets and assigning lambda to 0.6 worked well in our evaluations, which was also the case in Sievert and Shirley (2014). The expression $p(w \mid t) / p(w)$ denotes lift, which measures the ratio of the conditional probability of term w occurring under topic t relative to the likelihood of w occurring in the corpus.

Results

Sentiment Analysis Results

Sentiments in Turkish tweets

Sentiment analysis of Turkish tweets revealed that the majority had neutral sentiments: 5,991 tweets were neutral (45.43%) (Figure 1). There were also 5,638 positive tweets (42.75%), and 1,558 negative tweets (11.81%).

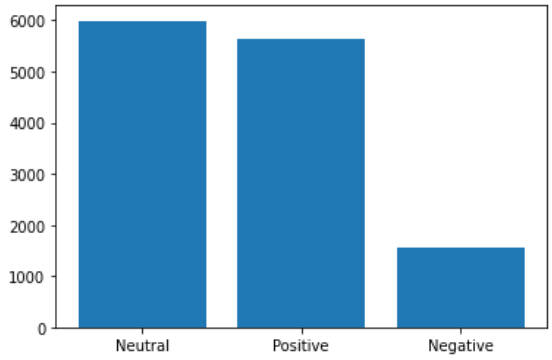

Figure 1. Sentiment Categories of Turkish Tweets

Most of the Turkish tweets were collected using hashtag "#uzaktaneğitim" followed by "#onlineeğitim". The tweets that belonged to these two hashtags collectively comprised the majority (Figure 2).

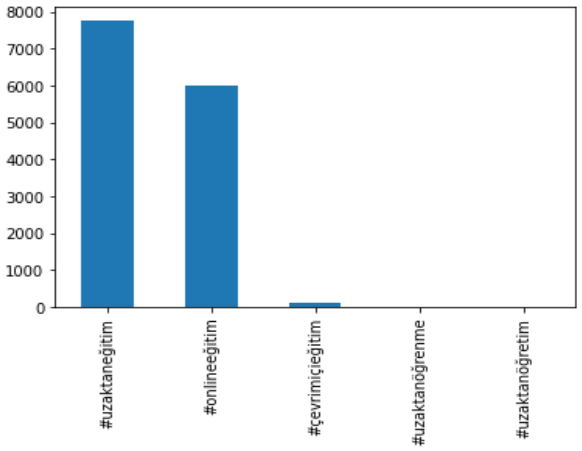

Figure 2. Number of Turkish Tweets per Hashtag

We also explored the changes in sentiments during data retrieval. Figure 3 presents the daily average sentiment scores of Turkish tweets. The highest average sentiment score per day was observed on July 20, 2021 while the lowest average sentiment score per day was observed August 10, 2021.

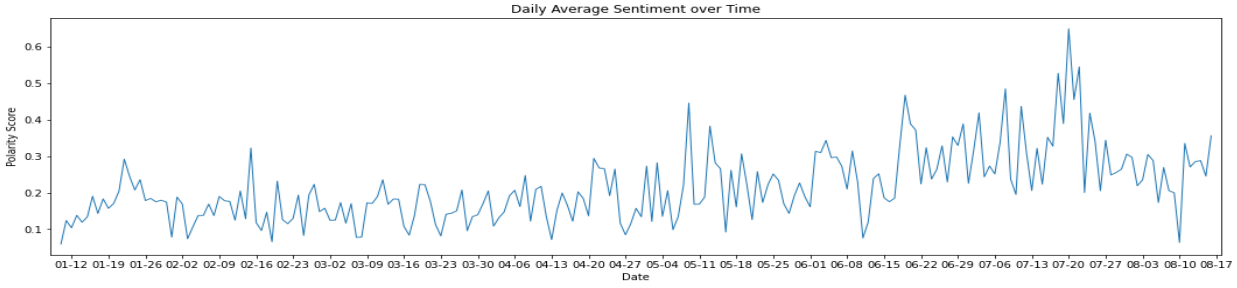

Figure 3. Daily Average Sentiment Scores of Turkish Tweets

Sentiments in English tweets

The majority of English tweets (89,807, 60.29%) turned out to be positive (Figure 4). There were also 49,400 neutral tweets (33.16%) and 9,761 negative tweets (6.55%).

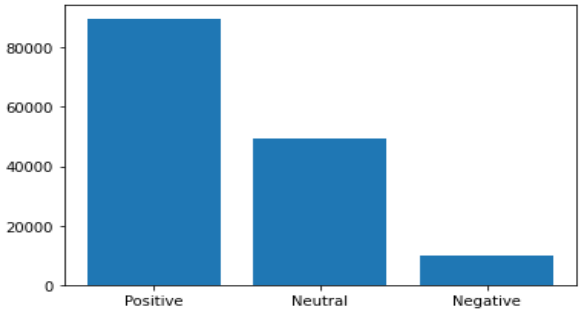

Figure 4. Sentiment Categories of English Tweets

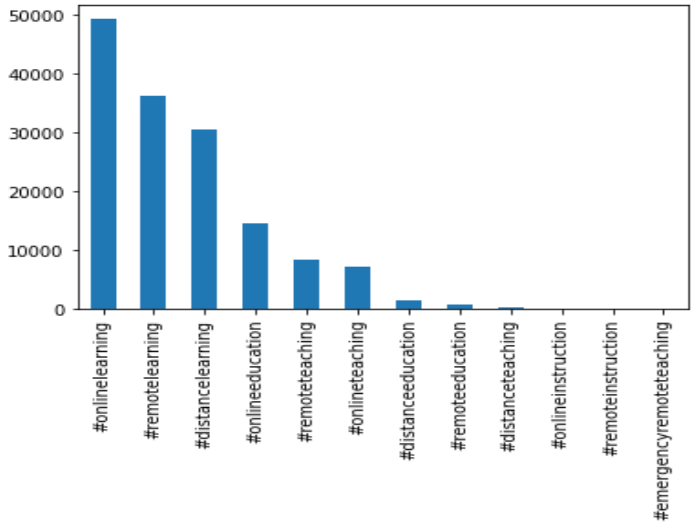

Figure 5. Number of English Tweets per Hashtag

The largest amount of the tweets were retrieved using the hashtag "#onlinelearning", followed by "#remotelearning" and "#distancelearning" (Figure 5) thereby constituting the majority. As for the daily average sentiment scores of English tweets, there was an overall decreasing trend. The lowest average sentiment score was observed on February 28, 2021 and the highest average sentiment score was noted on January 29, 2021.

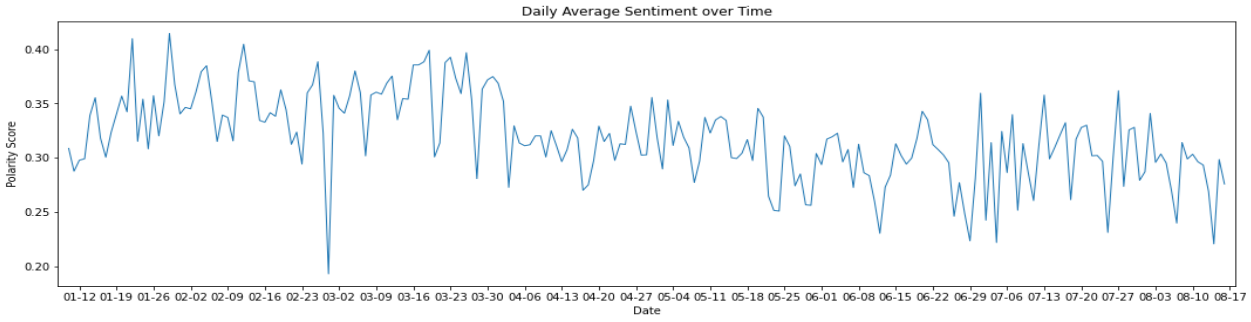

Figure 6. Daily Average Sentiment Scores of English Tweets

Word Clouds: Frequent Terms in Turkish and English Tweets

Word clouds were generated to determine the most frequent terms in Turkish and English tweets (Figure 7). In the English case, not surprisingly, the most frequent terms were "student","teacher", "school", "learn".

Figure 7. Word Cloud Representations of Frequent Terms in Tweets

Technological platforms supporting online learning such as “zoom” and “video” were among the highly frequent terms. Positive terms such as “thank”, “great”, “love”, “support”, “self-improvement”, and ”energy-efficiency” were more common in English tweets. On the other hand, frequent terms (e.g.,uzaktan eğitim, onlineeğitim, yüz yüze) observed in Turkish tweets were mostly neutral. The technologies and platforms used for emergency online education were also present in Turkish tweets (e.g., “eba”, “trt eba”, “ders eba”). Finally, Turkish tweets included opinions about politics and the government or public affairs. For instance, “ziyaselcuk”, name of the former minister of national education, and “meb”, “milli egitim”, and “milliegitim”, short names for the ministry of national education were among the frequent terms in the word cloud.

Topic Modeling Results

Topic modeling of Turkish tweets

Table 1 demonstrates primary topics discussed in Turkish tweets, and their relevant frequent terms as well as the main themes that were created manually using the frequent terms. The terms relevant to the most discussed topic were “eğitim”, “meb”, “uzaktan”, “lgs”,“onlineeğitim”, and “eba” that focused on ministry of national education, its e-school system and their connection to education and online education. The second topic included “eğitim”, “uzaktan”, “online”, “yüzyüzeğitim”, “uzaktaneğitim”, and “bilgi” that were related to learning via distance education and face-to-face education.

Table 1

Primary Topics in Turkish Tweets

Topic No	Topic Contribution of Tokens	Relevant Terms	Main Theme
1	13.7%	“eğitim”, “meb”, “uzaktan”, “lgs”,“onlineeğitim”, “eba”	Ministry of National Education and E-School System
2	12.2%	“eğitim”, “uzaktan”, “online”, “yüzyüzeğitim”,“uzaktaneğitim”, “bilgi”	Learning via Distance education and Face to face education
3	11.8%	“eğitim”, “anaokulu”, “anne”, “bebek”, “okulöncesi”, “ziyaselcuk”	Preschool Education
4	11.2%	“onlineeğitim”, “ders”, “eğitim”, “yksertelensin”,“uzaktaneğitim”, “lgs2021”	Postponing National Entrance Exams
5	10.1%	“uzaktaneğitim”, “eğitim”, “onlineeğitim”, “etkinlik”, “anaokulueğitim”, “kadın”	Preschool Education in Distance and Women
6	10%	“etkinlik”, “eğitim”, “evdekal”, “okulöncesi”, “anne”, “bebek”	Preschool education at home with respect to mothers and babies

7	8.3%	“eğitim”, “onlineeğitim”, “eba”, “uzaktaneğitim”, “sertifika” , “almanca”	Certification and Language learning in Distance education
8	8.1%	“bilgi”, “öğrenme”, “hızlıeğitim”, “uzaktaneğitim”, “kayıt” , “danışmanlık”	Fast learning techniques and Consultation
9	7.5%	“uzaktaneğitim”, “ziyaselcuk”, “onlineeğitim”, “eğitim”, “bilgi”, “etik”	Governmental affairs of distance education and ethics
10	7.2%	“eğitim”, “enstitü”, “sertifika” ,“uzaktaneğitim”, “tv”, “schools”	Certificates, Institutes and TV

Topic modeling of English tweets

Table 2 presents primary topics discussed in English tweets, the most frequent terms associated with them, and the main themes that were determined manually based on the frequent terms.The results of the topic modeling in English tweets indicated that the relevant terms to the most discussed topic were “students”, “teachers”, “school”, “learning”,“teaching”, and “education” that referred to the primary components of education. The second topic was related to terms “esl”, “efl”,”elt”, “tesol”, “tefl”, and “eal” that focused on English as a second or foreign language.

Table 2

Primary Topics in English Tweets

Topic No	Topic Contribution of Tokens	Relevant Terms	Main Theme
1	*18.9%*	*“students”, “teachers”, “school”, “learning”,“teaching”, “education”*	*Components of Education*
2	*16.6%*	*“esl”, “efl”,”elt”, “tesol”, “tefl”, “eal”*	*English as a Second or Foreign Language*
3	*16.6%*	*“education”, “online”,”elearning “onlineclass”, “onlinecourse”, “onlineeducation”*	*Education in an Online Setting*
4	*9.4%*	*“edchat”, “edtech”,”education”, “distincelearning”, “virtualreality”, “virtualteaching”*	*Virtual Education and Educational Technologies*
5	*8.1%*	*“onlinelearning”, ”languages”, “free”, “languagelearning”, “german”, “italian”*	*Language Learning Opportunities*
6	*7.6%*	*“elearning”, “onlinedegree”, ”digitalmarketing”, “business”, “university”, “career”*	*Online Degrees in higher education and its marketing*
7	*6.2%*	*“microsoft”, “teams”, ”workfromhome”, “remoteworker”, “digitalresources”,*	*Remote working, computer literacy and its digital resources*

		"computerliteracy"	
8	*5.8%*	*"affordable", "certificates", "offering", "diplomas", "certification", "tutoring"*	*Certification, diplomas and online tutoring*
9	*5.7%*	*"win", "homeschool","learntocode", "challenges", homeschoolingmom", "self"*	*Home schooling and its challenges*
10	*5.2%*	*"safety", "productivity", "selfimprovement", "energyefficiency", "higher", "webinar"*	*Self-improvement and productivity*

Discussion

In this study, a comparative analysis was performed to examine public sentiments on Twitter towards emergency remote teaching one year after the COVID-19 pandemic between January 10 and August 16, 2021 when mass vaccinations started and became available around the World. This time period is important to check people's online sentiments because it is when countries became more hopeful to overcome the pandemic due to mass vaccinations and there was an increasing sense of controlling the pandemic while in the early days, the public opinions were dominated by emotions of fear and hopelessness. Such an emotional turbulence was also accompanied by the sudden need to adopt emergency remote teaching in addition to inconclusive discussions on the origins of the pandemic virus and when the pandemic would be controlled. Thus, people's sentiments towards emergency remote teaching would not be mature enough and not reflect long-term generalizable opinions during the early period.

There were more neutral tweets than positive ones that outnumbered the negative ones in Turkish tweets, and the number of positive tweets was more than the neutral ones and far exceeded the negatives in English tweets. Namely, people's sentiments towards emergency remote teaching were mainly neutral or positive. As the vaccination efforts continued, schools started to open in some countries across the World, which seems to have positively influenced people's sentiments towards emergency remote teaching. However, the sentiments are not completely positive either, suggesting that especially Turkish people may have felt that there were both advantages and disadvantages of emergency remote teaching. For instance, emergency remote teaching did not have the face-to-face interaction or communication opportunity that most people would prefer; however, it provided a more secure opportunity to get involved in education. In other words, people may have understood and accepted the tradeoff between two aspects of emergency remote teaching: being less risky vs. lacking affordances of face-to-face education.

Most Turkish tweets were neutral followed by positive ones and negative ones respectively. This finding is surprising given that (a) Turkey had large-scale internet connection and/or band width issues as well as issues related to national e-school system or national education informatics network (a.k.a., EBA) (e.g., Dogan & Kocak, 2020); (b) average sentiment scores fluctuated significantly; and (c) discussions in Turkish tweets also touched on politics and government. Turkish tweets also focused on neutral terms including technologies thereby aligning with the dominance of neutrality. As for English, there were more positive tweets than neutral and negative ones.

Accordingly, despite all issues, emergency remote teaching may have continued to be regarded as a viable option in Turkey and beyond. After all, even though distance education may not replace some face-to-face affordances of in-person education, it has many advantages including accessibility that can let people learn during crises (Pregowska et al., 2021).

Both English and Turkish tweets contained more neutral and positive sentiments than negative ones, which is in contrast with such earlier findings as parents' negative perceptions of online education at the preschool level (e.g., Konca & Cakir, 2021) or teachers' concerns (e.g., Duran, 2021). Further, English tweets outnumbered Turkish ones in terms of positive content, and Turkish tweets consisted of proportionally more neutral and negative sentiments. This point further suggests that more people tweeting in Turkish chose to stay neutral and expressed their negative sentiments, and more people tweeting in English had positive sentiments towards emergency remote teaching. This insight further aligns with the finding that there were more neutral Turkish tweets than positive ones, which was the opposite for English tweets.

All these findings are also in tandem with what the word cloud analysis revealed: English tweets included a more positive content consisting of support and motivation, and people may have had a tendency to focus on technologies in both Turkish (e.g., eba, trt eba) and English (e.g., zoom, video) tweets. This last point suggests that specific technologies used may have influenced people's sentiments toward emergency remote teaching.

The lowest average sentiment scores for Turkish tweets coincided with the dates when the number of daily cases increased and national lockdowns, which is understandable given that such periods may have demotivated people. Overall, the average sentiment scores of all tweets fluctuated more starting in May 2021 and continued until August 2021. However, from January to April 2021, the average sentiment scores of English tweets fluctuated while the sentiment scores of Turkish tweets stayed more stable. In other words, people's emotional reactions to the pandemic had more ups and downs during summer 2021. Interestingly though, the average sentiment scores of English tweets were higher, and did not decrease as much as those of Turkish tweets. Those sudden increases (more positive) and decreases (more negative) in the average sentiment values of the tweets posted on a given day may have been caused by a social event, news, or any other factor that happened around that day, which is beyond the scope of the current paper. All these findings align with the earlier observation that more Turkish tweets were more neutral or negative than the English ones that were more positive content.

As for topic modeling results, the most common two topics covered in Turkish tweets focused on the ministry of national education and its e-school system as well as learning via distance education and face-to-face education using terms such as "onlineeğitim, yüzyüzeğitim, and uzaktaneğitim", which was in line with word cloud results.While the first largest topic, components of education, for English tweets was based on very similar terms (i.e., students, teachers, school, learning, and teaching) produced by the word cloud analysis, the second topic was English-as-a-second or foreign language education and it was based on different terms (e.g., esl, efl, tesol). This focus on English as a second or foreign language education suggests that English tweets were also coming from people for whom English was a second or foreign language. Namely, it seems that English tweets originated from not only English speaking countries most of which had access to COVID-19 vaccines earlier but also from non-English speaking countries, thereby increasing the generalizability of the current findings.

It is also interesting to compare the topics covered in Turkish and English tweets in terms of main themes. While the main theme of the number one topic for Turkish tweets was the ministry of national education and its e-school system, the main components of education was the overarching theme for English tweets. Given that Turkish tweets also had more political and government-related content, which is consistent with previous research showing that political tension is a common theme covered in tweets (e.g., Eutsler el al., 2020), it is no surprise that the most frequently discussed topic's main theme was related to the national education ministry that was a governmental unit. In the second topic, Turkish tweets switched to discussing distance and face-to-face education, while English tweets were mainly about English as a second or foreign language. This is also understandable given that English is the largest lingua franca in today's World and most people prefer it as a second or foreign language for different purposes. The other main themes including language learning opportunities, and higher education online degrees and its marketing also support this point. Discussing online education as a main theme was relevant to the third most common topic for English tweets that was still relevant to language learning and other associated main themes including homeschooling and its challenges, and certificates, diplomas and online tutoring.

The third main theme was preschool education for Turkish tweets and the fifth one was distance preschool education and women. Relevantly, the sixth largest topic's main theme was also about preschool education at home, mothers and babies. This finding implies that one of the educational levels where the impact of the pandemic was significant in Turkey was preschool education, which refers to concerns related to emergency remote teaching in this area. Given that students can be enrolled in preschool until the age of 5.5 years in Turkey (Goksoy, 2017), the concerns are understandable. This finding concurs with (a) the important role of distance education, technology, teacher professional development, and the cooperation between teachers and families in early childhood education (e.g., Alan, 2021); (b) the research showing that emergency online education had both advantages and disadvantages at the preschool level (e.g., Akkas-Baysal et al., 2020); and (c) the pandemic's overall impacts on preschool education in Turkey (e.g., Duran, 2021; Inan, 2020; Konca & Cakir, 2021). However, the focus on preschool education was not evident among the main themes for English tweets. Rather, English tweets' main themes were much more related to education in general, online higher education, language education, and virtual education and educational technologies.

Another big concern and the main theme of the largest topic for Turkish tweets was postponing national entrance exams for high school and university education that did not show up for English tweets. This last point implies that people in Turkey were worried about the upcoming national exams and how to handle them in emergency remote teaching, which is based on the high-stakes nature of these exams. Specifically, planning for and implementing emergency remote teaching would be much more effective when people's socio-economic and educational needs are taken into account. Ewing and Cooper (2021) highlighted that when lessons learned regarding pedagogy and instructional design keep up with technology, what we have been learning from the pandemic would be much more informative and have more long-term benefits. Consequently, solutions to sudden health crises including online education should be based on a systemic and comprehensive approach that covers the society's political, academic and socio-economic dynamics as well as pedagogy and instructional design to enhance learning and prevent learning loss.

Limitations and Recommendations for Further Research

We manually selected the target hashtags by carefully reviewing numerous potentially related hashtags and tweets to the best of their knowledge and observations. However, it is still possible that the search might have omitted some related tweets with the target hashtags. Moreover, there was a great deal of spam and irrelevant advertorial tweets marked with the target hashtags, which is common in social media. We did our best to clean the dataset by removing unrelated tweets.

In topic modeling, identifying the unique main topic of tweets is challenging as tweets might contain opinions about multiple topics and the output of LDA topic modeling can have terms related to multiple topics. For instance, the terms such as "education", "online", "student", "school","learning", "teaching" in English and "eğitim", "uzaktan", "online", "öğrenci", "okul", "öğrenme", "öğretim" in Turkish were present in multiple topics. While this makes it difficult to interpret the results, it is a general aspect of topic modeling.

Finally, this study focused on tweets collected in Turkish and English for a comparative analysis. English is a globally spoken language and Turkish is mainly spoken in a country. Therefore, English tweets are not location specific and may not reflect general sentiments about online education regarding specific countries. Specifically, the findings in the study cannot be generalized to other languages, and the sentiment analysis and topic modeling results may vary for different languages. As a result, future research may focus on tweets that are (a) marked with more hashtags determined by a larger research group; and (b) posted in more languages.

Conclusions

In this comparative sentiment analysis, both Turkish tweets and English tweets incorporated more positive than negative sentiments. Average sentiment scores of Turkish tweets was closer to zero and stable while those of English tweets decreased over time and remained mainly positive or above zero. Accordingly, English tweets were more positive, and Turkish tweets were more neutral, and tweeters largely presented neutral or positive sentiments towards emergency remote teaching when large-scale vaccinations became available. Namely, implementing large-scale vaccinations against health threats such as pandemics would motivate people and its positive impact may also hold true for people's opinions about educational interventions employed.

Positive sentiments in English tweets included more supportive and motivating insights while Turkish tweets were more neutral, focused on educational technologies and included political content. English tweets focused on English as a second or foreign language education, online education and educational technologies. Lastly, preschool education was a very common topic covered by Turkish tweets possibly due to the fact that preschool education was greatly impacted by the pandemic and emergency remote teaching. Consequently, systemic solutions owned by all stakeholders including policy makers, teachers, parents and administrators would work better during times of disruption, which would enhance people's sentiments towards them.

Ethic

We declare that the research was conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Author Contributions

This article was written with the joint contributions of three authors.

Conflict of Interest

There is no conflict of interest in the research.

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The Role of Personal Variables and Emotions Related to Preservice Teachers' Intention to Use Information Technologies in Acceptance of Educational Use of the Internet of Things (IoT)

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Abstract

The purpose of this study is to examine the relationship between pre-service teachers' internet of things acceptance behaviors (intention, usefulness, ease of use, facilitating conditions) and personal variables and information technology (IT) emotions. The research participants consisted of 171 pre-service teachers studying at the education faculty of a state university in Turkey. A personal information form and two different scales (IoT technologies acceptance scale and IT Emotion Scale) were used to collect data. Multiple Linear Regression Analysis was used in the analysis of the data. As a result of the research, competency in using digital technologies was an important predictor of the scores related to usability, and the increase in competency in using digital technologies positively affected the scores related to usability. The experience of using digital technologies and fun are important predictors in explaining the scores related to intention. The experience of using digital technologies and the increase in fun positively affect the scores related to intention. The experience of using digital technologies is an important predictor of the scores related to ease of use, and the increase in the experience of using digital technologies positively affects the scores related to ease of use. Finally, the scores related to the facilitating conditions of the competency in using digital technologies are an important predictor, and the increase in the competency of using digital technologies positively affects the scores of the facilitating conditions.

Key Words

Acceptance • Emotions in intention to use information technologies • Internet of things • Preservice teachers

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As technology offers new possibilities every day, the internet of things is one of these opportunities related to technology. With the integration of physical objects into information networks, internet of things technologies has emerged (Özdemir et al., 2014). According to Sarıtepeci et al. (2021), the internet of things (IoT) is a system that can transfer data between interrelated objects (sensors, devices, digital machines, mechanical tools, etc.) and people over a network. Sula et al. (2013) define the term internet of things as a global infrastructure that connects physical objects with the same internet protocol, allowing them to communicate and share information. The internet of things is an efficient technology with the aggregation and interoperability of various technologies (e.g. sensors, cloud systems, information security, etc.). This technology enables remote monitoring and control of objects, creating opportunities to communicate and integrate between physical and virtual worlds (Ray et al., 2016).

The internet of things applications are used in various fields. For example, education, health, marketing, customer service, smart homes, smart cities, and industry (Kassab et al., 2022; Sarıtepeci et al., 2021). The use of IoT technologies in the field of education can be considered relatively new compared to other field (Gökçearslan et al., 2022). Gökçearslan and Sarıtepeci (2021) draw attention to the integration of IoT technologies into more complex systems that include student participation, performance, and motivation in educational environments. Zaerov et al. (2020) emphasize the importance of adjustments such as heat, light, and air quality to provide an efficient learning environment. Gokcearslan et al. (2022) highlighted that smart classrooms' laboratory studies can be developed in the context of the internet of things, and if this technology is integrated into e-learning environments, it can enrich learning with various technologies such as augmented reality, wearable technology, and big data. According to Kassab et al. (2022), IoT applications are important in the education sector to address a wide variety of situations, goals, issues, and perceptions, monitor participation, and classroom activities, and improve knowledge on various topics.

In educational institutions that develop a vision to adapt to technological developments and change, the use of new technologies for educational purposes can provide many positive outcomes (Yildiz Durak, 2019). However, the key role in this integration belongs to teachers (Yildiz Durak, 2021a, 2021b). Stojanovic et al. (2020), on the other hand, indicated the limited number of studies on pre-service teachers' acceptance of these technologies. In this context, it is the first and most important step for the integration of this technology to raise the cognition and awareness of the teachers and, more importantly, the pre-service teachers about the importance of the use of the Internet of things.

Although there are various studies on the inclusion of the Internet of things in the field of education, there is a need for studies, especially on the variables that affect the acceptance by pre-service teachers and their intentions for their future applications. Thus, this study focuses on the acceptance and usage intentions of pre-service teachers regarding the inclusion of the Internet of things in the field of education. The current study discussed personal variables and emotions about ICT use in the context of beliefs, attitudes, intentions, perceptions, and behaviors proposed by Davis (1989) and adapted into education by Ionescu-Feleaga (2021). The technology acceptance model (TAM), which defines pre-service teachers' use of technology, provides a conceptual framework. According to TAM, the realization of the behavior of using technology is related to the behavioral intention to use it, and the intention is related to the perception of convenience, usefulness, and facilitating conditions (Davis, 1985, 1989). In

this context, pre-service teachers' perception of IoT technology as easy to use, perceived usefulness, and facilitating situations may affect their intention to use this technology in their future lessons. On the other hand, the achievement is defined as directly related to successful activities or successful results (Pekrun, 2006). Emotional processes in technology-based learning are associated with engagement, success, and satisfaction (Atman Uslu & Yildiz Durak, 2022). Identifying key emotions and examining their impact on technology acceptance is important for learning performance. According to Saadé and Kira (2006), emotion refers to feelings of sadness, boredom, happiness, pleasure, displeasure, or hatred related to a particular behavior. In this context, positive emotions towards a learning tool trigger important gains such as experience, knowledge, acceptance of use and self-efficacy. Negative emotions cause avoidance from the digital learning tool. Therefore, the emotion variable is considered as a variable in the study.

Ionescu-Feleaga et al. (2021) identified five acceptance structures for the IoT as intent, usefulness, ease of use, facilitating conditions, and training on the use of IoT technologies. Gokcearslan et al. (2022), on the other hand, validated four of these five constructs for the Turkish sample. In this study, the acceptance of the Internet of things in the educational environment was examined in the context of these four structures.

Purpose of the Study

The purpose of the current study is to examine the relationship between pre-service teachers' internet of things acceptance behaviors (intention, usefulness, ease of use, facilitating conditions) and personal variables and ICT emotions. For this purpose, answers to the following research questions are sought:

- Do pre-service teachers' personal variables and ICT emotions predict usefulness from their IoT acceptance behaviors?
- Do pre-service teachers' personal variables and ICT emotions predict intention from their IoT acceptance behavior?
- Do pre-service teachers' personal variables and ICT emotions predict ease of use from their IoT acceptance behavior?
- Do pre-service teachers' personal variables and ICT emotions predict facilitating conditions from their Internet of Things acceptance behaviors?

Method

Participants

The sample of the research consist of 171 pre-service teachers studying at the education faculty of a state university in Turkey. Pre-service teachers from many different departments participated in the study. Students are studying in 1st to 4th grade. 74.9% of the participants are female and 25.1% are male. The average age of the participants is 19.02.

Research Instruments

IoT technologies acceptance scale: Ionescu-Feleaga et al. (2021) developed this scale and this scale was translated into Turkish by Gökçearslan et al. (2022). In the 15-item scale structure, 4 factors are as follows: (a) intention (three items), (b) usefulness (five items), (c) ease of use (four items), and (d) facilitating conditions (three items). The answers in the scale are in five-point Likert type. The Cronbach's alpha value of this scale was calculated as 0.798 for intent, 0.898 for usefulness, 0.807 for ease of use, and 0.709 for facilitating conditions.

IT emotion scale: This scale was developed by Şahin (2021). There are 4 factors and 14 items on the scale. Factors in the scale are as follows: fun, enjoyment, anxiety, and frustration. The answers in the scale are in five-point Likert type. Cronbach's alpha coefficients of the scale factors were found to be fun α=0.923, enjoyment α=0.918, frustration α=0.892, and anxiety α=0.881. Therefore, the dimensions of the data collection tool have a high level of reliability.

Data Analysis

Multiple Linear Regression Analysis was used in the analysis of the data. Analyzes were made with IBM SPSS 24. From the analysis of the data, the skewness and kurtosis coefficients were examined for normal distribution. The values of kurtosis and skewness between -3 and +3 are accepted as an indication that the data has a normal distribution (Tabachnick & Fidell, 2007). Skewness values ranged between -1.46 and 0.65, and kurtosis coefficients ranged between -0.77 and 2.68. In this context, the data have a normal distribution.

The existence of autocorrelation between the variables was tested using the Durbin-Watson coefficient. The Durbin-Watson coefficient calculated between 1.5 and 2.1 indicates that there is no autocorrelation problem between the variables. VIF values considered collinearity statistics range from 1.04 to 4.81. These values demonstrate that there is no collinearity problem that is not suitable for regression analysis.

Results

The regression analysis results regarding the pre-service teachers' internet of things acceptance behaviors (intention, usefulness, ease of use, facilitating conditions), personal variables, and the predictive status of ICT emotions are presented in Table 1, Table 2, Table 3, and Table 4.

Table 1

Multiple Regression Analysis Results on Personal Variables and ICT Emotions Predicting Usefulness from the Internet of Things Acceptance Behaviors

	B	**Std. Error**	**B**	**t**	**Sig.**
(Constant)	9.811	5.255		1.867	0.064
Gender	0.471	0.667	0.052	0.706	0.481
Age	0.064	0.258	0.017	0.25	0.803

Daily usage time of digital technologies	0.027	0.108	0.018	0.252	0.801
Experience in using digital technologies (in years)	0.01	0.097	0.008	0.106	0.916
Competence in using digital technologies	0.53	0.177	0.25	2.989	0.003
Fun	0.195	0.179	0.16	1.088	0.278
Enjoyment	0.233	0.141	0.246	1.648	0.101
Anxiety	0.058	0.139	0.047	0.42	0.675
Frustration	-0.039	0.106	-0.041	-0.366	0.715

In Table 1, according to the multiple regression results between the predictor variables and the predicted variable, all the independent variables included in the model explain approximately 26% of the total variance regarding the dependent variable usefulness behaviors (R=0.506, R2=0.256, p<.01). This indicates that the 74% change in usefulness scores can be explained by different variables that were not included in the regression model. According to the standardized regression coefficients (β), the relative importance of the predictor variables on usefulness is "competence in using digital technologies, enjoyment, fun, gender, anxiety, daily usage time of digital technologies, age, experience in using digital technologies (in years), and frustration". According to the t-test results regarding the significance of the regression coefficients, competence in using digital technologies (t=2.989, p<.05), one of the predictor variables, is an important predictor in explaining the scores related to usefulness. Accordingly, considering the positive relationship, the increase in competency in using digital technologies positively affects the increase in usefulness scores.

Table 2

Multiple Regression Analysis Results on Personal Variables and ICT Emotions Predicting Intention from the Internet of Things Acceptance Behaviors

	B	**Std. Error**	**B**	**T**	**Sig.**
(Constant)	2.648	3.29		0.805	0.422
Gender	0.065	0.418	0.012	0.156	0.876
Age	0.255	0.161	0.113	1.579	0.116
Daily usage time of digital technologies	-0.008	0.068	-0.008	-0.115	0.908

Experience in using digital technologies (in years)	0.143	0.061	0.192	2.347	0.02
Competence in using digital technologies	0.118	0.111	0.091	1.062	0.29
Fun	-0.011	0.112	-0.015	-0.099	0.922
Enjoyment	0.208	0.088	0.361	2.352	0.02
Anxiety	-0.002	0.087	-0.003	-0.025	0.98
Frustration	0.016	0.066	0.029	0.249	0.804

In Table 2, according to the multiple regression results between the predictor variables and the predicted variable, all the independent variables included in the model explain approximately 21% of the total variance regarding intention behaviors, which is the dependent variable (R=0.460, R2=0.211, p<.01). This indicates that the 79% change in intention scores can be explained by different variables that were not included in the regression model.

According to the standardized regression coefficients (β), the relative order of importance of the predictor variables on the intention is "enjoyment, experience in using digital technologies (in years), age, competence in using digital technologies, frustration, gender, anxiety, daily usage time of digital technologies, and fun".

When the t-test results regarding the significance of the regression coefficients are analyzed, the predictor variables "experience in using digital technologies (in years) (t=2.347, p<.05)" and "enjoyment (t=2.352, p<.05)" scores on intention are important predictors in explaining intention scores.

Table 3

Multiple Regression Analysis Results Regarding Personal Variables and ICT Emotions Predicting Ease of Use from the Internet of Things Acceptance Behaviors

	B	**Std. Error**	**B**	**T**	**Sig.**
(Constant)	5.494	3.481		1.579	0.116
Gender	-0.225	0.442	-0.039	-0.509	0.611
Age	0.147	0.171	0.062	0.861	0.39
Daily usage time of digital technologies	0.023	0.072	0.023	0.314	0.754
Experience in using digital technologies (in years)	0.125	0.064	0.161	1.979	0.049

Competence in using digital technologies	0.079	0.118	0.059	0.673	0.502
Fun	0.156	0.118	0.201	1.313	0.191
Enjoyment	0.116	0.093	0.192	1.236	0.218
Anxiety	-0.003	0.092	-0.004	-0.036	0.972
Frustration	0.001	0.07	0.002	0.015	0.988

In Table 3, according to the multiple regression results between the predictor variables and the predicted variable, all the independent variables included in the model explain approximately 19% of the total variance regarding the dependent variable ease of use behaviors (R=0.439, R2=0.193, p<. 01). This indicates that the 81% change in ease-of-use scores can be explained by different variables that are not included in the regression model.

According to the standardized regression coefficients (β), the relative importance of the predictor variables on ease of use is "fun, enjoyment, experience in using digital technologies (in years), age, competence in using digital technologies, daily usage time of digital technologies, frustration, anxiety, and gender".

When the t-test results regarding the significance of the regression coefficients are analyzed, one of the predictor variables, experience in using digital technologies (in years) (t=1.979, p<.05) is an important predictor in explaining the scores related to ease of use. Accordingly, considering the positive relationship, the increase in the experience of using digital technologies positively affects the increase in the scores of ease of use.

Table 4

Multiple Regression Analysis Results on Personal Variables and ICT Emotions Predicting Facilitating Conditions from the Internet of Things Acceptance Behaviors

	B	**Std. Error**	**B**	**t**	**Sig.**
(Constant)	3.108	3.129		0.993	0.322
Gender	-0.017	0.397	-0.003	-0.042	0.966
Age	0.197	0.153	0.093	1.285	0.201
Daily usage time of digital technologies	0.002	0.065	0.002	0.028	0.978
Experience in using digital technologies (in years)	-0.039	0.058	-0.055	-0.673	0.502
Competence in using digital technologies	0.352	0.106	0.289	3.334	0.001
Fun	0.011	0.106	0.016	0.107	0.915
Enjoyment	0.165	0.084	0.304	1.967	0.051

Anxiety	0.082	0.083	0.115	0.997	0.32
Frustration	-0.049	0.063	-0.091	-0.777	0.438

According to the multiple regression results between the predictor variables and the predicted variable in Table 4, all the independent variables included in the model explain approximately 20% of the total variance regarding the dependent variable facilitating conditions behaviors (R=0.447, R2=0.200, p<.01). This indicates that the 80% change in facilitating conditions scores can be explained by different variables that were not included in the regression model.

According to the standardized regression coefficients (β), the relative importance of the predictor variables on facilitating conditions is "enjoyment, competence in using digital technologies, anxiety, age, fun, daily usage time of digital technologies, gender, experience in using digital technologies (in years), frustration".

When the t-test results regarding the significance of the regression coefficients are examined, competence in using digital technologies (t=3.334, p<.05), one of the predictor variables, is an important predictor in explaining the scores of facilitating conditions. Accordingly, considering the positive relationship, the increase in competency in using digital technologies positively affects the increase in the scores related to facilitating conditions.

Discussion

As a result of the research, competence in using digital technologies is an important predictor in explaining the scores related to usefulness. The increase in competency in using digital technologies positively affects the increase in the scores related to usefulness. ICT competence is not limited to technical skills and represents a broad and holistic body for building technological pedagogical knowledge with cognitive and instructional tools to promote learning (Tondeur et all., 2018). ICT competence has a key role in the integration of technology into education (Gökçearslan et al., 2022). On the other hand, Şahin (2021) emphasizes that competency can enable pre-service teachers to believe that they can use technology easily if they see themselves as competent in using digital technologies. In this context, the findings of the studies in the literature are in line with the current research findings. In the context of this result, it can be suggested that increasing the competence in using digital technologies of teacher candidates is taken as a basic starting point and the development of courses, contents and applications for this.

Experience in using digital technologies (in years) and enjoyment are important predictors in explaining the scores related to intention, and the increase in experience in using digital technologies and enjoyment positively affects the increase in intention scores. Triandis (1980) emphasizes that there is a strong relationship between emotion and behavior. Saadé and Kira (2006) emphasize that the emotion component affects an individual's emotional state towards technology, affecting all work and operations actually done or intended to do, perceived ease or difficulty. This effect points to the importance of emotion in explaining greater variability in users' intentions and behaviors. Among these emotions, especially enjoyment has a critical role in providing intrinsic motivation. Therefore, the fact that pre-service teachers see the use of digital technologies in education as a fun activity can reveal the flow experience and increase willingness (Şahin, 2021). This may strengthen the belief in the educational

benefit of technology. In this context, in future studies, the effect of the enjoyment element on the acceptance of new technologies such as the internet of things can be examined with experimental studies.

Experience in using digital technologies (in years) is an important predictor in explaining the ease-of-use scores. Ease-of-use is one of the most effective constructs affecting the intention to use technology (Venkatesh & Davis, 2000). This result shows that the ease-of-use perceptions of teacher candidates regarding integrating technology into their lessons are affected by their experiences of using digital technologies. In this context, it can be said that the implementation of applications that will expand the technology use experiences of teacher candidates will have positive reflections on their acceptance of new technologies. However, in this study, the concept of experience is taken as years. This can be considered as a limitation. In future studies, the context of the concept of experience should be examined in depth with qualitative studies.

The increase in the experience of using digital technologies positively affects the increase in ease-of-use scores. In this context, improving technology use experiences of pre-service teachers will positively affect their intentions and perceptions about using new technologies. Al-Abdullatif et al. (2022) highlighted that perceived ease of use and usefulness positively affect pre-service teachers' attitudes toward the use of IoT in classrooms.

Finally, competency in using digital technologies is an important predictor in explaining scores on facilitating conditions and increasing competency in using digital technologies positively affects scores on facilitating conditions. Gokcearslan et al. (2022) found that ICT competency is associated with usefulness, ease of use, and facilitating conditions. These study findings support the findings of this study. In this context, improving technology use experiences and competencies of pre-service teachers will positively affect their intentions and perceptions about using new technologies.

Ethic

In this study, all scientific ethical rules were followed.

Author Contributions

All stages of the study were organized and conducted by the authors.

Conflict of Interest

In addition, the authors declare that they have no conflict of interest.

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The Assessment of Technology Integration into Science Lesson Textbooks

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Abstract

Textbooks are still accepted as one of the most influential materials used during instruction today. On the other hand technological devices and processes have been used more during instruction as in every field in our lives. Therefore, this study aims to assess technology integration into textbooks for students' motivation. In this context, science lesson textbooks from 3rd to 8th grades were examined in terms of included technological concepts or technology use in the activities and handled digital competences. The study is carried out with the document analysis method in a qualitative research and it is found that technology, television, telephone and computer are the most used concepts in textbooks. And also it is found that "information and data literacy" and "communication and collaboration" competences identified in the European Digital Competency Framework are used most in the textbook activities. "Digital content creation" and "problem solving" competences are included less in the textbook activities. Depending on the data obtained from the study, it is seen that the use of only QR codes in textbooks is not sufficient to improve the students' digital competency. For this reason, it is suggested that different technological methods and techniques should be used more.

Key Words

Digital competence • Motivation • Science • Technology • Textbook

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People have undergone changes with the developments seen both in science and technology fields and their effect to each other. To reach the information through fast-growing technology has become easier and to reach this correct and reliable information through convenient sources has also become one of the competences of this era. Also, the importance of digital competency has become more prominent with the development of technology, high demand to it and the transfer of information to digital media. This competency includes various concepts like digital literacy, digital communication, digital security and digital trade in it (Şimşek, 2022). Since most of the work is performed with different technological devices and processes in daily life, people's acquisition of specific information and skills in obtaining this competency becomes compulsory. Therefore, technology literacy and digital literacy skills that require the correct understanding of technology and using it for correct purposes (Bakioğlu & Çevik, 2022; Direkçi et al., 2019) have become one of the important education matters.

Since the philosophy and aims of education are considered, the importance of the information, skills and competences come forward in terms of daily life. Students should not only acquire information and skills but also use them for their emerging desires or against encountered difficulties (Saputra & Abdulkarim, 2021). The pandemic, for example, affected almost the entire world and the global climate crisis effects led the spread of distance education implementations. Therefore, as an alternative to face-to-face education, a learning process, which is independent of time and place has become effective (Aslan & Güner, 2022; Birhan & Doğru, 2022; Kılıç Koçak, 2019). In addition to the scientific and technological developments, similar situations like this increase rapidly the relationship between education and technology.

Various educational technologies and digital content are used for students to be active during instruction processes nowadays (Kabak, 2020; Kılıç Koçak, 2019). Because thanks to scientific and technological developments, there are new educational tools and equipment that help students learn easier by taking their attention and increasing their motivation (Heafner, 2004; Puspitarini & Hanif, 2019). Learning motivation is one of the key factors for achieving learning goals. Since using just learning methods is not sufficient alone, media is a necessity as a means for students (Puspitarini & Hanif, 2019). Likewise, it is emphasized in the study by Lee and Hwang (2022) that learning opportunities compliant with technology should be provided for instructors as a means for sustainable education.

Technology use in science lessons in schools is expected to increase students' motivation and make learning easy. In this way, it is possible to say that students are provided with a better educational setting. Because computer, simulation, animation, digital image, video and internet use helps to achieve educational goals and also enable to improve students' development processes (Birhan & Doğru, 2022). Thus, in their study on hybrid education that come out because of pandemic Kumaş and Kan (2022) state that interactive simulation, video, online experiments and infographic designs are the applications that equalize the opportunities for students attending face-to-face or online lessons. In the study by Kılıç Koçak (2019), it was concluded that e-contents of biology lessons should be enriched with different applications such as interactive applications, virtual experiments and 3D visuals.

There has been quite a lot of research about technology use in science lessons. According to Büyükcengiz (2017), the digital storytelling method applied in science lessons in secondary schools has a positive impact on students'

academic performance and scientific process skills. It also helps students to have a positive attitude toward the lesson. In Becit İşçitürk and Coşkunserçe's study (2022), it is concluded that teachers' think about technology use in science lessons affected teachers' performance positively and decrease the effort they spend. Also, teachers think experiences have a positive effect on technology use. In the study of Akçöltekin et al. (2022), it is concluded that there are opinions that technological opportunities are utilized, time is used effectively, the personal learning opportunity is created and technology use competence is developed in science lessons. According to Bakioğlu and Çevik (2022), science lesson teachers use information technologies more during face-to-face education following distance education and they take the information technologies to the center of learning and teaching approaches. In the study of Kabak (2020), it is concluded that the use of digital contents developed by the students themselves during lessons affect their academic success, attitude towards the lesson and computer assisted education.

The use of textbooks in schools is also another important matter during instruction as well as technology use. Textbooks, which are accepted as basic materials during instruction (Çiftçi et al., 2007; Durakoğlu & Coşkun, 2019; Kahveci, 2020; Kurt & Demir, 2019; Tenekeci & Dursun, 2019) are prepared in accordance with curricula and students' age and cognitive level. The basic principle in the preparation of these books is to guide the activities prepared for students to get the knowledge, skills and competencies involved in curricula. Also, textbooks are basic sources, which enable teachers to present lesson contents systematically (Altay, 2020; Bayır & Kahveci, 2022; Erdoğan & Azizoğlu, 2022; Saputra & Abdulkarim, 2021; Ünsal & Güneş, 2002) and textbooks are easily accessible educational materials for students (Şimşek, 2022).

Rationale and Purpose of the Study

The education of children complies with today's conditions, changes occurring in the world are reflected in curricula and textbooks should be prepared according to this. Textbooks, maintaining their characteristics such as having pages including texts and visuals among front and back pages and providing the interaction among the teacher, students and content have become multiple learning materials providing different applications with external visuals and contents nowadays (Kurt & Demir, 2019). The preparation of curricula or textbooks incompatible with technology will have a negative effect on instruction (Alın Uran, 2009) and be challenging for students' learning process. Therefore, to state the quality of a textbook it is necessary to analyze it (Saputra & Abdulkarim, 2021).

It is stated in the study (Direkçi et al., 2019), which is one of the studies about the development of digital literacy in textbooks, there are activities for providing these skills. But there aren't any learning outcomes about digital literacy in activities in secondary school textbooks and any questions about this subject in evaluation parts of some themes in Turkish lesson textbooks. Likewise, in the study of Şimşek (2022), it is understood that digital competence isn't mentioned sufficiently, there are a few digital competences related to digital literacy and digital security and other sub-skills are not mentioned except for a text. According to the study by Maden et al. (2018), which assessed 5th grade Turkish lesson textbooks within the context of digital literacy, it is found that computer is the most used concept in textbooks and technology, internet and media concepts are used too. In the study of Yüksel and Taneri (2020), it is found that digital competences used at a low level in life science lesson textbooks in all grades.

On the other hand, science lesson curriculum was updated in accordance with the Turkish Qualifications Framework in 2018. In this context, there are eight qualifications defined in curricula and digital competence is one of them. But Eren and Dökme (2021) in their study, which examined science lesson curriculum in terms of digital competence stated that there were only a few learning outcomes about the competency and indirect learning outcomes were more prominent than directly related learning outcomes. In the study of Erdoğan and Azizoğlu (2022), it was concluded that the transfer percentage of life-based learning outcomes was low in science lesson textbooks in secondary schools. In Altun and Bangir Alpan's study (2021), it was found that computer and internet were the most used, tablet, smartphone, smart board, hardware and browser were the least used words related to digital literacy skill in science lesson textbooks. Tezcan (2019) stated that, teachers were of the opinion that science lesson textbook activities were inadequate in terms of digital knowledge applicability in secondary schools.

The important point here is to get people to use technology in daily life within the frame of ethical principles in the digitalized world. Therefore, content about digital competence and the way this content is handled, play a key role in science lessons. In this context, the key frame describing digital competence is the European Digital Competence Framework which was developed by The European Commission. According to it, digital competence consists of participation in social life, safe and critical use of digital technology in academic life and its responsibility. The Digital Competence Framework identifies in detail five key areas about knowledge, skills and attitudes, which people need. They can be used by employers, educators, policy makers or other actors interested in digital competence. This competence consists (1) information and data literacy, (2) communication and collaboration, (3) digital content creation, (4) safety and (5) problem solving (DigComp: The European Digital Competence Framework, 2018).

The reference framework for digital competence is Turkish Qualifications Framework in Türkiye. In Science lesson curriculum, which was updated in accordance with this framework digital competence was included (Ministry of National Education, 2018). In this context, skills for digital competence are expected to be included in textbooks, which are prepared in accordance with the curriculum. Because textbooks, which are accepted as basic materials used during instruction still maintain their effect on students' developments. It is also a must to educate students in accordance with technological developments and even with the qualifications that will make them lead the technology. For this reason, this study aims to examine the existence of technology related content and methods which increase students' motivation and provide an easy learning in textbooks. "Is there any technological information in science lesson textbooks?" and "Do science lesson textbooks support the use of technology or digital competence?" It is thought that the results of the study, which is based on these main subjects, may give an idea to the writers, teachers and researchers about how much the digital competence of students is considered in science lessons.

Method

The aim of this study is to assess the technology integration into science lesson textbooks from 3rd to 8th grades, which are used in primary and secondary schools in Türkiye. Because science lesson textbooks are considered important factors in increasing students' motivation during lessons.

Research Design

The qualitative research design is utilized for this study and the data are obtained with the document analysis method. Document analysis is known as the analysis of written materials, which contain information about the facts for the aimed study and textbooks can be used as data sources for educational studies (Yıldırım & Şimşek, 2021).

Research Sample

In this context, the criteria were specified for the examination of textbooks at the beginning of the study. (i) Textbooks should be appropriate for the curriculum, (ii) be prepared and delivered to the students by the Ministry of National Education, (iii) be at least a textbook in each grade, (iv) be issued on EBA (Educational Information Web) platform, (v) be used during 2022-2023 academic year. There isn't any science lesson textbook prepared by the Ministry of Education for 8th graders in secondary school. Therefore, a textbook, which was prepared by a private publishing house was included in the study. The textbook meets the criteria and it is delivered to the students by the Ministry of Education. The aim of doing this is to maintain the unity of the study and present the educational content in primary schools as a whole.

Research Instruments and Processes

Science lesson textbooks are handled in two dimensions to assess the technology integration into them in this study. First, it was analysed if there was any information about technological knowledge, changes and developments in texts, activities or images in textbooks. Therefore, it was examined if there were any technological concepts (analysis units), which were determined at the beginning of the study in any text, visual (picture or photograph), activity, assessment and evaluation question (open-ended, multiple choice etc.) or warm up (at the beginning of the unit or section) part. Also, the contents of science lesson textbooks that provide students to learn and use the technology were determined. Therefore "Technological Information Acquire" and "Technology Use" concepts were used. Second, the state of utilized technological methods was analyzed in textbooks. For this, a literature review was carried out and five key concepts (information and data literacy, communication and collaboration, digital content creation, safety and problem solving) identified in the European Digital Competence Framework and the description of these concepts were taken as a reference. After the examination, analysis units were determined in accordance with the descriptive analysis, which is one of the methods used in qualitative research. At this stage, the opinions of three field experts, who studied during the preparation, updating, examination and assessment of the science lesson curriculum and textbooks were taken. The accounting log developed by Miles & Huberman (1994) was utilized to check the reliability of analysis units created for the study. The percentage of experts' conformity was calculated and it was found 83 %. After the determination of this percentage reliable, the examination was carried out according to the analysis units. Therefore, "smart board, computer, informatics, digital, hardware, internet, social media, tablet, technology, telephone, television and software" analysis units were utilized during the examination of textbooks.

Data Analysis

Textbooks, which meet the criteria determined at the beginning of the study were reached from the web page (www.eba.gov.tr) of the Ministry of National Education. A comprehensive reading to understand the content of

textbooks was carried out in the first phase of the study. After the result of the examination, which was carried out in accordance with analysis units, contents related to the codes were handled under the "text, activity, image, evaluation question and warm up" categories. The existence of each of the analysis units in textbooks was stated with numbers and presented in tables. Except for analysis units, the other contents, which are related to technology in textbooks were also identified and presented. In the second phase of the study, each activity in textbooks was examined one by one and the relevance of each activity with the digital competence was determined. In this way, technology integration into textbooks in each grade was explained with two different tables.

One of the ways to ensure the reliability of qualitative research is to explain each stage of it and explain the way followed in detail (Büyüköztürk et al., 2022). Since the examined textbooks were reached from the official web page (www.eba.gov.tr) of the Ministry of National Education and it was understood after the interviews made with the authorities of the institution that they were the last updated version, the documents were accepted to be reliable and valid. On the other hand, for the internal validity of the research, the researcher made the research impartial and unbiased. Therefore, the data were rechecked thanks to the detailed notes that took a long time on the studied subject (Büyüköztürk et al., 2022). Since the external validity is based on the generalization of the results, the comparability concept is used for this kind of research (Büyüköztürk et al., 2022) and a path that enables the comparability has been followed for the accessibility of textbooks to everyone. All of this process was conducted by having a consensus among the researchers.

Results

In this study, the examination of the integration of science lesson textbooks into technology in primary and secondary schools in Türkiye was carried out and the obtained data were handled separately in each grade and presented in tables. For this reason, there are two presented tables in each grade. One of them is used to express the state of inclusion of technological information in science lesson textbooks. On the other hand, the other one identifies the technology use in textbooks or the state of digital competence support.

Inclusion of Technology in Primary School 3rd Grade Science Textbooks

The state of technological concepts and content use in science lesson textbooks in 3rd grade in primary schools and findings on technology use in textbook activities are presented in Table 1 and Table 2.

Table 1

Inclusion of Technology in Primary School 3rd Grade Science Textbooks The Existence of Research Analysis Units in Textbooks

Content Type	Smart Board	Computer	Informatics	Digital	Hardware	Internet	Social Media	Tablet	Scanner	Technology	Telephone	Television	Software
Text	x	3	x	x	x	x	x	1	x	2	4	8	x
Activity	x	x	x	x	x	x	x	x	x	x	x	x	x

Visual	x	4	x	1	x	x	x	1	x	14	7	4	x
Evaluation Question	x	4	x	x	x	x	x	x	x	2	5	6	x
Warm up	x	x	x	x	x	x	x	x	x	x	2	1	x

Other Contents about Technology in the Textbook

	Page Number	*Content Type*
Technologic Information Acquisition	47	The Story of Bionic Ear (Biyonik Kulağın Öyküsü)
Technology Use	13, 37, 67, 99, 137, 177, 209	QR Codes

When Table 1 is examined, it is understood that the most used analysis units created for the research are television, technology, telephone and computer and tablet and digital concepts are used less. It is understood that these concepts related to technology are used mainly first in images and then in texts. In textbooks activities, these concepts are not used at all. On page 47 of the textbook, there is a definition of a technological device in the text named "The Story of Bionic Ear (Biyonik Kulağın Öyküsü)" that can take the students' attention. Apart from this, students are directed to the use of technology with QR codes. The page numbers of these codes are presented in Table 1.

Table 2

The Relationship of 3rd Grade Science Lesson Textbook Activities with Digital Competence Skills in Primary Schools

Page Number	*The Name of Activity*	*The Content of Activity*	*Digital Competence Skill*
163	Let's Recognize the Sound Magnitude (Sesin Şiddetini Fark Edelim)	The discovery of the relationship between the sound magnitude and hearing by using radio	Information and data literacy Communication and cooperation
214	Let's Make a Wheel (Çarkıfelek Yapalım)	The determination of the aim of electrical cars' use	Information and data literacy Communication and cooperation
227	Let's Determine the Source of Electricity (Elektrik Kaynağını Belirleyelim)	The determination of electric source type, which is used by cars	Information and data literacy Communication and cooperation
230	I Make A Waste Battery Box (Atık Pil Kutusu Yapıyorum)	The consciousness about waste batteries	Safety

It is concluded that four 3rd grade science lesson textbook activities can be related to technology in the context of different units' scope and content. The page number and activity names are stated in Table 2. When this relationship is handled, it is concluded that information and data literacy and communication and collaboration skills are focused more as the digital competence skills of the students.

Inclusion of Technology in Primary School 4th Grade Science Textbooks

The state of technological concepts and content use in 4th grade in primary schools and findings on technology use in textbook activities are presented in Table 3 and Table 4.

Table 3

Inclusion of Technology in Primary School 4th Grade Science Textbooks

The Existence of Research Analysis Units in Textbooks													
Content Type	Smart Board	Computer	Informatics	Digital	Hardware	Internet	Social media	Tablet	Scanner	Technology	Telephone	Television	Software
Text	x	8	x	x	1	1	x	x	x	11	10	11	x
Activity	x	x	x	x	x	1	x	x	x	1	1	x	x
Image	x	x	x	4	x	x	x	x	x	35	1	x	x
Evaluation Question	1	3	x	x	x	x	x	x	x	4	6	1	x
Warm Up	x	x	x	x	x	x	x	x	x	5	x	x	x

Other Contents about Technology in the Textbook

	Page Number	*Content Type*
Technologic Information Acquisition	108, 109	The expression of the samples of technological products in which magnets are used
	182-191	Lightning Technologies Section
	186	The inventions (such as tape recorder) of Thomas Edison under the section of "People Shaping the Future"
	206-216	"Sound Technologies from Past to Present" Section
	236	Japanese inventors, who invented Blue LED and their inventions under the section of "People Shaping the Future"
	263	The invention of first electric battery by Alessandro Graf Volta under the section of "People Shaping the Future"
Technology Use	18, 50, 84, 120, 180, 230, 254	QR Codes

When Table 3 is examined, it is understood that the most used analysis units created for the research are television, technology, telephone and computer and smart board, digital, hardware and internet concepts are used less. It is understood that these concepts related to technology are used mainly in images and then in texts. In textbook activities, internet, technology and television concepts are used once. In addition to this, there are reading texts about the relationship of the magnet with today's technological devices such as external hard drive, CD/DVD, MR device and Maglev train. Also, under the section of "People Shaping the Future" there are reading texts about scientists, who have technological inventions. There are two different sections "Lightning Technologies" and "Sound Technologies from Past to Present" in the textbook. It is found that these sections are directly related to the instruction of technology. Apart from this, students are directed to the use of technology with QR codes. The page numbers of these codes are presented in Table 3.

Table 4

The Relationship of 4th Grade Science Lesson Textbook Activities with Digital Competence Skills in Primary Schools

Page Number	*The Name of Activity*	*The Content of Activity*	*Digital Competence Skill*
184	Let's Make a Poster of Lightning	The preparation of a poster about	Information and data

	Technologies from Past to Present (Geçmişten Günümüze Aydınlatma Teknolojilerinin Posterini Hazırlayalım)	lightning devices from past to present with images	literacy Communication and cooperation
198	Light Pollution (Işık Kirliliği)	The search for the awareness about light pollution and poster preparation	Information and data literacy Communication and cooperation Safety
207	Let's Make a Simple Telephone (Basit Bir Telefon Yapalım)	The modelling of working principle of telephones with simple materials	Information and data literacy
214	How Salt is Affected by the Loudspeaker? (Tuz Hoparlörden Nasıl Etkileniyor?)	The visualization of the high sound magnitude effect	Safety
248	Let's Try Ourselves (Kendimizi Deneyelim)	Drawing attention to the saving with the digital form of electricity bills	Information and data literacy Safety

It is concluded that among 4th grade science lesson textbook activities, only five of the activities can be related to technology in the context of different units' scope and content. The page number and activity names are stated in Table 4. When this relation is handled, it is understood that *information and data literacy*, *communication and collaboration* and *safety* skills are focused more as the digital competence skills of the students.

Inclusion of Technology in Secondary School 5th Grade Science Textbooks

The state of technological concepts and content use in science lesson textbooks in 5th grade in secondary schools and findings on technology use in textbook activities are presented in Table 5 and Table 6.

Table 5

Inclusion of Technology in Secondary School 5th Grade Science Textbooks

The Existence of Research Analysis Units in Textbooks													
Content Type	Smart board	Computer	Informatics	Digital	Hardware	Internet	Social media	Tablet	Scanner	Technology	Telephone	Television	Software
Text	x	3	1	x	x	x	1	x	x	1	x	2	x
Activity	x	x	x	x	x	x	x	x	x	x	x	x	x
Image	x	x	1	2	1	x	x	x	x	25	x	1	x
Evaluation Question	x	x	x	x	x	x	x	x	x	2	x	1	x
Warm Up	x	x	x	x	x	x	x	x	x	x	x	x	x

Other Contents about Technology in the Textbook

	Page Number	*Content Type*
Technologic Information Acquisition	26	The news about the sending of Dragon Z space craft to the Moon in the newspaper
	32	Informative texts about space crafts
	107, 108	The stories of "Hürkuş" plane and "Devrim" car
	182	A reading text about the invention of camera obscura by

		İbn-i Heysem
	260	Introduction of Nikola Tesla and Thomas Alva Edison
Technology Use	17, 51, 79, 117, 163, 207, 247	QR Codes

When Table 5 is examined, it is understood that the most used analysis unit created for the research is *technology* and *smart board, internet, tablet, scanner, telephone* and *software* concepts are not used at all. Other analysis units are the least used ones. It is found that these concepts related to technology are used mainly in images and then in texts. In textbook activities, these concepts are not used at all. In addition to this it is found that there are news or informative texts about space crafts, the story of Hürkuş plane and Devrim car, which can be related to technological developments and the introduction of scientists such as Nikola Tesla. Apart from this, students are directed to the use of technology with QR codes. The page numbers of these codes are presented in Table 5.

Table 6

The Relationship of 5th Grade Science Lesson Textbook Activities with Digital Competence Skills in Secondary Schools

Page Number	*The Name of Activity*	*The Content of Activity*	*Digital Competence Skill*
25	Show Yourself (Göster Kendini)	The imagination of the design of space craft traveling to the Sun	Digital content creation Problem solving
29	Show Yourself (Göster Kendini)	The investigation of life on the Moon	Safety Problem solving
33	Show Yourself (Göster Kendini)	The imagination of space travel as an astronaut	Digital content creation Safety Problem solving
61	The Revival of Mayas (Mayalar Canlanıyor)	The use of Microscope	Information and data literacy
125 134-135 137 140 141 143 147	• Is It Evaporation? or Is It Boiling? mı? (Buharlaşma mı? Kaynama) • Let's Discover the Melting and Freezing Points (Erime Noktası ve Donma Notasını Keşfedelim) • The Freezing Point (Donma Noktası) • It's Your Turn (Sıra Sende) • Show Yourself (Göster Kendini) • Heat and Temperature (Isı ve Sıcaklık) • Let's Mix Hot and Cold Tea (Sıcak Çayla Soğuk Çayı Karıştıralım)	The use of thermometer and chronometer	Information and data literacy
255	Show Yourself (Göster Kendini)	The design of a toy, which has simple electric circuit	Information and data literacy Digital content creation Problem solving

It is concluded that among 5th grade science lesson textbook activities, only twelve of the activities can be related to technology in the context of different units' scope and content. The page number and activity names are stated in Table 6. It is understood that in the activities where the focus is on imagination, investigation and designing, *digital*

content creation, problem solving and safety skills are also taken into consideration in addition to *information and data literacy.*

Inclusion of Technology in Secondary School 6th Grade Science Textbooks

The state of technological concepts and content use in science lesson textbooks in 6th grade in secondary schools and findings on technology use in textbook activities are presented in Table 7 and Table 8.

Table 7

Inclusion of Technology in Secondary School 6th Grade Science Textbooks

The Existence of Research Analysis Units in Textbooks														
Content Type	Smart board	Computer	Informatics	Digital	Hardware	Internet	Social media	Tablet	Scanner	Technology	Telephone	Television	Software	
Text	x	4	x	1	x	x	x	2	x	3	4	6		1
Activity	x	x	x	x	x	1	x	x	x	x	x	x		x
Image	x	x	x	x	x	x	x	x	x	8	x	x		x
Evaluation Question	x	x	x	x	x	x	x	x	x	4	x	x		x
Warm Up	x	x	x	x	x	x	x	x	x	3	x	x		x

Other Contents about Technology in the Textbook		
	Page Number	*Content type*
Technologic Information Acquisition	134	The thermal camera use subject
Technology Use	20, 46, 86, 112, 150, 174, 208	QR Codes

When Table 7 is examined, it is understood that the most used analysis units created for the research are *technology, television, telephone, computer* and *tablet; digital, internet, tablet, scanner* and *software* are used once. Other analysis units are not used at all. It is understood that these concepts related to technology are used mainly in images and then in texts. Among text book activities, in only one activity *internet* concept is mentioned; other concepts are not used at all. In addition to this, there is an example of a daily technological device by mentioning about the use of thermal camera in a subject related to thermal insulation. Apart from this, students are directed to the use of technology with QR codes. The page numbers of these codes are presented in Table 7.

Table 8

The Relationship of 6th Grade Science Lesson Textbook Activities with Digital Competence Skills in Secondary Schools

Page Number	*The Name of Activity*	*The Content of Activity*	*Digital Competence Skill*
81	Let's Design Together (Birlikte Tasarlayalım)	The design of stethoscope and manometer	Information and data literacy Digital content creation Problem solving
101 102	• Who is Faster? (Kim Daha Süratli?) • Let's Calculate Our Speed (Süratimizi Hesaplayalım)	The use of chronometer	Information and data literacy
125	Let's Find the Density of Different Liquids (Farklı Sıvıların Yoğunluklarını Bulalım)	The use of electronic scale	Information and data literacy
126	Different Matters Different Density (Farklı Madde Farklı Yoğunluk)	The use of electronic scale	Information and data literacy
136	Let's Make Insulation (Yalıtım Yapalım)	The use of thermometer	Information and data literacy
137	Alternative Thermal Insulating Materials (Alternatif Isı Yalıtım Malzemeleri)	The use of thermometer	Information and data literacy
224	Let's Design Together (Birlikte Tasarlayalım)	The design of fruit and vegetable battery	Information and data literacy Problem solving

It is concluded that among 6th grade science lesson textbook activities, only eight of the activities can be related to technology in the context of different units' scope and content. The page number and activity names are stated in Table 8. In activities such as using the chronometer and electronic scale or designing battery or manometer, mostly *information and data literacy* competence is focused. It is concluded that *digital content creation* and *problem solving* skills are used only in two activities.

Inclusion of Technology in Secondary School 7th Grade Science Textbooks

The state of technological concepts and content use in science lesson textbooks in 7th grade in secondary schools and findings on technology use in textbook activities are presented in Table 9 and Table 10.

Table 9

Inclusion of Technology in Secondary School 7th Grade Science Textbooks

The Existence of Research Analysis Units in Textbooks													
Content Type	Smart board	Computer	Informatics	Digital	Hardware	Internet	Social media	Tablet	Scanner	Technology	Telephone	Television	Software
Text	x	4	x	1	x	x	x	x	x	6	2	4	2
Activity	x	x	x	x	x	5	x	x	x	2	x	5	x
Image	x	x	x	6	x	x	x	x	x	16	x	x	x
Evaluation Question	x	x	x	x	x	x	x	x	x	2	x	x	x
Warm Up	x	x	x	x	x	x	x	x	x	2	x	x	x

Other Contents about Technology in the Textbook

	Page Number	*Content Type*
Technologic Information Acquisition	20-29	The relationship between technology and space studies section
	24	Reading text about telescope types
	26	Reading text about the telescope study of Galileo, Newton and Hercher
	43	A question about a technological device used for observing the sky
	57	Description about electronmicroscopy
Technology Use	18, 44, 78, 106, 148, 184, 206	QR Codes

When Table 9 is examined, it is understood that the most used analysis units created for the research are *technology, digital, television, internet and computer*. The least used analysis units are *telephone* and *software* and other analysis units are not used at all. It is understood that these concepts, related to technology are used mainly in images. Among text book activities, while in five activities *internet and television* concepts are mentioned, *technology* concept is mentioned in two activities. In addition to this, it is found that there is a part about technology and space studies on the pages of the textbook from 20 to 29. It is also found that there are texts about technological devices such as telescope and microscope. Apart from this, students are directed to the use of technology with QR codes. The page numbers of these codes are presented in Table 9.

Table 10

The Relationship of 7th Grade Science Lesson Textbook Activities with Digital Competence Skills in Secondary Schools

Page Number	*The Name of Activity*	*The Content of Activity*	*Digital Competence Skill*
57	Let's Search and Discuss (Araştıralım ve Tartışalım)	Discussion of the technology effect to Aziz Sancar's studies	Information and data literacy Communication and collaboration

137	Recycling (Geri Dönüşüm)	The preparation of newspaper, internet or TV advertisement about recycling	Information and data literacy Communication and collaboration Digital content creation Problem solving
141	What Did We Learn? (Neler Öğrendik?)	Producing ideas about recycling with the samples of chips used in the USA	Information and data literacy Problem solving
176	Imaging Device (Görüntüleme Aracı)	The preparation of newspaper, internet or TV advertisement by designing an imaging device	Digital content creation Problem solving

It is concluded that among 7th grade science lesson textbook activities, only four of the activities can be related to technology in the context of different units' scope and content. The page number and activity names are stated in Table 10. In these activities, the focus is on discussion and the preparation of presentation and *information and data literacy* competence is used most. Also, *communication and collaboration*, *digital content creation* and *problem solving* skills are used.

Inclusion of Technology in Secondary School 8th Grade Science Textbooks

The use of technological concepts, contents and the findings on technology use in the activities in science lesson textbooks for 8th grades in secondary schools are presented below in Table 11 and Table 12.

Table 11

Inclusion of Technology in Secondary School 8th Grade Science Textbooks

The Existence of Research Analysis Units in Textbooks													
Content Type	Smart board	Computer	Informatics	Digital	Hardware	Internet	Social media	Tablet	Scanner	Technology	Telephone	Television	Software
Text	x	6	x	x	1	x	x	x	x	14	1	3	x
Activity	x	x	x	x	x	x	x	x	x	1	x	2	x
Image	x	x	x	x	x	x	x	x	x	12	x	x	x
Evaluation Question	x	x	x	x	x	x	x	x	x	5	x	x	x
Warm Up	x	x	x	x	x	x	x	x	x	2	x	x	x

Other Contents about Technology in the Textbook

	Page Number	*Content Type*
Technologic Information Acquisition	56-62	The instruction of biotechnology subject
	129-130	The presentation of chemistry-based jobs involving technology
	184	The electronic waste and descriptions about recycling
	212	An explanatory text about the use of robots
	214	Reading text named "Robots are Everywhere"
	215, 216, 219	The explanation of the production of electrical energy and its usage area

	223, 224	An explanatory text about technological devices and electrical energy save
	228	Evaluation question about technological device and energy transformation
Technology Use	12, 24, 68, 84, 136, 154, 196	QR Codes

When Table 11 is examined, it is understood that the most used analysis units created for the research are *technology, computer and television. Hardware* and *telephone* are used once and other analysis units are not used at all. It is understood that these concepts, related to technology are used mainly in texts. Among text book activities, only in one activity *technology* is used and in two activities *television* is utilized. In addition to this, it is concluded that the emphasis on the relationship of technology with other fields increased. It is also found that there are subjects about biotechnology, chemistry-based jobs including technology; robots, technological devices and energy transformation. Apart from this, students are directed to the use of technology with QR codes. The page numbers of these codes are presented in Table 11.

Table 12

The Relationship of 8th Grade Science Lesson Textbook Activities with Digital Competence Skills in Secondary Schools

Page Number	*The Name of Activity*	*The Content of Activity*	*Digital Competence Skill*
59	Let's Discuss (Münazara Yapalım)	The discuss of advantages and disadvantages of biotechnological practices	Information and data literacy Communication and collaboration
99	Let's Observe Conservation of Mass in Chemical Reactions (Kimyasal Tepkimelerde Kütlenin Korunumunu Gözlemleyelim)	The use of electronic scale	Information and data literacy
110	Let's Search and Present (Araştıralım Sunalım)	The search of acid rain from the sources such as internet, library and video-CD	Information and data literacy Safety Problem solving
115 116 118	• Let's Observe the Effect of Mass of Matter to Heat (Maddenin Kütlesinin Isınmaya Etkisini Gözlemleyelim) • Let's Observe the Effect of Temperature Rise to Heat (Maddedeki Sıcaklık Artışının Isınmaya Etkisini Gözlemleyelim) • I Observe Change of State (Hal Değişimini Gözlemliyorum)	The use of thermometer and chronometer	Information and data literacy
119	Let's Discover the Necessary Factors for Change of State (Hal Değiştirme İçin Gerekli Isının Bağlı Olduğu Faktörleri Keşfedelim)	The use of chronometer	Information and data literacy
213	Project Assignment (Proje Görevi)	The design of robot	Information and data literacy Communication and collaboration Digital content creation Safety Problem solving

It is concluded that among 8th grade science lesson textbook activities, only eight of the activities can be related to technology in the context of different units' scope and content. The page number and activity names are stated in Table 12. It is found that digital competence skills are used through the activities such as discussion of biotechnology practices, the use of electronic scale, the research through the internet, the use of chronometers and the design of robots. In this context, it is found that *information and data literacy* skill is used in these activities and there are also *communication and collaboration*, *safety*, *problem solving* and *digital content creation* skills are included in the activities.

Discussion, Conclusion & Suggestions

It is very difficult to mention a field without technology today. Most of the daily actions are performed with the help of technological devices and processes and this requires the necessity of acquiring related information and skills in this field. Therefore, technology literacy, which requires technology understanding and using it in conformity with technological aims and also digital literacy skills (Bakioğlu & Çevik, 2022; Direkçi et al., 2019) have become one of the prominent educational matters. On the other hand, educational technologies and digital content, which are used for students to be active during instruction (Kabak, 2020; Kılıç Koçak, 2019) provide an easy learning by taking their attention to the lesson and increase their motivation (Heafner, 2004; Puspitarini & Hanif, 2019). In this context, technologies utilized in science lessons in schools are expected to motivate students and provide an easy learning. Because the use of a computer, simulation, animation, digital image, video and the internet help realize education goals and provides the improvement of students' development processes (Birhan & Doğru, 2022). On the other hand, textbooks are accepted as basic materials during instruction (Çiftçi et al., 2007; Durakoğlu & Coşkun, 2019; Kahveci, 2020; Kurt & Demir, 2019). Therefore, this research aims to assess technology integration into textbooks, which are accepted as the basic materials for the science lesson.

When science lesson textbooks from 3rd to 8th grades were examined, the state of technology use can be assessed under three dimensions. In the first stage, it is found that among analysis units (*smart board, computer, informatics, digital, hardware, internet, social media, tablet, scanner, technology, telephone, television* and *software*) created for the research *technology, television, telephone* and *computer* concepts are the most used ones in texts or images in textbooks. This case shows similarity with the study of Maden et al., (2018), which was about 5th grade Turkish textbooks. On the other hand, this research shows similarity with the study of Altun and Bangir Alpan (2021), which was about science lesson textbooks in terms of the most frequently used concepts and also least used concepts (*smart board*, *hardware* and *tablet).* It is found that only *scanner* concept is not used at all in any grade. In addition, analysis units created for the research are used in textbook activities in 4th grade (3) times in primary school; in 6th grade (1) time, 7th grade (12) times and in 8th grades (3) times in secondary school in total. The analysis units are not used at all in 3rd grade in primary school and 5th grade in secondary school textbook activities. This case is not sufficient to make a comment about the use of technologic devices and processes in activities. Therefore, all the activities in the textbooks are handled one by one and examined in terms of technological relationship and inclusion of digital competence.

According to the research results, it is found that (4) activities in 3rd grade, (5) activities in 4th grade in primary school; (12) activities in 5th grade, (8) activities in 6th grade, (4) activities in 7th grade and (8) activities in 8th grade in secondary school are related to technology use in terms of technological knowledge and process use. As a result of this association, the activities found related to at most "*information* and *data literacy*" and "*communication* and *collaboration*" among the competences identified in the European Digital Competence Framework (DigComp: The European Digital Competence Framework, 2018). "*Digital content creation*" and "*problem solving*" competences are used less in activities. This case supports the study of Tezcan (2019), which founded that science lesson teachers were of the opinion that textbook activities used in secondary schools were insufficient in terms of applicability to digital information. But we should not overlook that the critical point is that textbooks are prepared in accordance with the curriculum.

In the study of Eren and Dökme (2021), it was found that in terms of digital competence, indirectly related learning outcomes were more prominent than directly related ones in the science lesson curriculum. When the study is also considered, the examination of the textbook in detail is found necessary. In this context, in addition to the examination of analysis units and activities, all of the images and texts in the textbooks are assessed in terms of technology relation. It is found that there are QR codes at the beginning of each unit in all of the examined textbooks as a current technological use. Also, it is seen that there are reading texts about scientists who have technological inventions. There are two different parts as lightning and sound technologies in the 4th grade, in primary school. In secondary school, there is a different part about technology and space studies in 7th grade. There are subjects about biotechnology and robot in 8th grade in secondary school.

As a result, when both this research and the other researches in literature are considered together, it is seen that technological devices such as *television, telephone* and *computer* which are used most in daily life are the most frequently used concepts in textbooks. This case can increase the students' motivation because the taught subjects are related to the daily life. On the other hand, due to the rapid growth of technology; *internet, social media, tablet, digital* and i*nformatics* concepts take much more place in our lives. So, the frequent use of these concepts in textbooks is important in terms of the development of digital competences. Activities in textbooks play an important role in providing the permanence of the learned subjects and they also make learning easy. Therefore, in accordance with both field research and expert opinions, it is suggested that analysis units created for this research should be used more in textbooks activities. In the examination within the context of this research, it is found that activities related to technology are limited and in these activities "*digital content creation*" and "*problem solving*" competences are not used enough. In accordance with the aim that students should be educated as information producers rather than receivers, they should all be provided with equal opportunities. Therefore, it is suggested that the number of technology-related activities should be increased. Also, technology use in textbooks shouldn't be limited to only QR code use. The integration of a wide range of activities stated in Electronic Educational Content: At a Glance (Ministry of National Education, 2022a) such as animation, simulation, video, infographic, digital game, augmented reality practices, artificial intelligence technology practices and online survey into textbook content in accordance with the principles identified in Electronic Educational Content Guide (Ministry of National Education,

2022b) which is issued by the Ministry of National Education will play an important role in the permanence of learning and students' motivation.

Ethic

Since the research is a document and literature review, it is not among the studies that require Ethics Committee Approval.

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This article was written with the joint contributions of both authors.

Conflict of Interest

The authors have no competing interests to declare that are relevant to the content of this article.

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Students' Opinions on the Use of Virtual Museums in Science Teaching

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Abstract

This study aims to present secondary school students' opinions on a science learning process supported by virtual museum activities. The study was conducted with 29 5th grade students studying at a public school during the academic year 2021-2022. During the study, the science lessons were enriched with virtual museum activities in addition to the activities presented in line with the curriculum and the content of the textbook. As the virtual environment, researchers used the virtual museum of Smithsonian National Museum of Natural History in the USA. After the lessons, semi-structured interviews were held to identify the participants' opinions on the virtual museum activity. It was observed that all the students had a positive impression and were satisfied with the process even though they addressed the virtual museum experience from different aspects. The students stated that they enjoyed both seeing the remains of creatures that lived in the past and getting information about the creatures they were familiar with. In addition, it was observed that they felt as if they had made a physical visit to the museum and related their learning with the achievements of the course. In the light of the findings, it is thought that virtual museums can be given more place in science lessons.

Key Words

Out-of-school environments • Science teaching • Virtual museums

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Since there are too many abstract concepts in science, all kinds of components that can support classroom learning in science lessons are researched. One such component is out-of-school learning environments. Various studies have revealed that activities carried out in these environments at different grade levels increase students' academic achievement (Çığrık & Özkan, 2016; Marth & Bogner, 2018; Mertoğlu, 2019), attitudes towards science lesson (Mertoğlu, 2019), motivations (Çığrık & Özkan, 2016; Dönel Akgül & Arabacı, 2020; Marth & Bogner, 2018; Uitto et al., 2006), permanent learning (Çiçek & Saraç, 2017; Dönel Akgül & Arabacı, 2020; Özcan & Yılmaz, 2018), interest in out-of-school learning environments (Bozdoğan, 2008) and sense of responsibility (Sujarwo & Tristanti, 2017). Museums, which are frequently encountered among out-of-school learning environments and placed on top in the "Handbook for Out-of-School Learning Environments" in Türkiye, are essential learning environments that the Ministry of National Education recommends schools to cooperate with. Museums, which aim that many artifacts are examined using the necessary scientific techniques and displayed to the public, continue their work in many fields from science to art, from history to geography. The principal objective of contemporary museology is that museums are acknowledged as places where knowledge is acquired as well as places where valuable historical items are kept and observed by visitors (Okan, 2018). Therefore, museums are not places for passive exhibitions and tours, but active learning environments where many kinds of formal and informal learning take place. It is indicated in some studies that the use of museums in science lessons strengthens communication (Yener et al., 2018) and increases students' academic achievement (Bolat et al., 2020), permanent learning (Bozkurt, 2022), and interest in science (Conway, 2014; Kartal & Şeyihoğlu, 2020). In addition, it is considered important that these experiences in museums are examined in detail for high quality learning. In their study on the museum experiences of 5^{th} grade students, Çil and Yanmaz (2016) identified that the students had little experience with museum activities throughout their school life and hardly ever participated in educational activities in museums. It was also observed that the students were interested in museums and activities with scientific content, but they were not active especially in trips to natural history museums. This is an important finding as it shows that the level of effectiveness of museum visits in promoting learning in science lessons may change. It is also emphasized in the same study that teachers should include museum activities in their science teaching.

With the increase in the interaction of museums with technology, the concept of a virtual museum has emerged. Virtual museums, also known as museums without walls, are defined as digital platforms that present all the content that traditional museums have (Schweibenz, 2004). With the emergence of this concept, museums have become available to larger masses and more widely used (Ustaoğlu, 2012). Virtual museums enable visitors to open up to a different world smoothly by using technology instead of visiting a place. These new environments can bring in the potential for direct interaction by acting as a natural museum so that visitors become eager participants rather than passive viewers (Margetis et al., 2021).

Virtual museums provide the opportunity to experience art and culture for those who cannot make time for museum trips or who live in geographically remote locations, and offer different alternatives for those who cannot follow museum hours or lack the time to visit. Virtual museums offer the chance for interactive participation, especially for visitors who reside at a distance from museums (Barlas Bozkuş, 2014). Besides, they increase students' creativity as well as improve their learning (Ismaeel & Al-Abdullatif, 2016). It is stated that students'

socioeconomic differences make it difficult to carry out activities including physical museum visits (Dilli, 2017). In this respect, the availability of virtual museums in the home or school environments is important for students with limited economic opportunities to benefit from museum activities (Uslu, 2008).

In the last twenty years, there has been a rising generation who masters especially in the digital environment. This generation, who has been familiar with the virtual world due to computer games from an early age, feels more confident and comfortable in virtual environments. Çetin (2021) evaluated 8th grade students' reading behaviors in virtual environments and observed that students did not use virtual environments to learn, but they enjoyed these platforms, and activities carried out there enhanced their reading skills. Demirbağ (2020) aimed to investigate three-dimensional virtual environments and evaluate how convenient it was to use them for educational purposes, based on the examples in the literature, and conducted studies on Second Life activities. As a result of the overall literature review, it was identified that Second Life and alternative virtual environments provided a contemporary educational environment for students. It was also emphasized that Second Life activities offered an enjoyable learning environment, enhanced students' creative thinking skills, and shed light on the principle of learning by doing. Moreover, it was considered an advantage that lessons learned in virtual environments could promote students' foreign language learning, and time and costs of education could be saved. In a different study, the data obtained from 89 secondary school students revealed that most of the students spent time in virtual environments for games or social network platforms, and that they felt happier in such environments (Bulut Özek, 2018). Such strong and effective ties of students with virtual environments have made it possible to include these environments in the learning process.

Many studies have been conducted on the use of virtual museums in education. In a study by Uslu (2008), it was observed that CD-supported museum education provided for 7th grade students in visual arts class increased student achievement. Similarly, Ermiş (2010), who investigated 6th grade students' opinions on virtual museum activities using the example of Ankara State Art and Sculpture Museum, concluded that in-class virtual museum visits were useful for visual arts lesson. Gılıç (2020) carried out similar studies regarding the English learning process and emphasized the positive effects of virtual museums on students. Moreover, Ismaeel and Al-Abdullatif (2016) noted that concepts learned in social studies course became more permanent with the help of virtual museum and provided the students with the sense of protecting their cultural heritage. It was also observed in various research findings that virtual museums increased students' interest in biology lesson (Donaldson, 2005), contributed to students' science learning (Campos et al., 2016), and increased their knowledge of zoology (Castro et al., 2021). Furthermore, at university level, it was identified that the use of virtual museums positively changed students' attitudes towards museum activities (Çalışkan et al., 2014), increased their interest in physical visits to museums (D'Alba, 2012), made learning permanent (Islek & Danju, 2019) and improved creativity and questioning skills (Bidyuk et al., 2021). Virtual museums have shown their effects not only on students but also on teachers. It was discovered that virtual museum experience increased teachers' creativity, supported classroom activities with effective materials (Salar et al., 2013) and offered teachers various experiences that they did not have in their undergraduate education (Sungur & Bülbül, 2019), and that teachers had a favorable opinion of using virtual museums in lessons (Canlı, 2016; Karataş et al., 2016).

As it can be observed in the studies conducted, the use of museums in the field of education has become increasingly widespread. For this reason, museums are considered as an important tool that supports teaching processes with their positive effects. Furthermore, virtual museum environments, which significantly facilitate access to museums and popularize museum culture, provide teachers not only with rich course materials, but also with the opportunity to take many more students to museums at a much lower cost, and these opportunities promote the enrichment of course content accordingly. Nevertheless, there are very few studies on the use of virtual museums in science education (Ünal et al., 2022). In the light of this information, this study aims to examine secondary school students' opinions on a science learning process supported by virtual museum activities. The research question of the study is as follows:

- What are the opinions of 5th grade students on virtual museum activities in science lesson?

Method

Research Design

The study was a qualitative descriptive research. Such research examine individuals'experiences or thoughts and make a description. These studies can be seen as a more basic and less interpretive version of phenomenological studies (Sandelowski, 2010). In this study, it was aimed to identify the opinions of the students attending the virtual museum-supported science lessons regarding the process and the activity.

Participants

The participants were 29 5th grade students studying at a public school during the 2021-2022 academic year. As one of the researchers was science teacher at a public school, and it was not possible to take students for dividing in different groups, a 5th grade class (n=29) was chosen as study group. There were 16 male and 13 female students in the class. They all had one of tablet PCs or PC at home and they could actively use those for lessons or individual research. The science lesson within the scope of the study was delivered by one of the researchers, and all the students in the class involved in the activities.

Implementation Process

During the study, the science lessons were enriched with virtual museum activity in addition to the activities presented in line with the curriculum and the content of the textbook. The additional activity aimed to use the museums, which were selected in accordance with the relevant subjects and learning outcomes, in the lessons. The activity was developed for the learning outcome *"Students will be able to question the importance of Biodiversity for natural life"* in the Human and Environment Unit. As the learning environment, researchers chose the virtual museum of Smithsonian National Museum of Natural History in the USA. After planning the details about lessons and learning environment, two academician from science education reviewed the lesson plan in terms of content compliance with outcome, applicability and duration of the activity. In line with experts' feedback, some steps of the activity were revised and the activity became more useful for the lesson duration.

In the activity, the virtual museum exploration form was first distributed to the students. Before the Smithsonian National Museum of Natural History virtual tour, the students were given plenty of time to check the worksheet and ask their questions about it. After the students' questions were answered by teacher, the virtual museum tour was started. As there was a smartboard in the class and it was used as an important component of science lessons, there was no need for students to explain how to use the board. But, as all virtual museums, this museum had its own platform and buttons to use during the tour. Therefore, the teacher explained how to use these buttons actively, what do they mean in Turkish (because the main language of menu is English) and how to use information in the museum. After that, the museum plan was shown on the virtual museum map. In line with the requests and comments of the students, the teacher led a virtual museum tour. During the tour, students checked the questions on the worksheet and noted their new questions in addition to answers. The teacher asked for volunteers for leading the tour and allowed them to take a tour themselves. Although students filled their worksheets individually, they worked in groups during the tour on the board. They chose their group mates according to their common questions. Naturally, groups reshaped dynamically according to questions. The activity was performed in a classroom setting for a total of 2 lesson hours. Virtual tour was ready for students to continue and try during these lessons. Both during and after the tour, teacher asked questions about what they see and what are the differences between those. Students were encouraged to think and question about our planet, animals, human, other livings and their interaction with each other. They explained some questions using the information that they had from the museum. Some students argued the features of extinct animals with each other experiencing the tour. After students' all questions were answered by other students or the teacher, they completed to fill their worksheet. Sample images from the implementation process of the activity are presented in Figure 1 and 2.

Figure 1. Students Leading The Tour to Find Answers of Their Questions

Figure 2. Students Experiencing How to Use The Platform and to Start the Tour

Data Collection Tool and Data Analysis

In the study, semi-structured interviews were held to identify the participants' opinions on the virtual museum activity. Semi-structured interviews serve as an advantageous technique in that they enable both to progress by receiving answers to predetermined questions and to seek in-depth answers when necessary (Büyüköztürk et al., 2020). For the interviews in this study, the questions developed by Kaya and Okumuş (2018) on the use of virtual museums were utilized in line with the level of students and the course content. The interviews that consisted of a total of 8 questions were held individually with all participants following the activity.

The interviews were analyzed using content analysis, in which the data are examined in detail, and codes, categories and themes are created to identify participants' opinions on a given subject (Creswell, 2021). Number and frequency values, which indicate how often the codes are used, are also presented (Büyüköztürk et al., 2020). The responses of the participants in the study were examined thoroughly by the researchers, and the codes and categories were created. To ensure the reliability of the findings obtained, the analyses were performed by two researchers working independently of each other. Following the analyses, percent agreement between the codes of the researchers was calculated using the formula by Miles and Huberman (1994) (Reliability=Agreement/Agreement+Disagreement). The intercoder agreement was estimated as 94.7%, it can thus be stated that the codes were reliable (Miles & Huberman., 1994)

Results

The answers of the students to the questions asked for their opinions following the virtual museum-supported science lesson are presented in detail below. Table 1 presents the findings regarding the question "What are your opinions after your virtual visit to the American National Museum of Natural History?".

Table 1

Opinions on the Virtual Museum Experience

Category	Code	n
Content experience	I saw extinct animals	13
	I saw animals that I had never seen	9
Feelings	It was as if I went there	9
	I had a lot of fun	6
Learning process	I learned better	14
	I learned more easily	1

In Table 1, it is observed that the students mostly focused on extinct creatures in the virtual museum. They also stated that they felt like they physically visited the museum and that they learned better. Considering these responses, all the opinions of the students were positive. Some sample statements are as follows:

S4: "It was as if we were there, we learned better."

S12: "Yes I liked it, it is better."

S21: "We learned better."

S22: "We learned very well; we saw the history."

S18: "We saw the history, I liked it. It was more fun."

Table 2 presents the findings regarding the question "How did the virtual museum activity change your interest in the science lesson?".

Table 2

Opinions on the Change of Interest in the Lesson

Category	Code	n
Content-based effects	It was more interesting	28
	We saw many animals	10
Process-based effects	The time passed quickly	9
	We learned better	3

In Table 2, it is observed that almost all the students found the lesson more interesting. In addition, they stated that animal diversity attracted their attention and that they had a more enjoyable learning process. It is also an important finding that all the responses were positive. Some sample statements are as follows:

S5: “We became more interested.”

S6: “We saw many animals.”

S9: “It was more enjoyable. The time passed very quickly. I saw animals that I had barely seen.”

S13: “We got more interested in science, and it was fun. The time passed quickly.”

Table 3 presents the findings regarding the question of “What do you think about the usefulness of virtual museums?”.

Table 3

Opinions on the Usefulness of Virtual Museums

Category	**Code**	**n**
Usefulness	I found it very useful	27
Teaching	I understood very well	15
	Like America was in the village	14
	We saw many animals	15

All the students expressed positive opinions about the usefulness of the virtual museum, with two different categories presented in the table. Most of them emphasized that they found virtual museums useful. In addition to these statements there were some other statements about especially the instructional aspect of them. Some sample statements are as follows:

S1: “I found it useful, I understood the subject very well. We had a better lesson. I saw many paintings. America was here.”

S10: “I found it useful, we went to America.”

S11: “I found it more useful, we understood the lesson better. It was more fun. We saw many paintings. America was here in X village.”

S16: “I found it more useful, we learned the lesson better. We saw many animals.”

Table 4 presents the findings regarding the question of “What attracted your attention the most in the virtual museum?”.

Table 4

Content that Attracted the Participants' Attention the Most

Category	Code	n
Extinct creatures	Fossils	25
	Mammoth	15
	Dinosaur	11
Living creatures	Giraffe	11
	Octopus	6
	Human bones	2
	Marine animals	2
	Monkey	2
	Lion	2
	Tiger	1
	Chamois	1
	Snake	1
Other	The whole museum	4

Considering the sections that attracted students' attention, the answers were categorized by the period in which the creatures lived. In Table 4, it is observed that most of the students were interested in the extinct creatures. On the other hand, other sections of interest included creatures that they were less likely to observe in their immediate surroundings. In the category labeled as "other", the participants stated that they found every part of the museum interesting and gave an answer inclusive of other participants' responses. Some sample statements are as follows:

S18: "Mammoth, giraffe, fossil."

S21: "Fossil, octopus."

S24: "Fossil, mammoth, giraffe, monkey, octopus."

S26: "Fossil, giraffe, marine animals, mammoth, dinosaur, lion, octopus."

S28: "Fossil."

S14: "Fossils, dinosaurs, mammoths, marine animals."

Table 5 presents the findings regarding the question of "Which creatures did you find different?"

Table 5

Creatures that Participants Found Different

Category	Code	n
Extinct creatures	Mammoth	20
	Dinosaur	9
	Fossil	2
Living creatures	Octopus	14
	Giraffe	9
	Human	3
	Chamois	2
	Kangaroo	2
	Lion	2
	Zebra	1
	Snake	1
	Swordfish	1
	Monkey	1
	Hippopotamus	1
	Panda	1
	Marine Animals	1
	Elephant	1
Other	All	2

When the answers about the different creatures are examined, it is observed that mammoth is the most frequent answer. It is noteworthy that the creatures that attracted students' attention were also the most frequently stated creatures among those they found different. But the creatures that students found different were not limited with those. They stated some animals that they already know from TV or zoos (such as octopus, kangaroo, lion). Some sample statements are as follows:

S14: "Swordfish."

S13: "Mammoth because I saw it for the first time."

S9: "Mostly Dinosaur."

S6: "Octopus, Mammoth."

S2: "Octopus."

S19: "Mammoth, Octopus and Chamois."

S21: "I saw a Mammoth."

S25: "Mammoth, Dinosaur."

Table 6 presents the findings regarding the question of "What did you learn as a result of the virtual museum activity?".

Table 6

What is Learned as a Result of the Virtual Museum Activity

Category	**Code**	**n**
Science-related learning	Extinct animals	19
	Animals I have never seen	7
	Fossils	4
	Differences of ancient humans	3
Non-science learning	Museum concept	2

Considering the students' statements about their learning experiences, the responses are categorized into two as "science-related learning" and "non-science learning". In the science-related learning category, it is observed that learning about extinct animals stands out. Similarly, learning about animals never been seen and humans of previous periods is emphasized. Some sample statements are as follows:

S28: "I have learned what a museum is."

S26: "We saw fossils that we had never seen. We examined extinct fossils."

S10: "We learned about history and extinct animals."

S13: "We saw animals that we had never seen. We saw extinct animals. We saw fossils."

Table 7 presents the findings regarding the question of "Would you like to reexperience a lesson with virtual museums?".

Table 7

Opinions on Reexperiencing the Virtual Museum

	n
Yes	29

As it is observed in the table, all the students answered yes to this question. The absence of negative statements among the answers to the previous questions also presented findings consistent with this table.

Table 8 presents the findings regarding the question of "What do you think can be done to make virtual museums better and more effective?".

Table 8

Suggestions for Better Virtual Museums

Category	**Code**	**n**
Enrichment of museum content	Cartoons can be created	26
	Animal sounds can be included	10
	Animals can be animated	3
	An audio guide can be included	2
	Real life state of the fossils can be presented	2
Variety of museum components	A zoo can be included	3
	Statues can be included	1

Students' opinions on better and more effective virtual museums were divided into two categories as "Suggestions for the enrichment of museum content" and "Suggestions for the variety of museum components". Among the suggestions, the statements about supporting the content in the museum with various technological components stand out. In addition, suggestions were proposed regarding the inclusion of statues and a zoo in the museum. Most of the suggestions were for enriching the content with various components. Some sample statements are as follows:

S2: "I would like to see the pictures of fossils when they were alive."

S7: "The sounds of animals could be included."

S13: "There may be displays like cartoons. There may be statues. We can hear the sounds of animals."

S18: "It could be like a cartoon. Audio could be included. Animal sounds and movements could be included."

S19: "It could be like a cartoon. Dinosaurs could be displayed realistically."

S24: "It could be like a cartoon. I wish animal sounds were included."

S14: "There could be a display like a cartoon. Statues could be included. The animals could be animated, and we could hear their sounds."

Discussion, Conclusion & Suggestions

What is noteworthy in the findings is that all the statements were positive. It is observed that all the students had a positive impression and were satisfied with the process even though they addressed the virtual museum experience from different aspects. It is identified that what attracted the students' attention the most in the museum was the creatures that they had never seen before due to the difference in period or habitat. This is an expected situation as it is a reaction to any content encountered for the first time, yet it is also an important finding in increasing students' awareness of both other museum content and learning that takes place here. As a matter of fact, the students stated that they felt like they were in a museum and had a better and easier learning experience in the virtual museum activity. Besides, the number of students who emphasized learning constituted more than half of the participants. These results are consistent with those of other studies indicating that out-of-school learning activities support students in terms of academic achievement (Çığrık & Özkan, 2016; Marth & Bogner, 2018; Mertoğlu, 2019). The fact that students felt like they were in a museum indicates that one of the most important purposes of using virtual museums as an out-of-school learning environment could be achieved. By combining this achievement with the awareness of learning experiences, students' science-related learning can be enriched. It is believed that expanding the use of museum environments, which are relatively rarely used in science lessons, is important for the relevant awareness. At this point, the fact that the students had a real-like experience in an environment, which they did not have the opportunity to experience in their immediate surroundings, and had a learning experience in this way corresponded with the purpose of both the science lesson and the virtual museum integration in the study.

The creatures that attracted the students' attention the most include mammoth, octopus, dinosaur and giraffe. These animals may have attracted the students' attention because they differ in physical structure from the ones that the students frequently see. Moreover, since these are prominent characters in various movies, the students may have found them more intriguing. The fact that the students consider the creatures that are extinct or not available in their environment as interesting may stimulate them to be preoccupied with situations different from those they see as problems in daily life. It may be possible that they are triggered by this virtual tour and concern themselves about situations that they normally do not mind (for example, endangered animals and conservation methods). Therefore, it is likely that they turn to topics intended in the course content, and that their interest in science, history of science and history is triggered considerably. Presenting the living conditions of these creatures, the characteristics of their relatives that are still alive today, and the present ways to obtain relevant information today through a virtual museum can directly promote formal learning outcomes of science lessons. Evolution, extinct creatures, fossils are the first relevant examples that come to mind. Studies indicating that the use of museums in science lesson increases students' academic achievement (Bolat et al., 2020; Campos et al., 2016), communication skills (Yener et al., 2018) and permanent learning (Conway, 2014; Kartal & Şeyihoğlu, 2020) are also in line with these findings.

Considering the details of the content that attracted students' attention in the museum, it is observed that the emphasis on fossil stands out. The students highly enjoyed seeing and getting information from the remains of creatures that lived in previous periods. This learning supports the learning outcome of "Students will be able to question the importance of biodiversity for natural life" in the course content. Furthermore, a significant part of the students stated that they were also interested in seeing the creatures that they had the chance to observe in real life. These results indicate that the museum is considered interesting not only for being an environment where the students encounter creatures that they cannot see, but also for the knowledge that they acquire about the creatures that they are familiar with. The fact that students consider museums as an environment for acquiring knowledge is stated among the objectives of contemporary museology (Okan, 2018). Therefore, virtual museum experience not only allows students to experience a museum visit, but also contributes to the understanding of contemporary museology. It is also noted in different studies that virtual museums positively affect attitudes towards museums (Çalışkan et al., 2016; Peker, 2014). For this reason, it is believed that virtual museums, for example a natural history museum, can serve as an effective learning environment for learning about the life cycles and changes of creatures, and particularly evolution, in science lessons. Regarding their interest in the lesson, 28 students stated that they got more interested with the virtual museum-supported learning process. The high rate is an indication that inclusion of virtual museum activities in science lesson can be highly effective in motivating students. In addition, this result supports the studies indicating that similar activities increase students' interest (Bozdoğan, 2008) and motivation in the lesson (Dönel Akgül & Arabacı, 2020; Çığrık & Özkan, 2016; Marth & Bogner, 2018; Uitto et al., 2006).

With the help of different questions, the students' opinions on whether the virtual museum was effective and enjoyed were tested, and all their statements were consistently positive. All the students replied in the affirmative when asked about their willingness to have a similar experience again. These results indicate that virtual museums are out-of-school learning environments of which use is convenient in science lessons and which increase the quality of the lesson. The students participating in the study offered various suggestions about enriching their museum experiences. Among these suggestions, supporting the content with cartoons and including the sounds of animals were emphasized the most. What these suggestions had in common was that technological components should be added. Although this study was limited to the virtual museum experiences (in science lessons) of 29 students in a public school, these suggestions can contribute significantly to both teachers trying to identify museums to use in science lessons and researchers studying on the development of museum content. Besides, it also gives an idea about what other activities a teacher, who plans to use virtual museums to teach any science subject, can carry out as integrated with this process. For example, following the virtual tour in the study, a cartoon or short film with similar content can be selected and shown to the students. Consequently, it is possible to evaluate the expectations of students in science lessons and museums by making inferences from these suggestions.

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The Courses are Online, What about the Students? Did They Really Online? Using Kahoot! In the Emergency Remote Teaching Process

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Abstract

This study investigates the effectiveness of using Kahoot! as an educational tool for emergency remote teaching during the COVID-19 pandemic. The research follows a phenomenological approach, which is a qualitative research method. The study group consists of 83 university students who were taking the HIST-101 course on Ataturk's Principles and History of the Turkish Revolution. The sample was selected using easily accessible sampling due to the pandemic situation. The research utilized a semi-structured interview form developed by the researchers and LMS records as data collection tools. The study lasted for 15 weeks, and the interviews were conducted online via Google Forms and the LMS. The findings were analyzed using content analysis from a holistic perspective. The research concludes that Kahoot! sessions positively impacted the students' attitudes towards the lesson and enhanced their learning. Many students found Kahoot! to be a useful tool for learning, engaging with the lesson, and having an emotionally comfortable and enjoyable educational experience without stress. The study's results suggest that using such tools for distance education has numerous benefits.

Keywords

Emergency Remote Teaching Process • Gamification • History teaching • Kahoot! • Online learning

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With the Covid-19 epidemic that has affected the whole world, like many countries, Turkey has switched to Emergency Remote Teaching Practices instead of face-to-face education. This situation has brought with it many questions and problems. It was not easy to maintain the existing curriculum on the one hand and to keep students of all ages and levels in front of the screen during long lesson hours. In this process, there are some questions discussed by families, teachers, and all institutions and organizations related to education. There is an epidemic that affects the whole world, and a compulsory distance education process has started due to the epidemic. Lessons are online, but are students ``really" in front of the screen? Do they listen to the lessons from the beginning to the end, do they actively participate in the lesson? These questions were asked by the educators as well as by the families during the epidemic process. It is known that it is difficult to teach large groups of students in the distance education process and to provide one-to-one interaction with the students in the lessons, but digital apps can be useful in preventing low motivation, apathy, and distraction (Karadağ & Yücel, 2020; Erol-Şahin, 2019). These apps are increasingly used to increase participation, improve classroom dynamics, encourage autonomy, and improve the student learning experience and learning environments. Many teachers have started using digital apps and tools to make classroom activities more interactive (Kohnke & Moorhouse, 2022). There are several applications that could be used for gamified learning. The most famous ones are Edmodo, Socrative, Kahoot!, Quizizz, Padlet; Mentimeter; Edpuzzle (Orhan-Göksün & Gürsoy, 2019). "Kahoot! it!" was used more frequently in gamification activities when compared to the other applications (Biçen & Kocakoyun, 2018; Borrell, Cosmas, Grymes, & Radunzel, 2017; Orhan-Göksün & Gürsoy, 2019; Wang & Tahir, 2020; Zhang &Yu, 2021).

Rationale and Purpose of the Study

Gamification Gamification was defined by Karl M. Kapp (2012) as the use of game-based mechanics, game thinking, and aesthetics to bring people together, encourage learning, provide motivation and solve problems. In other words, gamification is the use of game elements in non-game content to increase the experience and interest of users (Özkan & Samur, 2017, p.859). The basic elements of gamification are; goal, result, badge, score, level, challenge, challenge, competition, story, contest, rule, leaderboard, feedback, obstacles to overcome, excitement, fun, avatar, etc. (Özkan & Samur, 2017, p.859). Gamification also provides the quality sought for learners to achieve their learning goals in cognitive, affective, and social areas with various technological components (Plump & LaRosa, 2017; Yuruk, 2019; Kapp, 2012). Studies have been carried out on the use of gamification in educational institutions that follow innovations and new technologies in education. There are studies on the use of gamification, especially in computer communication technologies teaching, foreign language teaching, mathematics teaching, adult education, and the teaching of various courses in higher education institutions (Gökkaya, 2014; Güldüren, 2020; Karamert & Vardar, 2021; Karataş, 2014; Özkan & Samur, 2017; Yapıcı & Karakoyun, 2017; Yığ & Sezgin, 2021; Yıldırım & Demir, 2014; Yürük, 2019).

One of the gamification applications used in the field of education is Kahoot!. Kahoot! is an application where students in the classroom can actively participate in preparing for exams and measuring and evaluating with music and effects that give excitement to the competition. On its official site, Kahoot! is advertised as "a free software that combines the words curiosity and plays, aiming at lifelong learning regardless of subject, age or ability" (Kahoot!.it.). Kahoot! is an application that allows you to create multiple choice quizzes, matching quizzes, surveys,

true-false, short answer, ranking questions, video-audio questions, word cloud, or puzzles. Kahoot! is an application that aims to increase participation, motivation, enjoyment, and concentration to improve learning performance and interaction (Wang& Tahir, 2020).

It was thought that alternative teaching methods and digital learning tools could attract the attention of students and increase their motivation towards the lesson during the difficult epidemic process where university students try to continue their lessons at home, away from their friends and school environment. When the relevant literature was examined, applications like Kahoot! have a potential benefit when used in the learning process (Plump & LaRosa, 2017; Wichadee & Pattanapichet, 2018). In this context, it is aimed to learn the experiences of the students about Kahoot! they use during the lesson and the effect of the experience on their learning processes. Overall, this research aims to contribute to a better understanding of using the interactive game "Kahoot!" during the online learning process. It is aimed to understand how students experienced the use of Kahoot! and to explore the extent to which this interactive technology influences classroom dynamics, engagement, motivation, and learning. In our study, we addressed the following four research questions:

RQ1. In what ways does Kahoot! impact classroom dynamics during online learning?

RQ2. Does the use of Kahoot! influence students' engagement, motivation, and overall learning experiences?

Research Design

The research was designed with phenomenology which is known as an educational qualitative research design (Creswell, 2015, Yıldırım & Simsek, 2013). Phenomenology is a qualitative research approach that focuses on exploring the subjective experiences and perspectives of individuals. In the context of education, phenomenology can be used to understand the lived experiences of students, teachers, or other stakeholders in the educational process. In this study, the phenomenology method was chosen because it included a 14-week online teaching process and focused on the student experience.

Research Sample/Study Group/Participants

Convenience sampling, one of the purposeful sampling methods, was used to determine the study group, with preference given to an easily accessible sample for practicality and speed (Yıldırım & Şimşek, 2013). Additionally, given the current epidemic situation, students who were readily available and could be easily reached were selected for the study. The study group consisted of 83 first-year students who were enrolled in a mandatory history course (HIST-101) at a state university in Ankara, with 36 female and 47 male participants. To maintain anonymity, coding was used for participant names. As the study required the use of computers or smartphones with Kahoot!, only students who met these criteria and volunteered were selected from the announced classes.

Research Instruments and Processes

Phenomenological design typically relies on phenomenological interviewing as the primary method of collecting data, which is used to reveal the underlying meaning or basic structure of an experience (Creswell, 2015 Merriam, 2013). To collect qualitative data for the present study, a semi-structured interview form developed by the researcher

was used, and participants were asked to complete the form online. According to Merriam (2013), semi-structured interviews are effective in allowing participants to share their perspectives and experiences. Apart from interviews, other data collection tools such as diaries, observation notes, and study group records can be employed in phenomenological research. In the current study, the researcher kept a diary to take notes on relevant content related to the research question, and the student's attendance in online classes was also recorded through the LMS system. Additionally, to ensure data diversification, the researchers used various data collection tools, such as Zoom meetings, researcher comments, WhatsApp group messages, and LMS records. The data obtained from the interviews and documents carried out within the scope of the research were first subjected to descriptive analysis and then to content analysis. Descriptive analysis refers to the summarization and interpretation of qualitative data according to the previously determined themes that form the conceptual framework of the research. The data summarized and interpreted by descriptive analysis are further deepened by content analysis. In content analysis, interrelated data is organized under certain themes. (Baltacı, 2017; Maxwell, 2008; Yıldırım & Şimşek, 2013).

The Process for 15 weeks

The study took place in the fall semester of 2020-2021 over a 15-week course period. For this study, the participants were asked to join online Kahoot! sessions during their history classes for this purpose 15 weekly schedules have been completed in the following order.

- Due to the coronavirus epidemic period, the opportunity to meet face-to-face with the participants could not be found, and the participants had to be worked with through distance education tools throughout the application. A message was sent from LMS at the beginning of the semester. LMS: "Learning Management System" is a versatile program that provides both live lessons and tools for students to share files.

- In the first week, the subjects were introduced to using active teaching methods and the digital tools that can be used in the history lesson, and it was explained that these tools would be used during the lesson. In the second lesson, the students were asked to participate in the warm-up game after brief information about one of these tools, Kahoot!, was given. The Kahoot! played in the first week was an icebreaker activity that was prepared in the format of a warm-up game. With this Kahoot! some of the questions below can be seen, and it was aimed to help students warm up to the lesson by asking small-scale general culture questions and using humorous elements at the same time.

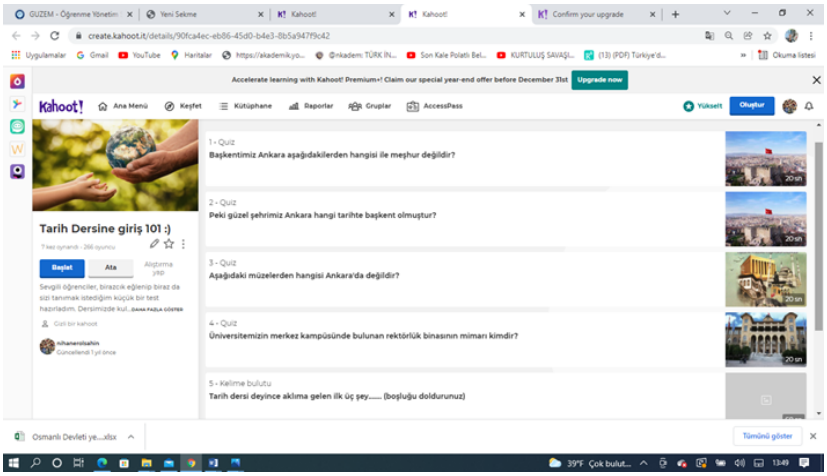

Figure 1. Warm-up Kahoot! activity for the first week

Above is the Kahoot! questions that were designed as an icebreaker activity for our first week. In this Kahoot! simple general culture questions were asked to the students about our course, our university, and Ankara. Some of which could not be seen by some of my students due to the epidemic, rather than giving information. There are also two-word cloud questions in this Kahoot! in addition to 4 test questions.

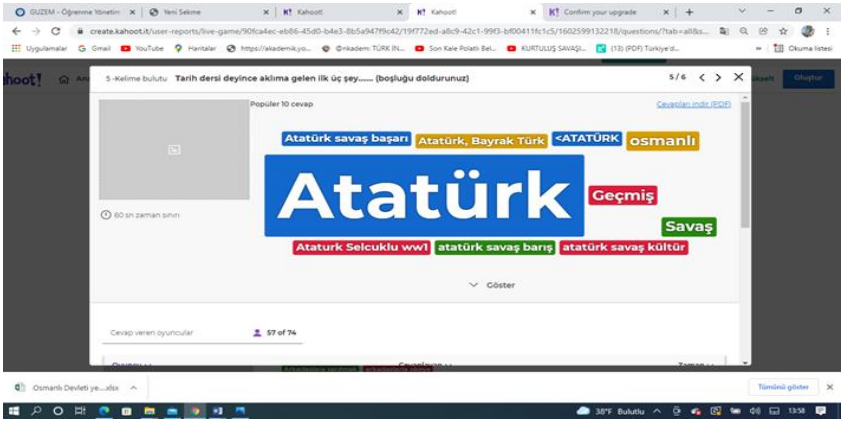

Figure 2. An example for a word cloud question- ice breaker lesson

One of the icebreaker questions asked was "What are the first three things that come to mind when you think of history lessons?" The 10 most popular answers to the question were "Atatürk, War, Peace, Ottoman, WW1, and Past. The first week of the semester was spent with acquaintance activities and the introduction of the course content, and the second week with the subject of concepts related to the course. In the second week, short information questions were asked to the students using visuals to learn their preliminary information about our lesson. This week's Kahoot! consists of 8 tests and 9 questions with a word cloud. A quiz based on the topics that will be covered during the semester was prepared in this Kahoot! By showing them familiar pictures and images of known historical events that they often come across on social media, I wanted to learn what these images mean to them, especially. With this game that was prepared as an introduction to the lesson, my students were encouraged to wonder about the content of our lesson.

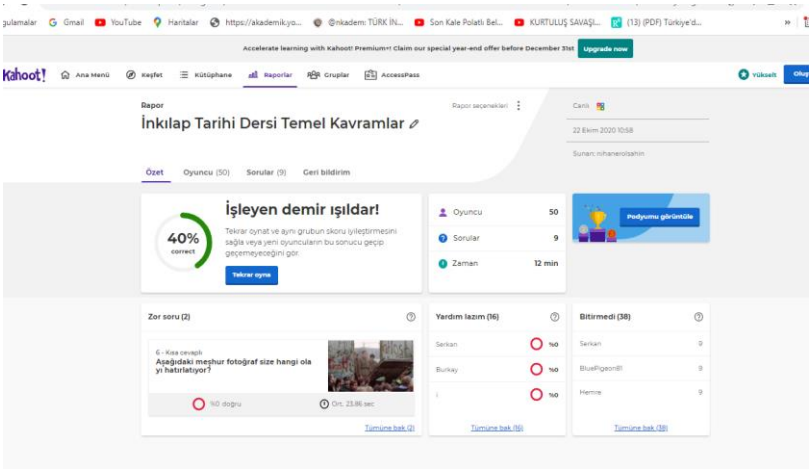

Figure 3. The Kahoot! report for the second game

When the report is examined, it is seen that the success rate of the class is 40%. The game was completed in 12 minutes in total. The question about the Berlin Wall was the most difficult. It is seen that 38 students could not complete the questions on time, and 16 students received low scores.

In the following weeks, notes and articles about the course were sent to students via LMS. Kahoot! about the topic of that week was played sometimes at the beginning of the lesson and sometimes at the end of the lesson. Kahoot! scores were tracked for 15 weeks from the beginning of the semester, and the scores of the students who entered the ranking were recorded. Features such as reports of the students, rankings, and scoreboards are provided by Kahoot! Premium account. A picture of the 4th week's scoreboard is shown below.

Figure 4. 4th week's scoreboard

Kahoot! was regularly applied in all classes throughout our 14-week course period, either as an introductory activity or an end-of-course evaluation activity. In our 15th week, a crowded Zoom event was organized with our students at the end of the semester. During the period when this application was being done, all lessons were taken remotely by our students due to the epidemic. Therefore, the freshmen students who had no opportunity to meet each other yet, had not physically experienced the university environment, and had been confined to their rooms for their

entire lives were our students. With the interactive activity that was done in the lesson, they had the chance to see and communicate with their other friends, even if it was virtual. This situation was understood both from the feedback received from them at the end of the semester and from the smiles on their faces and the jokes they made during the Zoom. In addition, the WhatsApp group established was used almost every day throughout the entire application process, creating a dynamic structure for both my announcements and the information exchange of my students. The correspondence here is thought to be a factor that strengthens intra-group communication.

In last week's live Kahoot! The event, an open-ended question was asked, which was "What are your expectations and suggestions for our next classes," shown above.

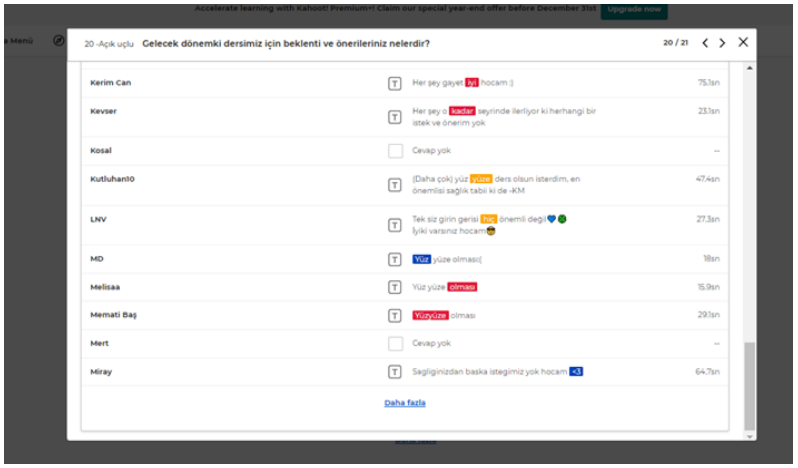

Figure 5. Suggestions from students

When the answers of the students were checked, it was observed that starting face-to-face lessons as soon as possible was mostly wanted by them. As mentioned, many things were deprived of university students due to the epidemic process that affected the whole world. Along with the request for face-to-face lessons, it was seen that many students wanted Kahoot! to be continued to be used in the next semester. In addition, requests and expectations such as using different applications in the lessons, processing recent history topics in more detail, including documentaries and videos, conducting group studies, visiting museums, and extending the lesson hours were expressed by the students. Throughout the term, many students expressed their satisfaction with the activities carried out and wanted the lessons to continue in the same way. Similar statements were made in the meeting held on Zoom after the game.

A few days after this event, the LMS lecture was logged in to announce the results of the gamified lesson plan. After collecting the scores for all weeks, small gifts were sent to the addresses of the students who ranked in the top three. Thus, the term was completed. Below is the message sent by one of the students who received the gift with their permission.

Figure 6. One of the photos of the gift for the winners'

Data Analysis

Content analysis was utilized to analyze the data gathered during the research, and to identify relevant concepts and relationships that could explain the collected data. By applying content analysis, the data were systematically examined to identify any potentially hidden facts. The content analysis process involved gathering similar data under specific concepts and themes and interpreting and presenting the findings in a manner that could be easily understood by the reader (Yıldırım & Şimşek 2013). The goal was to gain a deeper understanding of the data and to derive meaningful insights from the analysis.

Validity and Reliability

The following steps were taken for the validity and reliability of the study.

-The pilot study of the semi-structured interview form for the use of Kahoot! developed by the researchers was carried out with ten students and one question was revised. After the pilot study expert opinions were taken and one question was removed. The data sources were diversified by using interviews, documents, and LMS records in the collection of the research data in the formation of the research question and during the analysis of the data.

-Documents and the researcher's diary are stored electronically so that they can be accessed when necessary. The findings are presented with direct quotations without including the personal opinion of the researcher

-Throughout the research, the students were informed that their personal information would be stored, and participation in the study was voluntary. To maintain anonymity, students' names were replaced with codes (e.g., S1, S2, S3, etc.). During data analysis, frequency counts varied due to some participants providing multiple responses that fell under more than one category (n=83).

Results

The objective of the questions was to gain insight into the students' utilization of Kahoot! and how it affected the classroom environment, participation, drive, and educational achievements. The initial inquiry sought to determine whether Kahoot! had a positive or negative influence on the students' engagement levels in History 101 and the factors that contributed to it. The subsequent question aimed to establish whether Kahoot! had a positive or negative

impact on the students' learning in History 101 and the reasons behind it. The findings obtained regarding the question asked to the participants about their experiences of playing Kahoot! in online classes are gathered and presented in Table 1.

Table 1

Participants' Views of Experience in the Use of Kahoot! in Online Classes

Theme	**Category**	**Code**	**f**
Fun, enjoyment, and challenge	Kahoot! features (funny,exciting, enjoyable)	· The exciting music · The feedback after answers (like "you did it well, back luck, you can do it better" were enjoyable · The exited countdown · A new and enjoyable application · Challenge	36
	The quizzes	· Enjoyable/ funny/ interesting questions · Unforgettable questions · 15 different types of quizzes for 15 weeks · Different question types (quiz, poll, world cloud, puzzle, etc.)	32
	An interactive tool	· To be in a live Kahoot! session in Zoom was fun · To see the other friends' faces was fun · chat/talk about the quiz was enjoyable	29
Interaction, engagement, attention, and focus	Kahoot! features	· The app is competitive and motivating · The music and the other attractive features	28
	Gamificated lesson plans with Kahoot!	· Announcements before classes · Different question types · Interesting questions on the topic · The need for attendance due to the scoring system	27
In-depth learning	Learning history with Kahoot!	· Research from different sources · Wanted to learn deeply	30

		·	Discussion/talking with friends about the questions	
Socializing application	Socializing Connection	·	Online Kahoot! sessions	28
		·	Quizzes with rewards	
		·	Challenging quizzes	
		·	To see friends in live sessions	
		·	WhatsApp group and LMS forum	
		·	Like to be a part of a group	
Motivation	Motivated to attend classes	·	Not boring	28
		·	Need to attend all classes	
		·	Need to pay attention	
		·	Wanted to wait till the end of the class.	

When Table 1 is examined, it is seen that the views of the participants about the application are gathered under the themes of fun and enjoyment, interaction, engagement, attention and focus, in-depth learning, socializing application, and motivation. Some of the opinions of the participants in the "fun and enjoyment" category are presented below.

- Fun and enjoyment (n56)

S9. Kahoot! increased my learning in a fun way. This tool helps us visualize and entertain and understand the subject.

S1. The lesson was very entertaining as it was, even my brother wanted to join the lesson with me and answer Kahoot! questions.

S11. Teaching the lesson in a fun and active way affects both the adaptation process and understanding positively.

S32. ……because it makes the lessons more fun and this makes me more interested in the lesson.

- Attention, Focus (n22)

S40. Kahoot! helped me to focus on the lesson. Because having a small exam related to those subjects at the end or beginning of the course allowed me to focus more on the course, even though it did not have a negative effect on my exam results.

S61. I think Kahoot! is an interesting tool with its music and feedback. Also, the fact that you ask very interesting questions aroused my curiosity every week.

S9. It keeps your mind fit during the lesson, we need to give our attention, so it makes you more interested and focused on the lesson and the subject.

- Kahoot! features (n8)

S1. ... The interface was user-friendly and adaptable, making it easy to use without much difficulty. The use of the program offers a comfortable working process ...

S18: ... It was really nice and interesting questions, and also I liked the music and feedback, it was easy to use.

Although most of the participants found the tool easy and fun, some participants stated that they had some difficulties while using the program. Some of the students stated that they had connection problems. some of them had to give up the game. some of them couldn't join some sessions.

The second theme is in-depth learning, the quotes from the category are shown below;

- Learning history with Kahoot! (n 30)

S12. I felt good in this lesson, because frankly, what we do during the pandemic period is just look at the screen, read or listen to a lecture note, and solve a test in this way. Plus, it has the consistency of social activity. It is even more enjoyable to play this game with everyone's camera open at the video Zoom meeting. Because I see everyone's gestures and facial movements and it's like a real date.

S66. The knowledge I gained was permanent and I saw similar question types by working with Kahoot! before the exams and I think I was successful in the exam. It made me research to find out the answers to the questions I didn't know.

S70. Using Kahoot! in our lessons increased my motivation towards the lesson. Because I entered the class knowing that I would do a fun activity and interact with my friends that I did not see face to face. Testing my knowledge in this way and not getting any points for it reduced my stress.

S11. ….increased it. Because in Kahoot! questions, when I was asked about topics that I did not know before, I made a mistake. However, I researched the issue I was doing wrong. In short, I can say that Kahoot! triggers the motivation to do research.

S72: This application increased my interest in the lesson because it allowed me to learn the information mentioned in the lesson but that I could not remember or remember incorrectly and that it was permanent.

When the views of the students are examined, it is seen that the online classes with Kahoot! affected them in many different ways; "wanted to learn deeply", "Discussion/talking with friends about the questions", "researching the subject from different sources", and "increasing interest in history lessons".

As a result of the epidemic that affected the whole world in the year the application was made (2020-2021), courses in Turkey started to be given by distance education on a compulsory basis. Our participants, university students, often say that this process turns into a boring one for students.

Students find applications such as Kahoot! useful, motivating, and interesting as they make the monotonous distance learning process more enjoyable and interesting. There are some quotes from students about these categories of "Socializing and motivation":

S2. These lessons with Kahoot! increased my learning. It gets boring after a while that we don't do any activities related to the lesson in our other lessons, but only teach the information given, and even if you are interested in that lesson, you may not want to attend the lesson because it is monotonous. Events like Kahoot!, zoom meetings make it more fun and effective. In this way, our motivation increases against the course.

S19. ….Yes, it keeps my interest in the lesson as it is new, different, and fun instead of the classic lecture.

S22. …..Unlike other classes, when entering the history lessons, "Yes, let's see what I have to memorize in these 40 minutes." Instead of thinking, "Let's see what kind of questions I will test myself at the end of the lesson" I think. Of course, keeping the lesson times at a level that will not be boring thanks to the understanding of our teacher is also effective :)) I am glad that I got to know you. One of the rare things I regret at the end of the term is that your classes are over and I couldn't meet you face to face and chat about recent history.

S59. Using Kahoot! in our lessons increased my motivation towards the lesson. Because I entered the class knowing that I would do a fun activity and interact with my friends that I did not see face to face. Testing my knowledge in this way and not getting any points for it reduced my stress.

S80. Yes, having different and entertaining questions increased my interest and motivation in the course.

S82. …… increased. I was also motivated to listen to the lesson, especially knowing that what I learned in the lesson will come up after me and that the subjects come across in a fun way rather than ordinary history subjects that we know in the past.

Our data showed that Kahoot! can increase student engagement and motivation and Kahoot! can help students retain information by allowing them to review material in a fun and interactive way. In addition, when the LMS records were examined, it was seen that 83 participants followed the course from the beginning to the end for 15 weeks, and did not make any absences except for illness or travel. Based on all these results we can say that by gamifying the learning experience, students are more likely to participate in class and enjoy the learning process.

Conclusion and Suggestions

The primary objective of this study is to uncover the experiences of students regarding the use of Kahoot! in online learning. In this regard, the 15-week implementation process and the feedback obtained from the students at the end have led to various conclusions.

Participants stated that the tool had many advantages. Most of the students stated that their learning experience was described as "fun and enjoyable" (Licorish, Owen, Daniel, & George, 2018) also found that their students found Kahoot! fun and they state that fun is a useful classroom engagement dynamic. Also, many students stated that Kahoot! helps with interaction, engagement, attention, and focus in online lessons.

According to analysis, it was concluded that the use of Kahoot! in an emergency remote learning process connects the students to the class. Some researchers agree that Kahoot! had positive effects like willingness to

prepare for class and learning (İsmail et al., 2019; Plump & LaRosa 2017; Wang 2015; Wang and Lieberoth, 2016). Also, our data from LMS recordings shows more than 90% of students participated in the formative assessment activities with Kahoot!. There was a common problem of emergency remote learning during the Coronavirus pandemic. Students' motivation and discipline had become an important problem during the pandemic in Turkey (Erol-Şahin & Kara-Erol, 2022). It has seen that Kahoot! helped students to attend their classes regularly, and students stated that this tool increased their learning. The researches had similar results like Kahoot! can increase enthusiasm for attending lectures and helpful for student lecture activities (Kalleny, N,K., 2020; Romadhon, 2022; Setyawan, F. F. N., & Hidayat, N., 2021; Wirani, Nabarian & Romadhon, 2022). There have been several studies that suggest that Kahoot! can increase student engagement and motivation. Biçen and Karakoyun (2018) found that Kahoot! increased student motivation and engagement in a college-level programming course. Méndez and Slisko (2013) also have found a positive effect of this tool for instance, classroom dynamics, motivation, social interaction, and attention. Our data showed that Kahoot! can increase student engagement and motivation. Especially students stating they need to contact each other somehow. They stated that Kahoot! helped them to socialize and improved their engagement and motivation. Researchers found that Kahoot! improved student engagement and motivation in the Coronavirus pandemic (Dyannah, M, 2021; Martin-Somer, M. at all, 2021; Tetep, T. and Arista, Y. 2022; Toma at all, 2021). Overall, these studies suggest that Kahoot! can be an effective tool for increasing student engagement and motivation in a variety of educational settings.

As a result, the transfer of university lectures to remote due to the pandemic situation has been detrimental to students. They stated that “they were on the screen; they were online but they were not really there”. The pandemic produces a decrease in their interest in studies and in their degree of learning. The data showed us the 15-week interactive, gamified lesson plans engaged the students. A large number of students found the use of Kahoot! a very useful tool for learning and engaging in the lesson. They also felt emotionally comfortable, and happy, and experienced an educational process without stress and having fun. Based on our research results, using such tools for distance education seems to have many benefits.

Suggestions:

1. This qualitative study was conducted in a single institution; therefore, caution should be observed in extending the findings to other populations.

2. This research specifically explores experiences with one digital educational tool. Future studies could investigate experiences with multiple digital educational tools.

3. This digital tool can be used in other courses.

Conflict of Interest

There is no conflict of interest in this research.

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The Views of Undergraduate Students and Faculty Members: Distance Education during COVID-19 Pandemic

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Abstract

This study aimed to examine the views of undergraduate students studying in and their faculty members teaching in distance education during COVID-19 pandemic. The sample consisted of 35 undergraduate students and 34 faculty members. The 'typical case sampling' method was used for selection of participants from different faculties of a foundation trust university in Türkiye. Sampling continued until theoretical saturation (until no new information was obtained from participants). Data was collected through online focus group interviews. Data was analyzed inductively by repetitive data collection cycles, data coding with multi-step processes and comparative analysis. Findings revealed negative, neutral and positive metaphors which described distance education during the COVID-19 pandemic. In fact, these metaphors indicated the existence of a continuum in the form of three higher order categories including the Experience of Loss, Transformation and Neutrality under which a number of themes and sub-themes were present. The present findings present a user-derived evidence base for improving distance education and therefore these findings could be considered as targets for systems aiming at improving distance education that would be delivered in the future in similar difficult circumstances.

Key Words

COVID-19 Pandemic • Distance education • Faculty members • Grounded Theory • Metaphors • Undergraduate students

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SARS-CoV-2 virus first appeared in China, then spread rapidly to become a global pandemic. As with other traumatic events, the COVID-19 pandemic seriously challenged human psychology. For example, Wang et al.'s (2020) study in the Chinese general population on the psychological effects of COVID-19 pandemic showed that 16.5%, 28.8% and 8.1% of the participants showed signs of depression, anxiety and stress, respectively. Roy et al. (2020) in an Indian population showed that 80% of the participants were concerned about COVID-19 pandemic. Studies have also shown that, during the pandemic, university students experience significant psychological problems (Zimmermann et al., 2020).

During COVID-19 pandemic, distance education has emerged as a mandatory replacement for traditional face-to-face education. Since the middle of March 2020 all the universities (both state and foundation trust) in Türkiye started to offer distance education. As in other parts of the world, this has been a challenging shift. It is almost inevitable that this challenging shift will be compounded with the psychological toll of COVID-19 pandemic among university students and faculty members. Therefore, it is important to examine the ways in which distance education has been experienced by both groups.

Several quantitative and mixed design studies have examined different aspects of university students' and faculty members' experience of distance education within the context of COVID-19 pandemic. Some studies have shown several difficulties associated with distance education based on the views of the students. Technical or technological problems (such as unstable internet connection) have been reported as the most common difficulty (Almossa, 2021). Being overloaded with information and experiencing difficulties in understanding lectures, inability to learn independently, having to spend too much time in front of the computer and being subjected to unsuitable evaluation methods were among other difficulties (Almossa, 2021; Himat et al., 2021; Ng et al., 2021). A lack of communication between students and their professors and a lack of support from professors (Kedraka & Kaltsidisi, 2020) were also reported. Other prominent difficulties for the students were disruptions in social life and daily life, unsuitability of home environment for studying and experiencing negative feelings and physiological states (Almossa, 2021; Kedraka & Kaltsidisi, 2020; Ng et al., 2021). By contrast, other studies have also shown that students perceive some advantages of distance education including the experience of positive feelings and the perception that distance education saves time and money, allows more time to spend with family, to study or to rest (Almossa, 2021; Kedraka & Kaltsidisi, 2020). Sitting in easier exams, having lenient submission deadlines, having a better understanding of the content of classes, improving one's performance, receiving support from professors, being subjected to opportunities for developing new skills have been among other advantages based on the views of the students (Almossa, 2021; Kedraka & Kaltsidisi, 2020; Khalil et al., 2020). In a quantitative study, Lassoued et al. (2020) among faculty members and students at universities in the Arab world found a range of barriers to distance education. Some of which included reluctance to implement distance education, difficulties in teaching/learning applied subjects and evaluating learning, a lack of interaction between faculty members and students, low confidentiality and protection of data and unsuitability of home environment for distance education.

These findings are noteworthy. However, quantitative research is guided by theoretical or professional views. However, since students' and faculty members' experience of distance education during COVID-19 pandemic is not

yet well-understood, it is also important that this experience is also examined by undertaking qualitative research. This is because arguably qualitative research has the potential for identifying factors that cannot be captured by quantitative research.

A qualitative study (van der Meer, 2021) among faculty members teaching in medical schools and their students, identified a number of challenges such as students not attending classes and not socializing outside the classroom, experiencing difficulties in staying connected to the medical professional community. Findings also stressed the importance of sharing emotions and experiences, adjusting one's communication style, giving group assignments, and initiating group discussions. Findings also provided some guidelines for improving distance education. Of particular importance were planning online video breaks with students, conversing via unofficial means of communication, giving creative assignments and assignments that stimulate autonomy and competition and proving opportunities for students to share their emotional experiences and interests and future career plans. Yet another qualitative study (Porter et al., 2020) among faculty members teaching in nursing faculty, found that faculty members lacked necessary skills to teach in distance education, time to prepare and review their work prior to the commencement of the classes but this transition provided opportunities to be creative in how they delivered the courses. Findings also suggested that faculty members created an engaging learning environment by giving innovative assignments, quizzes and videos. In a review on distance medical education in the context of COVID-19 pandemic, Nimavat et al. (2021) described the challenges that faculty members and students experienced. These included a general negative attitude towards distance education, difficulties in time management, a lack of consideration for personal life, experience of stress and students' decreased interest in classes.

Although previous studies have been useful in identifying some aspects of university students' experience of distance education during COVID-19 pandemic, some of these studies have been quantitative in nature and consequently were guided by theoretical or professional views. On the other hand, other studies have been mixed design studies. It is also important to examine university students' views by using a qualitative methodology because this has the potential for identifying factors that cannot be captured by quantitative research. Also, the sample of most studies included university students who were studying a particular subject. Therefore, it is important to examine the views of university students studying different subjects in a single qualitative study in order to identify commonalities. To the authors' knowledge, no such study has been carried during the COVID-19 pandemic. Qualitative findings undertaken among faculty members indicated that qualitative research could help to identify aspects of faculty members' experience of distance education in medicine and nursing during the COVID-19 pandemic in ways that were not identified by quantitative research. To the authors' knowledge no qualitative study was undertaken among faculty members who are teaching various subjects other than medicine and nursing in distance education within the same study during COVID-19 pandemic in a systematic and detailed way in Türkiye and in different parts of the world.

Therefore, the present qualitative study aimed to understand the experience of undergraduate students who were studying different subjects and of faculty members teaching various subjects in distance education during COVID-19 pandemic in a foundation trust university in Türkiye and to compare and contrast these experiences. The

findings of the present study can provide a user-derived evidence base for more efficient delivery of distance education in similar difficult circumstances. These findings can also guide future efforts to develop a user-derived questionnaire to measure the effectiveness of distance education in similar difficult circumstances.

Method

Participants

Qualitative studies collect detailed data from a small number of individuals, making the findings difficult to generalize (Miller & Crabtree, 1992). Therefore, qualitative studies utilize the concept of transferability, which means applying the findings of a study to situations like those of the study (Henwood & Pidgeon, 1992). Since the present study is a qualitative study, the sample was chosen using the purposeful sampling method. In this context, the 'typical case sampling' method was used to select participants who could provide detailed information about the subject of the research (Henwood & Pidgeon, 1992; Patton, 1990). The 'typical case sampling' method allows targeting key participants who show typical characteristics on any topic (Patton, 1990). That is, this sampling method helped select participants who could describe and illustrate what is typical of distance education during the COVID-19 pandemic (i.e., the key issues that should be taken into account when thinking of distance education during the COVID-19 pandemic) (Patton, 1990). Therefore, this sampling was considered as the best method to select undergraduate students who were studying and faculty members who were teaching via distance education in a foundation trust university during the COVID-19 pandemic. In qualitative research the use of the 'typical case sampling' method, key informants can help identify or define what is ‘typical,’ and ‘typical’ undergraduate students and faculty members can be selected through the cooperation of these key informants (Patton, 1990). In this study, 'typical undergraduate students’ in this context can be defined as students who were between the ages of 18 and 30 and were studying in distance education at various departments of the given foundation trust university. These undergraduate students were identified by the Deans of each faculty where they were studying in as key informants. 'Typical faculty members' during the COVID-19 pandemic were defined as faculty members who were teaching both compulsory and elective courses through distance education at the faculties of the given foundation trust university, were employed on a full-time basis, and who held at least a doctorate degree or were writing their thesis towards obtaining this degree. These faculty members were identified by the Deans of each faculty where they were teaching as key informants.

Typical case sampling ensured the transferability of the findings to the undergraduate students and the faculty members of other foundation trust universities in Türkiye who studied in or provided distance education during the COVID-19 pandemic (Henwood & Pidgeon, 1992). Being reflective was considered to contribute towards transferability. Being reflective meant the provision of sufficient transcript material to illustrate the themes and the sub-themes identified during the analysis. Sampling continued until ‘theoretical saturation’ was reached (Patton, 1990); that is, the data collection process continued as new information was gained, and the sampling was terminated when no new information was obtained (i.e., when additional data did not change the analysis including themes and sub-themes identified).

The sample consisted of 34 faculty members and 35 undergraduate students. The undergraduate students were studying in various faculties. Table 1 summarises their demographic characteristics. All participants were single and most were unemployed. The faculty members were teaching in faculties of Economics; Administrative and Social Sciences; Pharmacy; Health Sciences; Medicine; Arts and Sciences; Engineering; and Fine Arts, Design and Architecture. Table 2 summarises their demographic characteristics.

Data Collection

Data was collected through focus group interviews, which were video-recorded over an online platform. The interviews were transcribed before the analysis. Undergraduate students and faculty members participated in separate focus group meetings.

The focus group interviews were undertaken based on the general interview approach, which had been used in previous studies by the first author (Krespi et al., 2004; 2008; 2016; 2017a; 2017b; Krespi Boothby, 2011; Tankurt et al., 2016). In the general interview approach, several key topics are identified before focus groups interviews start and questions are drafted based on the flow of the focus group interviews. In the process, the order and wording of the questions may change (Patton, 1990). The general interview approach allows for the emergence and description of unforeseen topics before the focus group interviews begin. During the focus group interviews participants were prompted to describe the nature of distance education during the COVID-19 pandemic, difficulties experienced, the ways in which these difficulties were managed, feelings about distance education during the COVID-19 pandemic, positive and negative aspects of distance education during the COVID-19 pandemic, motivation towards distance education during the COVID-19 pandemic and ways of improving distance education in the future in difficult circumstances like COVID-19 pandemic. All focus group interviews were undertaken by the first author, MRKU. At the end of these meetings, participants were also asked to complete the sentence, 'distance education is like …… because ……..' to develop metaphors to describe distance education which was previously used (Kaleli Yilmaz & Guven, 2015). The interviews were undertaken in Turkish. The analysis was undertaken on the data in Turkish than the data included in the article was translated.

After obtaining Ethics Committee approval, participants were asked to read and approve the informed consent form via the Qualtrics platform. After the participants completed the informed consent form, they completed the General Information Form, which included questions about demographic characteristics. They then participated in the focus group interviews via an online platform. Each focus group interview lasted approximately 40-50 minutes. The focus group meetings were undertaken with faculty members between 16.06.2020 and 07.07.2020 and with undergraduate students between 30.06.2020 and 12.07.2020.

Data Analysis

Various theoretical approaches can be used for data analysis and interpretation in qualitative research. Grounded Theory (Glaser & Strauss, 1967) shaped this research. In the context of this theory, a few qualitative data analysis strategies (repetitive data collection cycles, data coding with multi-step processes and comparative analysis) have

Table 1

Demographic Characteristics of Undergraduate Students

No.	Sex	Date of Birth	Occupational Status	Faculty	Scholarship (%)	Grade
1	Male	2001	Unemployed	FoP	50	2
2	Female	1998	Unemployed	FoP	25	3
3	Male	2001	Unemployed	FoP	0	1
4	Female	1999	Unemployed	FoP	25	3
5	Male	1998	Unemployed	FoHS	25	4
6	Female	1998	Unemployed	FoHS	25	4
7	Male	1997	Unemployed	FoHS	25	4
8	Female	1996	Unemployed	FoHS	100	4
9	Female	1999	Unemployed	FoHS	100	4
10	Male	1999	Unemployed	FoEASS	Missing	1
11	Male	1999	Unemployed	FoEASS	Missing	4
12	Female	1998	Unemployed	FoM	50	
13	Male	2000	Unemployed	FoM	25	2
14	Female	2000	Unemployed	FoM	100	1
15	Female	1998	Unemployed	FoAS	100	4
16	Female	1999	Unemployed	FoAS	0	3
17	Female	1999	Unemployed	FoAS	50	3
18	Female	1997	Unemployed	FoAS	50	3
19	Male	1999	Unemployed	FoFADA	50	2
20	Missing	2000	Unemployed	FoFADA	25	1
21	Female	2000	Employed	FoFADA	50	2
22	Male	2000	Unemployed	FoFADA	25	2
23	Missing	2000	Employed	FoFADA	50	2
24	Female	2001	Unemployed	FoE	50	2
25	Male	2000	Unemployed	FoE	50	2
26	Female	1995	Employed	FoEASS	100	4
27	Male	2000	Employed	FoE	50	2
28	Male	2000	Unemployed	FoE	100	2
29	Male	1990	Unemployed	FoE	50	3
30	Female	1998	Unemployed	FoEASS	100	4
31	Male	1999	Unemployed	FoEASS	100	4
32	Male	1995	Unemployed	FoEASS	100	4
33	Male	2000	Unemployed	FoEASS	100	1
34	Male	2000	Unemployed	FoP	25	2
35	Male	-	Unemployed	FoP	100	1

Note. FoEASS= Faculty of Economics,Administrative and Social Sciences; FoP= Faculty of Pharmacy; FoHS= Faculty of Health Sciences; FoM= Faculty of Medicine; FoAS= Faculty of Arts and Sciences; FoE= Faculty of Engineering; FoFADA= Faculty of Fine Arts, Design and Architecture.

Table 2
Demographic Characteristics of Faculty Members

Participant No.	Sex	Date of Birth	Marital Status	Faculty	Title	Tenure	Previous Experience of Teaching in Distance Education	Device
1	Female	1964	Married	FoEASS	Dr.	4 years	No	Laptop
2	Female	1980	Single	FoP	Dr.	2 years	Yes	Computer
3	Male	1966	Married	FoP	Prof.	3 years and 3 months	Yes	Laptop
4	Female	1957	Married	FoP	Assoc. Prof.	8 years	No	Laptop
5	Female	1988	Single	FoP	Dr.	4 months	No	Laptop
6	Male	1985	Single	FoP	Instructor	6 years	No	Laptop
7	Female	1982	Single	FoEASS	Dr.	2,5 years	No	Laptop
8	Male	1982	Single	FoEASS	Dr.	Missing	Yes	Laptop
9	Male	1987	Single	FoEASS	Dr.	3 years	No	Laptop
10	Female	1971	Married	FoEASS	Dr.	26 years	No	Laptop
11	Female	1967	Married	FoHS	Dr.	3 years	No	Laptop
12	Female	1980	Married	FoHS	Assoc. Prof.	10 years	No	Computer
13	Female	1953	Married	FoHS	Prof.	44 years	Yes	Laptop
14	Male	1952	Married	FoHS	Prof.	30 years	No	Laptop
15	Female	1966	Married	FoHS	Dr.	8 years	No	Computer
16	Female	1977	Single	FoM	Dr.	7 months	No	Laptop
17	Male	1983	Living apart	FoM	Dr.	16 years	No	Laptop
18	Female	1984	Married	FoM	Dr.	4 years	No	Laptop
19	Male	1988	Single	FoM	Dr.	3 years	No	Laptop
20	Female	1986	Married	FoM	Dr.	10 years	No	Laptop
21	Female	1975	Single	FoAS	Assoc. Prof.	13 years	No	Laptop
22	Male	1981	Married	FoAS	Dr.	Missing	Yes	Laptop
23	Male	1982	Married	FoE	Dr.	5 years	No	Laptop
24	Female	1987	Married	FoE	Dr.	2 years	No	Laptop
25	Female	1986	Single	FoAS	Instructor	1 year	Yes	Laptop
26	Male	1973	Married	FoE	Prof.	20 years	No	Laptop
27	Male	1967	Living apart	FoE	Dr.	5 years	No	Laptop
28	Female	1984	Married	FoAS	Instructor	8 months	No	Laptop
29	Female	1987	Single	FoAS	Instructor	7 years and 10 months	No	Laptop
30	Female	1968	Married	FoFADA	Dr.	18 years	Yes	Computer
31	Male	1965	Married	FoAS	Assoc. Prof.	21 years	No	Laptop
32	Female	1979	Single	FoFADA	Dr.	2 years	No	Laptop
33	Male	1951	Married	FoFADA	Dr.	10 years	No	Laptop
34	Male	1986	Married	FoE	Dr.	2 years	No	Laptop

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been developed to analyze qualitative data systematically (Glaser & Strauss, 1967; Strauss & Corbin, 1990; Yardley, 1997). These qualitative data strategies were also used in previous studies by the first author (Krespi et al., 2004; 2008; 2016; 2017a; 2017b; Krespi Boothby, 2011; Tankurt et al., 2016).

Thematic data analysis was undertaken in parallel with the recruitment and the focus group interviews. The data was analyzed using the inductive method. That is, no theme(s) was specified in advance. Our analysis procedure followed established principles of data analysis that helped to ensure that the analysis was `grounded' in the data, rather than pre-existing theoretical or professional ideas (Henwood & Pidgeon, 1992; Patton, 1990). That is, analysis was based on patterns indicated by the data independent of previous findings on distance education (Glaser & Strauss, 1967). Interview transcripts were coded manually by using a constant comparative approach based on the Grounded Theory (Strauss & Corbin, 1990). This ensured that analysis was inductive and led by the data. More specifically, the analysis was undertaken by following a number of steps. First, the preliminary coding and analysis of a subset of transcripts was undertaken by one author (MRKU) who read and reread these transcripts. Second, this preliminary analysis was developed on the basis of the other authors reading and commenting on it and recurrent themes and sub-themes were identified. Third, these were tested and modified by 'cycling' between different sets of data (Salmon, 2002; Stiles, 1993). That is, recurrent themes identified in the preliminary analysis were compared against the new data obtained in the new focus group interviews and where necessary, the themes or sub-themes were changed or added as the analysis was further developed (Salmon, 2002). Fourth, the developing analysis was further read by and discussed with all the other authors. Lastly, the analysis was ended when no further changes were necessary and all transcript materials were categorized. Overall, the final themes and sub-themes were based and defined on the basis of common accounts provided by several participants.

In order to ensure the reliability of the data special attention was given to the comprehensibility of the themes, in addition to giving sufficient accounts that illustrated the themes (Stiles, 1993). In order to ensure the trustworthiness of the analysis (validity) (Stiles, 1993) attention was paid to coherence, searching for negative cases, reflexive validity, theoretical validity, triangulation of the analysis, theoretical validity and catalytic validity. Coherence is related to a number of characteristics including the degree to which: 1) the interpretations were comprehensive, 2) the themes and sub-themes fit the data, and 3) the themes and sub-themes were associated with the subject being studied in this case distance education during the COVID-19 pandemic (Henwood & Pidgeon, 1992; Stiles, 1993). Searching for negative cases involved looking for participants' accounts which illustrated the reverse of a theme (i.e., accounts indicating that a particular theme was not universal) (Henwood & Pidgeon, 1992; Patton, 1990; Stiles, 1993). For example, contrary to some accounts which illustrated academic development, negative cases would be accounts which illustrated the absence of such development. Reflexive validity (Stiles, 1993) was ensured by explaining how the themes and sub-themes were developed and changed during analysis. That is, this was achieved by disclosing assumptions or preconceptions of the authors in the beginning of the analysis and describing the ways in which these assumptions or preconceptions gave way to an understanding of distance education during the COVID-19 pandemic as a result of a deeper engagement with the transcript material. Triangulation of the analysis was undertaken by ensuring that different authors read and commented on the emerging analysis (Stiles, 1993).

Theoretical validity refers to the degree to which the themes, sub-themes and interpretations made are associated with theoretical ideas and/or literature findings (Miles Huberman, 1994). Catalytic validity refers to the degree to which the data and the analysis (themes and sub-themes identified) have implications for future practice and research (Guba & Lincoln, 1989). Consensus which is the same as replication in quantitative research, was achieved by following established principles or recommendations (Guba & Lincoln, 1989). Quantitizing (counting instances of qualitative findings) (Dixon-Woods et al., 2004) helped to test the completeness of the analysis. We counted the participants who provided accounts to illustrate the main themes identified during the analysis. This ensures the internal validity rather than, as in quantitative research, external validity.

Findings and Discussion

The authors' engagement in the transcript materials helped them gradually change the themes that were identified and develop the analysis. In the beginning of the analysis, it was necessary to go beyond the authors' a priori assumptions about distance education during the COVID-19 pandemic. Initially, the authors assumed that technical difficulties and negative aspects of distance education were an important part of participants' experience. Consequently, the transcript material was categorized accordingly. These themes reflected the authors' commitment to quantitative methodology and its assumptions. Close and more prolonged engagement in the transcript materials actually showed that this kind of categorization did not represent participants' experience of distance education during the COVID-19 pandemic fully and coherently. There were many more different difficulties as well as positive aspects of distance education. As a result, not only technical elements but also other aspects of participants' experience stood out as important themes. In particular, there were a wide range of gains. These gains were initially categorized on the basis of teaching related activities. However, the authors realized that there were gains that included for example, the view that distance education during the COVID-19 pandemic helped towards getting developed both academically and personally which extended to the idea that one can find positive meaning from distance education. Also, many accounts described deterioration in teaching activities as well as improvement in them. Therefore, different themes and subthemes were developed that made the analysis more coherent. More specifically, it was possible to group the views of the participants about distance education under a number of themes: nature of the distance education; technical difficulties; gains; internal states; negative and positive aspects of distance education; motivating or demotivating factors of distance education; and ways of improving distance education.

Initially, the data related to metaphors were analyzed separately and were grouped into positive, negative and neutral metaphors. Further engagement in this data helped the authors realize that initial nine groups of main themes actually illustrate what is being pictured in metaphors. In fact, metaphors were so vivid that they also incorporated internal states both negative and positive, as well as positive and negative aspects and gains of distance education during the COVID-19 pandemic as well as motivating or demotivating factors of distance education. However, more in depth engagement in the data related to metaphors helped the authors realize that the metaphors were in fact higher order categories which formed a continuum including the Experience of Loss, Transformation and Neutrality. Only, moving away from a priori knowledge based on quantitative research made possible to understand the

importance of these metaphors in the participants' experience of distance education during the COVID-19 pandemic. Accounts in italics refer to participants' accounts illustrating a given theme. Numbers refer to the numbers given to participants to identify them.

Experience of Loss

This higher order category incorporated negative metaphors and reflected what distance education during the COVID-19 pandemic actually took away from participants' life (i.e., losses incurred because of the COVID-19 pandemic). In other words, this higher order category actually indicated the view that the essence of one's existence is lost because of distance education. Tables 3 and 4 detail the use of these metaphors. For example, for faculty members of particular importance, there was a metaphor describing distance education 1"like a life without spirit…" For the undergraduate students of particular importance, there was a metaphor describing distance education as 10"It is like the unsatisfactory season of a soap opera that you have waited for a long time." or distance education being 34"a bird with a broken wing…" To the authors' knowledge previous research did not report this higher order category or these metaphors. These metaphors can be used in future educational interventions aiming at promoting better distance education practices during difficult circumstances such as the COVID-19 pandemic. These can also be used to develop systems for supporting faculty members teaching in and undergraduate students studying in distance education in future difficult circumstances such as COVID-19 pandemic.

In a more concrete way, this higher order category incorporated the experience of technical difficulties, negative internal states and the views that distance education had a number of negative aspects and is demotivating.

Technical Difficulties

Undergraduate students stated that they experienced some technical problems such as 16"freezing" and 31"disconnection of internet," poor online recordings and a lack of internet access. Other technical glitches were described as 34"some professors could not be heard, … they could not see our messages." They also mentioned some systemic inadequacies. These included 27 "absence of a system where everyone can turn on their cameras or talk instantly," low upload capacity, and insufficient number of computers. According to undergraduate students,

Table 3

Undergraduate Students' Use of Metaphors to Describe Distance Education

Part. No.	Negative Metaphors	Part. No.	Positive Metaphors	Part. No.	Neutral Metaphors
1	It is like the girl that I love. I see her but I cannot touch her.	9	It is like a door because ... it has marked a new era.	7	It is like ying and yang. … both black and white, good, or bad.
2	It is like a nice perfume but too much of it is ineffective.	12	It was like a game for me because I have created my own character and attended classes. … This virtual character went to an adventure.	8	It is like an individual. This definition varies from person to person.
3	It is like an ocean you need to know how to swim.	13	It is like an app that is working in the background. I can use it any time that I need.	21	It is like a sport video. Just watching is useless but practicing at the same time gives favorable results.
8	It is like a dish. The more stuff you add in it, the harder it gets to digest.	16	It is like freedom, like statue of liberty because in distance education we can reach to lectures anytime we want.		
10	It is like the unsatisfactory season of a soap opera that you have waited for a long time.	17	It is like future because I think the future will be shaped this way.		
15	It is like longing because it is like trying to make up for lost face-to-face education via technology.	26	It is like a bridge. Because ... this system is a system that ensures the link between the old and the new system.		
24	It is like loneliness because I had to study in my room on my own.				
25	It is like a vegetative state. … It was a process that everything was managed inside a room.				
27	It is like the space because at the beginning, everything was uncertain.				
28	It is like the missing part that we never find while doing a puzzle. … you wish to complete something, … but something is always missing.				
34	a bird with a broken wing … because … we could not go to a place like a bird who have wings.				

Table 4

Faculty Members' Use of Metaphors to Describe Distance Education

Part. No.	Negative Metaphors	Part. No.	Positive Metaphors	Part. No.	Neutral Metaphors
1	Like a life without spirit... Like miscommunication... Because there is no communication, ... Like a tree which gives no fruit... Because there is no interaction.	2	It is the necessity of our time. It is like a life jacket.	6	It is like a life jacket…. Because the ship sank. There is nothing to do anymore, but this life jacket may not be that effective.
7	It is like lecturing on your own because it is hard to inspire students.	4	It is a technological revolution … because there are so many things to discover.	8	It is like a practical effort ... because … all of us had to adapt to it as an obligation.
9	It is like pretending because it is distant. It is not real.	5	It is both a life jacket and saver and it is also supportive.	10	It is like listening a soap opera on the radio ...—its effectiveness depends on how vivid it is narrated.
14	It is like driving in a foggy day. If you are not careful, you cannot achieve your aim …and you can also hurt someone.	20	It is like a lighthouse because it has brightened our minds during quarantine.	11	I think it is just like an iceberg. We are working on the part that we can see. But if the infrastructure is insufficient, the situation can be unperceivable, uncontrollable, and unmanageable like the lower part of the iceberg. And all our efforts can be wasted.
17	It is like a long-distance relationship because you cannot be in it for a long time. It is like a flower because … it is nice to see it, but it cannot be effective if you cannot smell it.	23	It is like a newborn baby because it is open to development.	13	Snowball … If you add something on it, it will grow. But you need to be attentive, or else the snowball will melt, or it turns into an avalanche. … it could also be dangerous.
21	It is like a tunnel that you cannot see the end of it. … You cannot predict where the light is.	24	It is like technology because as the technology improves, our lives get easier.	16	It is a flower because if you care, …. if you water, it becomes fruitful. But if you do not, it will dry out.
26	It is like breaking up... because there is no face-to-face physical interaction anymore.	25	It is like Netflix; you can watch it any time you want.	18	I can say it is like a necessity. Because it is at the center of our lives.

29	It is like a video game because it is virtual. Everything was so virtual and distant.	28	It is like a lifeboat because it took us to the shore.	19	It is like an egg. If you hold it tight, you could break it. If you hold it loose, you could drop it.
30	It is like a dream because I cannot touch it.			22	It is like a wild ocean. If you can swim, it (distance education) will take your load off, will take you to the shore, to the safety. But if you cannot swim, it will choke you.
31	It is like a little amount of water … in the desert. … although it is insufficient, you need to do with it any way.			27	It is something that somehow must penetrate and be in our lives.
32	It is like a life jacket because it keeps you above water, but it does not get you out of water and survive.			34	It is just like a carbon array because it could be a diamond or graphite

professors differed in terms of the ability to use the system. Similarly, technical difficulties and 20 "technical hardware problems" were mentioned by the faculty members. Technical difficulties included freezing of the system and disconnection from the internet or a lack of internet connection. However, the experience of technical difficulties was not universal. Hardware problems included the absence of systems for asking verbal questions, uploading lengthy video recordings, using audiovisual materials, using simulating applications, blackboards and systems for instant image and speech. In addition, there were difficulties in having access to computers and the necessity for using more than one platform in this process.

These findings are not surprising and are consistent with previous findings indicating the experience of similar technical or technological problems among students (Himat et al., 2021) and faculty members such as a lack of access to internet, sufficient computers and infrastructure (Lassoued et al., 2020; Nimavat et al., 2021). However, the present findings indicate a wider range of technical and hardware difficulties that need to be considered if the aim is to improve distance education practices in the future in similar difficult circumstances.

Negative Internal States

The negative internal states were an important part of faculty members' and undergraduate students' experience of distance education. Table 5 lists these negative internal states.

For faculty members internal states involved negative cognitions including the perception that one is sacrificing oneself and negative physiological states such as headache as well as many negative emotions/feelings ranging from fear to hatred. Of particular importance, there was longing. Participant 20 explained her longing as follows: "I miss the smiles of my students very much; I miss chatting with them and making jokes during the lesson…I think they (students) miss taking lessons in classrooms, in a crowded environment, in a social environment". Still, some faculty

members experienced mixed negative internal states such as worry and angry. Faculty members like themselves also recounted that their students, and their parents experienced negative internal states including negative emotions or feelings as well as negative physiological states. As in themselves, participants also felt that the students also

Table 5

Views on the Negative Internal States

Faculty Members' Views of their Internal States
Negative feelings
Being stuck; intolerant; out of control; uncertain; dissatisfied; restless; shy Feeling empty; unhappy; alone; worthless; helpless; inadequate; distrusted; bruised; tense; strained; worried; frighthened; anxious; uneasy; doubtful; stressed; panicky; uncertain; lethargic; overwhelmed; distracted; discouraged; hateful; angry; as if it is the end of the World; longing
Negative physiological states
Having a headache; being fatigued
Negative cognitions
Perception that one is sacrificing oneself
Faculty Members' Views of their Undergraduate Students' Internal States
Negative feelings
Feeling overwhelmed; uneasy; anxious; stressed; depressed; lethargic; empty; angry; distracted; psychologically weary; being alarmed; being bored; longing
Negative physiological states
Having a disturbed sleep
Undergraduate Students' Views of their Internal States
Negative feelings
Helpless, down, sad, discouraged, uncertain, shocked,hopeless, gloom, panicky, anxious, worried, lost, stressed, frighthened, demoralised, bored, pressurised, empty, confused, irritable, uncomfortable, devastated
Negative cognitions
Having a sense of: Sacrificing one's personal life, Giving up, Not being able to focus, Being biased, Lacking discipline, Lacking trust, Devaluation, Reluctance, Failure, Perfectionism, Pessimism, Longing
Negative physiological states
Exhaustion, Suffocation, Fatigue, Lethargy, Lack of sleep, Skin reactions

experienced longing for the classroom environment and professors. Indeed, these descriptions were consistent with undergraduate students' accounts of their internal states. Also, similar to the faculty members' experience undergraduate students recounted to experience a wide range of negative feelings (such as feeling 9"down,"), cognitions (such as having a sense of sacrificing one's personal life) and physiological states (such as fatigue). Participant number 24 explained the sense of a lack of discipline as follows: "if class starts at half past 10…I would get up at 10, so I would have breakfast quickly and go to class with my pajamas on my bed or at my table. it wasn't very good for me... What I understand is that it is the school that disciplines me."

These experiences are consistent with previous findings showing a wide range of negative feelings and physiological states among students (Almossa, 2021; Ng et al., 2021) and negative feelings among faculty members (Nimavat et al., 2021). Also, another study's (van der Meer, 2021) findings stressed the importance of sharing emotions and experiences. However, the present study identified a wider range of negative internal states which included feelings but also physiological states and cognitions. These findings highlight the importance of internal states in distance education. The experience of negative internal states is likely to hinder effective delivery of distance education. More specifically, these internal states are likely to interact with the ways in which distance

education is perceived and motivation occurs in relation to teaching or studying in distance education. Future quantitative studies need to examine these effects. Therefore, systems for supporting faculty members and undergraduate students in future difficult times need to reduce the experience of negative internal states if the aim is to offer effective distance education.

Negative Aspects of Distance Education

Both groups described some negative aspects of distance education related to the delivery of the classes, assessment and evaluation, and personal life. In addition, undergraduate students also described some negative aspects in relation to administration and professors. Table 6 lists the negative aspects of distance education in relation to the delivery of the classes. Some negative aspects such as late loading of the course materials can be also experienced during face-to-face education. However, there were many negative aspects specific to distance education. There were common negative aspects to both groups such as short duration of the classes. For example, the undergraduate number 34 described this prominent negative aspect as follows: 34"A two-hour or two-and-a-half-hour class lasts 45 minutes, so I think it's kind of a joke." Another prominent and common negative aspect of distance education to both groups was the view that applied courses were taught as if they were theoretical courses. However, there were also undergraduate students and faculty members who did not perceive these negative aspects.

There were other prominent negative aspects for the faculty members, although not for undergraduate students. One of which was low participation or attendance in the lessons. Faculty member number 19 described the consequences of this as follows: "This can cause various problems in the professional life in the later stages, …, one hundred percent students focus only on passing the course, completing the academic year, but in the future, they will be doctors, architects, engineers. … They need to acquire this knowledge here." On the other hand, some participants stated that class participation increased. Another negative aspect worth noting was the perception that one as a faculty member was not natural: 21"I didn't like seeing myself on the screen, I wasn't very natural in the first lessons.", although this was not shared by others.

Indeed, based on the undergraduate students' experience there were a number of consequences of these negative aspects. One of which was non-attendance to the classes. Other consequences included the classes remaining abstract and facing the dilemma of getting high marks and not learning properly: 19"even though we got high marks, we didn't learn anything from the thing we got high marks." Relatedly, the lessons were compared to YouTube videos: 21" I didn't feel like I was living a university life, sometimes I was asking myself what's the difference from … watching videos on YouTube." These consequences have not been reported before. Contrary to face-to-face education, undergraduate students emphasized that independent learning required from distance education was difficult to achieve: 8"I see it as a situation where accessing information is easy but managing the process is very difficult. I mean, I think it is a platform with more responsibility. … I think that you need to study more or to do more research, you need to allocate more time." They recounted several barriers to independent learning. Although some barriers can also be relevant to face-to-face education such as a lack of obligation to attend the course and

Table 6

Views on the Negative Aspects of Distance Education Related to the Delivery of the Classes

Undergraduate Students	
Short duration of the classes	Laboratory studies being stopped
Absence of extracurricular activities	Canceling the internship programs
Limited library resources	Late loading of the course materials
Theoretical teaching of applied courses	Not using any teaching tools
Receiving emails at inappropriate times	Requiring make-up lessons
Early start of the lessons	Not repeating the unrecorded lessons
Being held responsible for the topics that were not taught	
Faculty Members	
Short duration of the classes	Repeating lessons
Students having no obligation for attending the classes	Not doing synchronous lessons
Doing make-up lessons because due to technical problems	Inability to offer applied courses
Not being able to communicate	Increased opportunities for cheating
Not being able to cover the full curriculum	Becoming estranged from the computer
Not being given the recordings of the lectures	Not being able to benefit from body language
Applied courses being taught as if they were theoretical courses	Not being interactive in the lessons
Parents' reluctance to pay full fees and student complaints	Low attendance or participation in the lessons
A lack of opportunities for an ongoing measurement	Not being natural while giving lectures

inability to teach 26"more interactively due to a limited time," undergraduate students particularly stated that their professors could not benefit from the body language of their students.

Short duration of classes (Almossa, 2021) and not being able to learn independently (Himat et al., 2021) have been reported before among students although not in faculty members. Nevertheless, the present findings extend the literature by providing a wider range of such aspects based on the views of both groups. Also, these negative aspects of distance education were not universal. This finding suggests that the experience of distance education does not necessarily entail the experience of negative aspects.

In terms of assessment and evaluation, as probably in face-to-face education, undergraduate students mentioned pop quizzes, meaningless or too many assignments and insufficient exam durations. However, the experience related to student presentations was clearly specific to distance education: 31"I can't see anyone (other students) while making a presentation - you can see the professor … that's all. I felt like I was making a wasted presentation, I don't think anyone is listening to me." As probably in the face-to-face education, in addition to different deadlines, difficult assignments, plagiarism, 5 "copying," injustice in marking, problems with question banks and changes made to the marking system were also mentioned. In line with this, among faculty members there was the view that distance education lacked opportunities for an ongoing measurement. Although not universal, this view extended to the idea that distance education 27"increases the opportunities for cheating a little more." In fact, low attendance in the lessons was perceived as being associated with cheating. Faculty members also recounted that they became estranged from the computer: 29 "it took me one week to prepare the homework and two weeks to read it… After a while, I got estranged from the computer. I really didn't want to see any electronic device in front of me." Similar negative aspects have been also reported by previous studies in the context of distance education among students (Khalil et al., 2020) and faculty members (Nimavat et al., 2021). Systems aiming at promoting the effective delivery

of distance education also need to target these negative aspects of distance education as these will also likely have an adverse effect on undergraduate students' performance. Future studies also need to examine these effects.

Negative aspects of distance education in relation to personal life formed an important part of both groups' experience. Common to both groups was lack of socialization. Indeed, although not universal, many undergraduates students recounted that their 26"social relationships were … damaged", 34"social skills were declined", their 17"financial opportunities declined." Faculty members when reflected on their students' experience they also felt that their students' personal life got also affected. Accordingly, faculty members felt their students were not able to go out, were 3"staying away from each other socially", were 7"not leaving the house", and were 7"deprived of the social environment". Faculty members stated that the deterioration of students' social life might have had a negative impact on their academic success. On the other hand, some faculty members stated that the social lives of their students did not suffer and that distance education would have had a positive effect on students' success: 23"Thanks to distance education, they received the lesson in 2 hours, focused, … and asked me the question directly and did their homework. They did so much better". Similarly, although not universal, many faculty members felt that they themselves 7"were trapped in the house" and expressed that theirs and their students' social lives were disrupted. The classroom environment emerged as an opportunity to socialize, as one faculty member put it: 31"Classroom is both an academic environment for us, but also a special environment where we socialize with our students." This finding suggests that distance education does not necessarily entail difficulties in socializing. Disruptions in social life have been reported by previous studies among students (Kedraka & Kaltsidisi, 2020) and faculty members (van der Meer, 2021).

Relatedly, faculty members also asserted that concepts such as day and night, weekend, and overtime disappeared and the balance between personal life and work got deteriorated. Moreover, relatedly, they stated that the personal boundaries disappeared, and they complained that they led an unhealthy lifestyle. 29 "concepts of day and night …hours, sleep hours got mingled. Eating and drinking patterns were disturbed excessively". This boundary problem was linked to their students' lack of discipline. Despite this, faculty members felt that their popularity decreased. Faculty members also reported that distance education 28"brought burden to the house order", created 26" some problems in private life" and caused changes in family dynamics: 8"many times I never left my room from morning to evening. This, in fact, had an impact on the family". This situation also led to a situation where all the roles became mingled: 28"motherhood, also classes and exams, everything became mingled… The biggest problem was being a full-time mother and an employee at the same time during the pandemic".

Not surprisingly, negative aspects of distance education related to administration formed a minor part of undergraduate students' experience. They stated that they were not able to plan because they were being informed at the last-minute. However, those related to faculty members formed a large part of their experience. According to undergraduate students, as in probably face-to-face education, a lack of sufficient English of both faculty members' and theirs but as probably different from face-to-face education, the unsuitability of domestic conditions also affected participation in the lessons. On the other hand, other undergraduate students recounted that it was possible to

be 14"interactive." Getting feedback helped towards being interactive. Nevertheless, although not universal, undergraduate students complained that they could not communicate with the faculty members outside the classes.

Based on the undergraduate students' experience negative aspects related to faculty members formed some continua. On one hand, there was the view that faculty members 4"could not adapt to the system," because of a lack of training and facilities to give lectures such as having an old laptop and the system being inflexible: 27"since our professors had a scheduled time and duration, no matter what they had to record the lessons at this scheduled time, and this seemed obligatory. … they had to look well, they had to tidy up their rooms, they had to put their children to sleep." On the other hand, there was the view that they can adapt to the system. Another continuum was related to whether faculty members were understanding. On one hand, there was the view that the faculty members were understanding: 28"we had professors who say 'can you tell me what the problem is? Can you give me the details of the problem?' 'We want to help you... the students like you.'" and that the students 8 "could easily reach them (professors) via e-mail when there was a part that we did not understand." On the other hand, there was the view that faculty members were not understanding or they were neutral. Relatedly, the views that faculty members kept their cameras turned off, did not conduct live lessons, reproached their students, were 11 "stressed" and were unwilling to teach were also mentioned. Consequently, undergraduate students distanced themselves from the course. Some of these findings can also be a characteristic of face-to-face education such as faculty members being stressed and being unwilling to teach. A lack of effective communication or interaction and opportunities to give feedback and difficulties in delivering the curriculum (Nimavat et al., 2021) have been reported previously among faculty members, although not in undergraduate students. Moreover, to the authors' knowledge, these continua and their probable consequences have not been reported before among undergraduate students and faculty members in the context of distance education during the COVID-19 pandemic. Academic performance of undergraduate students who perceive their professors at the negative end of these continua will be adversely affected. Therefore, future studies need to examine these effects.

Overall, the present findings extend the literature by providing a wide range of negative aspects of distance education which is likely to affect the delivery of distance education in negative ways. Future quantitative studies can also examine this effect. Therefore, systems for supporting distance education in future difficult times also need to reduce these aspects if the aim is to offer effective distance education. In particular, barriers to independent learning, lack of socialization among others need to be targets of systems aiming at increasing the effectiveness of distance education in difficult circumstances.

Demotivating Factors for Faculty Members

Faculty members considered distance education as demotivating. These demotivating factors were outlined in Table 7. Some demotivating factors were related to their professional role whereas others were related to personal and academic life. Most of the former factors were also considered as negative aspects of distance education. Based

Table 7

Demotivating Factors

Faculty Members' Views on Demotivating Factors for Themselves
Professional role
Not being able to give practical lessons, not being able to be interactive in the lessons, an increased workload, low student participation in the lessons, students being disinterested, being under pressure to give a pass mark, students getting others to do their homework for money or cheating
Personal life
Experience of internal states including uncertainty, feelings of worthlessness and loneliness, being forced to take an unpaid leave, being perceived as working less, deterioration of the balance between personal life and work
Academic life
Inability to do research
Undergraduate Students' Views on Demotivating Factors for the Faculty Members
Faculty members being accustomed to face-to-face education, student non-participation in the lessons, the fact that even students attending the classes not participating in class discussions, feeling helpless, students not putting any effort into lessons or homework, technical problems, putting effort to manage time, being unhappy while giving homework, marking homework, student objections
Undergraduate Students' Views on Demotivating Factors for Themselves
Student role
Changes in the course syllabus, having lessons at early hours, restrictions in reaching and communicating with the faculty members, not being able to focus on the lessons, the haste to complete the homework,
Technology
Assessment and evaluation
Cheating becoming normal
Personal life
Internal states such as fear, lethargy, uncertainty, A lack of intrinsic motivation
Academic life
A lack of opportunities for applying what is learned and for academic development
Faculty Members' Views on Demotivating Factors for their Undergraduate Students
Student role
Not being able to communicate face-to-face, attending the lesson at home, working alone at home, a lack of equipment and the lessons being recorded
Personal Life
Negative internal states experienced by students including dissatisfaction, uncertainty, anxiety, inability to concentrate A lack of social life

on the views of the undergraduate students the fact that even those who attended the classes were not participating in class discussions was demotivating for the faculty members. This extended to feeling helpless which was also demotivating: 1"I can see the helplessness in the eyes of the professors, 'For God's sake, are you here', their eyes

say…., the professor feels like he/she is lecturing in vain, I think my professors' motivation levels to lecture to a computer decreased."

Although not stated by the faculty members, undergraduate students also thought that faculty members 8"being unhappy while giving homework," 3"marking homework," and student objections were among other demotivating aspects of distance education for the faculty members. In addition to 22"students' disinterest", faculty members felt demotivated because of the pressure they were under to give a pass mark to their students: 11"We gave high grades to their homework. We were told, in fact, not to put pressure on them. …I can say that this reduced my motivation a little bit". Another demotivating factor for the faculty members involved the students getting others to do their homework for money or cheating.

In terms of personal life, the experience of internal states was also considered as demotivating by the faculty members. Of particular importance another demotivating factor involved being perceived as working less: 27" Although we, as faculty members, did not spend less effort than our previous work as in face-to-face education, I felt that this was not perceived as such from the outside … which was a bit demotivating". Again, the deterioration of the balance between personal life and work, also mentioned as a negative aspect of distance education was also considered as demotivating. In terms of academic life, inability to do research was a demotivating factor.

The importance of motivation in education is well known. Although many of these demotivating aspects can also be relevant to face-to-face education, to the authors' knowledge the present study is the first study which identified a wide range of factors which demotivated faculty members during COVID-19 pandemic based on their point of view and that of their undergraduate students. These findings highlight the importance of motivation in teaching and provide information on the specific ways in which faculty members can get demotivated in distance education. Therefore, these factors can be also viewed as targets of systems aiming at supporting faculty members teaching in distance education in future difficult times such as COVID-19 pandemic. These systems need to reduce demotivating factors during distance education if the aim is to offer effective distance education.

Demotivating Factors for Undergraduate Students

The undergraduate students reported several demotivating aspects of distance education for themselves. Faculty members also thought that their students had low motivation and recounted different demotivating factors. These demotivating factors were outlined in Table 7. Based on the experience of both groups these demotivating factors were related to student role and personal life. In terms of student role, faculty member number 17 recounted the lessons being recorded as a demotivating factor as follows: 17" After a while, they got relaxed…at first, they followed the lessons with curiosity, then they realized that they could listen to the same lesson again afterwards. In that case, they said 'why should I get up and listen at ten in the morning? I will listen later". In terms of personal life both undergraduate students and faculty members mentioned the experience of internal states as demotivating for the undergraduate students. Based on the views of the students, there were also some demotivating factors related to technology, assessment and evaluation and academic life. In terms of assessment and evaluation there was the view that 35"cheating has become normal." Also, in terms of academic life, a lack of opportunities for applying what is

learned and for academic development was noteworthy as demotivating: 35"We can't do anything that can help us with our academic career, we have to sit at home with our hands tied, frankly, this was a really bad motivation."

Although some demotivating aspects can also be relevant to face-to-face education, to the authors' knowledge, these aspects of undergraduate students' experience have not been reported before in the context of distance education during the COVID-19 pandemic. These findings provide information on the specific ways in which demotivation takes place among undergraduate students based on their point of view and based on the views of the faculty members. Therefore, these factors can be also viewed as targets of systems aiming at supporting undergraduate students during distance education in future difficult times. These systems need to reduce demotivating factors for the undergraduate students during distance education if the aim is to offer effective distance education.

Transformation

This higher order category which incorporated positive metaphors reflected actually the kinds of positive elements brought by the COVID-19 pandemic. Tables 3 and 4 detail the use of these metaphors. Of particular importance were faculty members' metaphors describing distance education as a technological revolution and as a newborn baby, and those of undergraduate students describing distance education being like the statue of liberty or a bridge or a door. In essence, this higher order category reflected the view that distance education during the COVID-19 pandemic had the power to transform the faculty members and the undergraduate students for the better i.e., it helped to transcend conventional views on education. To the authors' knowledge previous research did not also report this higher order category or these metaphors. In a more concrete way, this higher order category incorporated the experience of positive internal states and the views that distance education had a number of positive aspects and gains, and is motivating for both groups.

Positive Internal States

Many positive internal states were described by the faculty members. There was for example, not only feeling full of hope, 2" feeling safe" and 9" feeling self-efficacious" but also not feeling empty. Other positive internal states included 4"feeling excited", 10" being happy, being self-confident", 29" feeling good…being calm,… feeling peaceful", 24" feeling relaxed", 25" feeling valued", and 16"being curious". By contrast comfort and hope emerged as the only positive internal states in the experience of the undergraduate students: 34"When online education started, it seemed like a hope…thanks to our professors, we were going to be able to carry out the process somehow." In addition to the 25"feeling of comfort for being at home," there was also comfort in relation to distance education itself: 16"we were told that we could watch the lessons comfortably again later and we would not have any problems with grades."

These positive internal states are consistent with previous findings showing the experience of many positive feelings among students (Almossa, 2021; Kedraka & Kaltsidisi, 2020), although not in faculty members. Contrary to these previous findings, in the present study the undergraduate students experienced a limited range of positive internal states. These differences may be due to methodological and/or cultural differences. Future research may

examine these differences. As far as the authors are aware no previous study identified these positive internal states among faculty members. These findings suggest that teaching or studying in distance education during the COVID-19 pandemic entails the experience of positive internal states which included not only emotions and feelings but also cognitions (such as self-efficacy). These findings highlight the importance of internal states in distance education and indicate that the experience of distance education during the COVID-19 pandemic does not entail only the experience of negative internal states but also positive internal states. The absence of these internal experiences will compromise the effectiveness of distance education and it is likely that its presence will facilitate attempts to deliver high quality distance education. Therefore, future quantitative studies need to examine these effects. Therefore, systems for supporting faculty members and undergraduate students need to promote the experience of positive internal states if the aim is to offer effective distance education.

Positive Aspects of Distance Education

Both groups mentioned a wide range of positive aspects of distance education. These positive aspects of distance education were related to lessons and personal life.

Positive aspects of distance education related to lessons formed a large part of faculty members' and undergraduate students' experience of distance education. The fact that the lessons especially the theoretical ones, can be taught, and the ability to allocate more time to lessons were mentioned by the undergraduate students: 1"I was able to devote more time to the theoretical part of my graduation project and other projects as I had a lot of time…I was able to write the articles I needed to write and do the research I needed to do, in more flexible hours." Undergraduate students recounted that the recording of the lessons helped to solve the problem of overlapping class times in face-to-face education and to follow the classes more easily even when they were ill. However, the experience of these positive aspects was not universal in that for some undergraduate students the classes being recorded was not perceived as a positive aspect of distance education: 27"I started telling myself that now I could quit the lesson after a very long lecture hour. There was an audio recording, there was a video recording: However, they were definitely not watched by me afterwards, because these were ongoing things and I started to skip watching all the recordings of all the lessons."

In addition to being given homework instead of exams, undergraduate students asserted that participation in classes was easier: 13"Students can write comfortably…, they can ask whatever they want to but when they talk face-to-face in class, this is not possible, they can be shy, they can be embarrassed." In this process, the undergraduate students also emphasized the importance of the faculty members' support. Through distance education, undergraduate students stated that they 26"saved both time…and money," in particular in terms of the content of the courses: 2 "In this process, I felt that I saved time in some lessons.…when the professor summarized the important points in one hour and sent the slide, we could work and get the same effect."

Faculty members also mentioned similar positive aspects related to the lessons. These included completing the curriculum and teaching in new and different ways: 26"I had a website. I added the videos of the solutions of the problems to that website with a YouTube link". Another participant mentioned the use of blackboard and video recording: 23"I actually used a blackboard in the home environment to teach the lesson in the first weeks. And I

recorded short videos using this board and uploaded them to the system before the lessons". Although some faculty members perceived recording of the lessons as positive, others disagreed. At the same time, according to faculty members, distance education provided both students and themselves with the opportunity to attend the lessons from anywhere.

Faculty members, although not the undergraduate students, mentioned other positive aspects that were related to the classes but went beyond the actual delivery of the classes. These included good library facilities, meetings, an increased interest in the course, opportunities for using different measurement and evaluation methods (for example, giving homework instead of exams and vice versa), improving lecture notes, transferring lecture notes to digital media and using lesson time more efficiently, as well as a higher percentage of sitting in the exams and the improvements in students' grades.

In terms of personal life, undergraduate students mentioned spending more time with family: 15"I'm in (city name). Right now, my school is there but my family lives in a different city. We hardly saw each other. … It was very good, to see my family, to relieve longing." Working from home, not commuting to work (1"the positive aspect was being able to stay away from the crowds and minimize the risk of the disease"), and laxed style of clothing were also mentioned: 17"There is a comfort, for example, you can give your lectures while you are wearing pajamas, tracksuits and shorts". Faculty members recounted that being at home also enabled them and their students to save money and time: 25" It seemed to me that it provided extra time…it was a very efficient process in terms of saving time, like the roads or other factors".

Previous studies have reported saving time, travel, and money, convenience of attending classes, having more time for family and studying, better understanding of the content of classes and receiving support from faculty members as positive characteristics of distance education among students (Almossa, 2021; Kedraka & Kaltsidisi, 2020), although not among faculty members. The present findings extend the literature by providing a wide range of positive aspects related to the delivery of the classes and personal life. Overall, these findings indicate that the experience of distance education does not entail only negative aspects but also positive aspects. The perception of positive aspects of distance education is likely to promote effective delivery of distance education. Future quantitative studies can also examine this effect. Systems for supporting faculty members and undergraduate students in distance education in future difficult times need to promote the perception of these positive aspects if the aim is to offer effective distance education.

Gains

The gains were an important part of the faculty members' and undergraduate students' experience of distance education during the COVID-19 pandemic. Faced with a style of teaching/learning that they were not familiar with, faculty members and undergraduate students gained experience in compensating for negative aspects of distance education. For both groups these gains included academic and personal development. For faculty members, these gains have been also related to fulfillment of professional role and helping student cope. For undergraduate students, these gains also involved learning to cope. Refer to Table 8 for a more detailed outline of these gains.

Based on the undergraduate students' experience, academic development included improving one's foreign language skills, learning 8"how to prepare homework, how to write an article", engaging in 18"career planning," and

Table 8

Gains of Distance Education

Faculty Members
Fullfillment of Professional role
Using extracurricular means: Telephone, WhatsApp, Systems offered by the university like ALMS and OIS
Using practical strategies: Adapting class schedule to the students; giving students homework; using course booklets and lecture notes and question banks; encouraging students to communicate verbally rather than in written format; making use of slides and videos; scheduling additional lessons and lessons for helping towards exams; extending the duration of the lessons; giving extra points for participation; clarifying the rules; working on a one-to-one basis; giving more detailed information on a given topic.
Undertaking motivational activities: Joking; making the lessons funnier; talking to and chatting with the students; listening to music; using role plays; receiving feedback; adapting the content of the course to COVID-19 pandemic; organizing meetings and online seminars; teaching students to have access to information quickly; giving responsibility to the students in the lessons in a balanced way
Management of technical problems: Getting support from research assistants; increasing internet quota; using platforms like Zoom and WhatsApp; using spare computers; providing computers to students; sitting closer to the modem; sending objections to the relevant units
Helping students to cope
Formulating stress-reducing sentences; empathising with the students; spending the first 10 minutes of the lesson for conversation; using soothing techniques; giving responsibility to the students in the lessons in a balanced way.
Academic development
Attending to training programs; reading and writing articles; developing technical skills; adapting distance education to one's style of teaching; helping students to develop themselves academically
Personal development
Gaining positive experience
Developing personal qualities: becoming adaptable; flexible, patient; less prejudiced; developing perseverance; thinking positively; overcoming fear of camera
Returning to studentship
Learning to find practical solutions to practical problems: Trying not to think; self-soothing; goal setting
Allocating time for oneself
Getting professional support for self-improvement
Finding positive meaning from distance education: Going inwards; developing a sense of reckoning; rebirth and discovery; realizing that an era is closing down and another one is opening; appreciating the importance of health; appreciating individual shortcomings; transcending oneself.
Undergraduate Students
Learning to cope
Assistant teachers playing a mediating role, being in touch with faculty members and family members by phone and email, meeting with the Dean, distracting oneself, reading books, watching soap operas, exercising, creating a WhatsApp group, conditioning oneself, focusing on studying, lessons which had poor audio and video recordings being repeated, being offered additional lectures which helped to catch up with the lessons, asking questions
Academic development

improving one's foreign language skills, learning how to prepare homework, learning how to write an article, engaging in career planning, adapting to 21st century
Personal development
Working towards being healthy, preparing for the future by gaining experience Finding positive meaning from distance education: appreciating the value of school, appreciating the value of education, appreciating the concept of family, developing a desire to help humanity

adapting to 21st century: 26"I found that I was a student who was more nervous in online conversations, … or was shyer in these video conversations. However, I discovered that being involved in technology somehow provided adaptation to today's world." For faculty members one important way by which academic development manifested itself involved adapting distance education to one's style of teaching: 10" I think that I adapted distance education to my own style … sharing day to day experiences that are not related to the lesson at the beginning of each week, guiding students and preparing them for life…I couldn't do distance education; I did something like a mixture of the two". The faculty members also stated that they also helped students to develop themselves academically: 1" I gave books for them to read…. I suggested articles. I said to them 'improve your foreign language". On the other hand, some faculty members commented that 6" Distance education slightly decreased the academic feeling". Therefore, the experience of academic development was not universal. To the authors' knowledge, no other study identified the ways in which academic development was experienced in the context of COVID-19 pandemic among both groups. Therefore, these findings extend the literature by providing a wide range of ways in which academic development takes place in difficult times such as the COVID-19 pandemic.

Similarly, many accounts described different ways of getting developed personally for both groups. For undergraduate students, personal development consisted of working towards 18"being healthy," and preparing for the future by gaining experience: 14"I think distance education was like a simulation of the future because human relationships follow such a path and we had a trial run. In the future, … many more years later human relationships will not be face-to-face. … I think that almost everything related to human beings will be carried out in this way with technological tools." For faculty members these included for example, gaining positive experience and developing personal qualities, such as 30"being less prejudiced and overcoming 22 fear of camera". This extended to the idea of returning to studentship as well as understanding changing relationships: 13" Their siblings came and they introduced them to us, …, there were some things that did not happen when we were face-to-face with the students. … everyone introduced their dog to us…our dog always came to online lessons". There was also getting professional support for self-improvement as in: 22 "I had my own concerns about my external appearance due to excessive focus on academia…Well, how does my face look? How is my voice perceived? … How is my intonation, my pacing? … I got support from a filmmaker about this".

For both groups, personal development extended to finding positive meaning from distance education. Undergraduate student number 34 described this as follows: "I can say that I questioned life more. I realized what was more valuable, in fact, every day is the same…when I went out, I thought that a lot of things started to seem worthless because I was doing the same things all the time…you can say that … I started to question the meaning of the issue." Finding positive meaning involved appreciating 19"the value of school." and 18"education, the concept of

family," and developing a desire to help humanity. For faculty members, finding positive meaning included not only going inwards but also developing a sense of 26"reckoning", 10 "rebirth, discovery" such as realizing that an era is closing down and another one is opening, as well as appreciating the importance of 30 "health", and one's 10"shortcomings" and transcending oneself: 2"We learned, got used to, adapted, transcended ourselves…I said we transcended because we learned … the university's system. We learned Zoom". To the authors' knowledge, these findings have not been reported before among both groups in the context of distance education during the COVID-19 pandemic. These findings indicate that the experience of distance education does not entail only the experience of difficulties, on the contrary, it also involves the experience of some gains. Personal development especially finding positive meaning which is in line with post- traumatic growth (Tedeschi & Calhoun, 1995; 2004) can be a mechanism by which academic performance and motivation to study are fostered during distance education. This needs to be examined in future studies. Overall, systems aiming at improving distance education in future difficult circumstances need to promote the experience of coping strategies and development, especially personal development and finding positive meaning in particular and gains in general. That is, these systems need to promote the experience of gains in faculty members and undergraduate students if the aim is to offer effective distance education in difficult times such as the COVID-19 pandemic.

To fulfill their professional role, faculty members gained experience in using many different strategies such as using extracurricular means and undertaking motivational activities. Some motivational strategies included strategies such as 1" listening to music", 21" talking and chatting with the students", receiving feedback and adapting the content of the course to COVID-19 pandemic. However, one participant did not use innovative options such as *25 sample videos* to avoid ethical problems. Meetings and online seminars were also organized by getting support from different platforms such as Zoom. Students were also taught to have access to information quickly. Although the faculty members emphasized the importance of giving responsibility to the students in the lessons, they emphasized that this should be done in a balanced way.

As another area of gain, faculty members recounted that they helped students to cope by for example, formulating 24"stress-reducing sentences" and empathizing with the students. Indeed undergraduate students also mentioned that they learned how to cope as a gain: 16"when I encounter the slightest problem, I will no longer whine, and I will say that … I went through more difficult processes." In addition to stressing the mediating role of assistant teachers, undergraduate students stated that the faculty members and their families helped them cope for example, by being in contact with them by phone and email and meeting with the Dean. Other strategies included strategies such as distracting oneself, reading books, 18"exercising," and focusing on studying. However, other undergraduate students said that they could not communicate with the faculty members as they would like because of not being face-to-face, and this situation made it difficult for them to cope and increased their level of stress and anxiety. Therefore, the experience of learning to cope was not universal. Learning to cope and its related strategies have not been reported before in the context of distance education during the COVID-19 pandemic. These findings are not surprising but can be considered as useful strategies for developing distance education practices in the future in similar difficult circumstances.

Motivating Factors for Faculty Members

Undergraduate students felt that faculty members were generally motivated. However, there were also undergraduate students who disagreed: 28"the professors were demotivated and this changed the way they taught the lessons. They had difficulty in focusing on their lessons, which affected us, the students. Also, there were problems in transferring knowledge." Therefore, the view that faculty members were generally motivated was not universal.

According to undergraduate students and the faculty members themselves, factors motivating the faculty members were related to both professional role and personal life. Refer to Table 9 for a more detailed outline of these motivating factors. In terms of professional role, undergraduate student number 2 expressed her views as follows: "I saw that the professor was happy to motivate the student to attend the class by saying 'Guys, come, get your tea and coffee." In this way, I saw that he/she invites the student to the lesson with pleasure. The fact that he/she can do this motivates him/her." Based on the views of the faculty members themselves, the fact that the lessons could even be taught and the view that they could manage this process well emerged as most important sources of motivation. However, these were not sources of motivation for all faculty members. Increased students' interest in the lessons were also considered as motivating: 10" The effort of my students for their homework motivated me".

In terms of personal life, based on the views of the undergraduate students. 1"working from home" and being with family emerged as other factors that motivated the faculty members: 11"We have professors whose families are in (another city) and come here every week, for them it might have been motivating to stay at home and spend time with their families." Similarly, saving time and being at home, also described as positive aspects of distance education, were mentioned as sources of motivation by the faculty members: 25" Being able to do something for my future plans or goals or…having a flexible side to my job was a huge advantage for me, a serious source of motivation". However, other participants did not perceive being at home as motivating: 24"our office or the classroom was an environment where we were more disciplined, managing the whole process at home made me lose motivation in the first place". Of particular importance, positive self-suggestion such as 16"This is an experience for me, I will learn this", and breaking the routine 9" by allocating space to do sports at home", were also among motivating factors related to personal life.

Although the importance of motivation is well known, to the authors' knowledge the present study is the first study which identified a wide range of factors which motivated faculty members during COVID-19 pandemic. These findings highlight the importance of motivation in teaching and provide information on the specific ways in which faculty members can get motivated in distance education. Therefore, these factors can be also viewed as targets of systems for supporting faculty members teaching in distance education in future difficult times such as COVID-19 pandemic. These systems need to promote motivating factors if the aim is to offer effective distance education.

Motivating Factors for Undergraduate Students

Students perceived themselves as motivated. Faculty members also thought that the students managed to motivate themselves. According to faculty members, undergraduate students were motivated because they felt that they

Table 9

Motivating Factors

Faculty Members' Views on Motivating Factors for Themselves
Professional role
Being able to teach, managing this process well, being able to interact, getting positive feedback from students, students getting high grades, increased students' interest in the lessons
Personal life
Being at home, saving time, being able to produce or to achieve something, the feeling that one is useful, positive self-suggestion, breaking the routine
Undergraduate Students' Views on Motivating Factors for the Faculty Members
Professional role
Being able to do make-up lessons, organizing extracurricular classes and giving creative homework,
Personal life
Working from home, being with family
Undergraduate Students' Views on Motivating Factors for Themselves
Student role
Raising marks, understanding and learning the lessons better, being supported by the faculty members through giving a homework instead of an exam and giving appropriate assignments
Personal life
Allocating time to oneself, family support, being at home
Academic life
An increased opportunities for professional development, acquiring professional knowledge
Faculty Members' Views on Motivating Factors for their Undergraduate Students
Student role
Listening to lectures while in bed, classes being recorded
Personal life
Being at home, flexibility and saving time

managed to adapt to the pandemic conditions, and that the lessons were not stopped. Participants stressed that during this process informing the students every step of the way was very important. In order to motivate themselves, undergraduate students were thinking positively about the lessons: 2"You have the chance to listen to the points you missed, or if you could not follow during the lessons from the recordings." They also reported to motivate themselves on the basis of some future incentives such as 10"I will have a nice vacation after I finish the homework and I will have a rest." According to faculty members and undergraduate students themselves, motivating factors for the undergraduate students were related to student role and personal life. The undergraduate students also reported motivating factors related to academic life. Refer to Table 9 for a more detailed outline of these motivating factors.

In terms of student role, undergraduate students recounted that they were supported by their professors, and this support took the form of 9"giving a homework instead of an exam," and giving appropriate assignments. However, giving a homework instead of an exam was not motivating for all undergraduate students. Of particular importance, faculty members recounted that listening to lectures while in bed was motivating for the undergraduate students: 1"

someone said, ‘Professor, I got up in the morning, now I'm in my bed, I'm listening to the lessons from where I sleep, which is a very good thing".

In terms of personal life, based on the views of the undergraduate students family support – 28 "having my family by my side gave me motivation" – and being at home were also motivating: 15"I was at home in a safe area, this is a little more positive, I would say motivating." Being at home, flexibility and saving time were also among factors that motivated the students according to the faculty members. In terms of academic life, an increased opportunities for academic development were also among motivating characteristics for the students: 4"I have more time to improve myself.…I had the chance to attend them (online conferences), … I am thinking about internships abroad, … I am a little motivated in terms of how I can improve myself. … It has been a bit of motivation for me to learn a language, so I can say that we found motivation in terms of self-development."

These findings indicate a wide range of factors that undergraduate students themselves and faculty members considered as motivating for their students. These findings also highlight the importance of motivation in teaching and provide information on the specific ways in which undergraduate students can get motivated in distance education during difficult times such as the COVID-19 pandemic. Therefore, these factors can be also viewed as targets of systems aiming at supporting undergraduate students during distance education in future difficult times, such as COVID-19 pandemic. These systems need to promote motivating factors during distance education if the aim is to offer effective distance education.

Neutrality

In between the continuum from the experience of loss and transformation described above, this higher order category incorporated the neutral metaphors and reflected the view that distance education provided during the COVID-19 pandemic could turn out to be both a positive and a negative experience. Table 3 and 4 detail these metaphors. Of particular importance were the metaphors describing distance education as an iceberg and a life jacket by the faculty members and as ying and yang by the undergraduate students. This higher order category indicates that the experience of loss and transformation can actually occur simultaneously as evidenced by accounts on the nature of distance education. Similarly, there was a simultaneous experience of both positive and negative internal states. Still, there was also the experience of no internal state. Arguably, positive experiences in relation to distance education can be maximized by paying attention to ways of improving distance education outlined. To the authors’ knowledge the simultaneous experience of loss and transformation represented by this higher order category has not been reported before.

Nature of Distance Education

Both faculty members and undergraduate students considered distance education during the COVID-19 pandemic as a new experience. Faculty members emphasized the distance education team’s dedication and sacrifice, and especially the team’s spirit, as being very important for the success of distance education but pointed out that the students did not recognize how rapid and smooth the transition was: 17" Some of them (students) did not realize how

lucky they were, because they (students) were able to start education immediately". Distance education was considered as a challenge by both groups.

Both groups' views on the process of distance education formed some continua. The first continuum was related to how the process of distance education was managed. On one hand, among undergraduate students there was the view that distance education 17 "was managed very well." On the other hand, there was the view that this was not the case as described as being 34"not like in school." The same was also recounted by the faculty members. The second continuum was related to whether distance education was satisfactory. On one hand, there were undergraduate students who were 9"satisfied," while others indicated that they were 27"not satisfied at all." Dissatisfaction with distance education extended to the idea that 27"distance education should definitely not be undertaken." For some undergraduate students, dissatisfaction was associated with oneself rather than distance education. Although some faculty members stated that they were satisfied with the process, others said that they were not satisfied. One reason for dissatisfaction was that distance education was not appropriate for applied subjects. The last continuum was related to whether one adapted to distance education. Although some undergraduate students stated that "adapted to the new process", others recounted that they could not adapt. Relatedly, some faculty members recounted that they were caught unprepared and had difficulties in adapting to the transition: 4" In order to provide a proper and professional education, a long preparation period was needed. … We got straightaway into this education with the materials we used in face-to-face education". In contrast, other faculty members stated that they were able to overcome this by *34 revising the material,* despite being caught unprepared.

One continuum identified in the present study, satisfaction versus dissatisfaction is consistent with previous mixed findings among students (Himat et al., 2021) although not in faculty members. However, to the authors' knowledge, no study among undergraduate students or faculty members in the context of distance education during the COVID-19 pandemic reported findings consistent with the other continua. It can be argued that undergraduate students or faculty members who are at the negative end of these continua will be at risk of experiencing difficulties in teaching or studying in distance education. These effects need to be examined in future quantitative studies.

There were also differences in terms of preferred style of education among both groups. Some preferred face-to-face, some others preferred distance education and still others hybrid education for several reasons. In addition to technical disruptions, undergraduate students emphasized that a lack of 10"eye contact" and other difficulties experienced in distance education adversely affected classroom management, unlike in face-to-face education: 28"In face-to-face education, we could ask our questions more easily, we could express ourselves more clearly, we could understand our professors better. Our professors could analyze us much better, and they could shape the teaching style according to the way they analyzed the class." Still other undergraduate students stated that they would like to have "21 "both distance and face-to-face education." Faculty members advocating face-to-face education explained the reasons as to why face-to-face education was necessary as follows: 19" the mood of the person while lecturing to the audience is different from the mood to the computer in front of him". Conversely, the reasons for advocating distance education were explained as follows: 33" I don't even wish to think that such a system didn't exist in such a dangerous process. … I have to describe this system not as useful, but as necessary". Other faculty members

preferred hybrid education: 18" I think that home or distance education can also be beneficial for some courses". They also recounted the reasons for these preferences such as face-to-face education providing opportunities for interaction. These different preferences for educational style are not surprising and reflect the reluctance or unwillingness of some faculty members and undergraduate students to accept distance education because of being accustomed to face-to-face education. These are also in line with previous findings showing preference for distance (Khalil et al., 2020) or hybrid education (Ng et al., 2021) among students.

Ways of Improving Distance Education

Several ways of improving distance education were also mentioned. These have been related to the system, classes and broader aspects. These are listed in Table 10. In terms of the system, of particular importance some faculty members thought that the existing system needed to be improved for example, by enriching the software and ensuring the harmony of the different systems used: 23" the system where we enter the final grade, and the system where we enter the grade temporarily, …, were different from each other". Relatedly, some faculty members suggested using a single system rather than a number of different systems. Other faculty members recounted that it was necessary to switch to a new system. Still other faculty members emphasized that the university should have its own system. These faculty members also recommended that the system 1"was more interactive like zoom", 23"was more fluid…objective", and had a number of features including 17" a quick play option", 23" an increased visuality", 12" an increased variety of materials", and 26 "option for the students to talk". On the other hand, faculty members recommended that distance education could be offered as an option, and realistic virtual classrooms and laboratories could be used. Faculty member 34 described the virtual classroom as follows: "Each student chooses his/her own place, and there is a small image of the student on the desks.…you can even put a body instead of this image, … I think it would be nice if there was such a thing as an avatar that could walk in that classroom, in such a three-dimensional simulation environment…it would be nice for your fellow students to raise their hands and ask questions…when they press the button, the avatars there will raise their hand.… I think it would be a legend in the house.…this virtual reality has improved a lot". Undergraduate students also recommended that a number of improvements were made to the system such as switching to 16"video communication," reviewing the audio and video system and increasing the capacity of the system: 31"They used to say that a thousand people can participate in the system. … this number of participants can be increased. It can be 2000 people."

Of particular importance in terms of classes, undergraduate students recommended that lessons should be held in either hybrid or face-to-face format, and 27 "should be definitely moved into a system that is more interactive, where students and professors are integrated in the school environment more." In cases where this was not possible, they recommended that no distance education should be provided. 18"Doing the exams…under the supervision of professors at school," and changing the homework system such as giving short-term assignments were among ways of improving distance education. Various strategies for tracking class attendance such as 13"writing the school numbers on the chat panel," were also recommended. In addition to lengthening the duration of the lesson hours, undergraduate students also recommended the use of different teaching tools such as 10"giving examples instead of reading the slide." Although these ways of improving distance education were mentioned, some undergraduate

students were happy with the quality of teaching. More importantly, the undergraduate students stressed that 26"organizing … the environment where the professor lectures," was important. In relation to this area, faculty members suggested that increasing the duration of the lessons to 90 minutes, making attendance compulsory, not

Table 10

Ways of Improving Distance Education

Undergraduate Students
System
Moving into a more interactive system
Improving the system: switching to video communication, reviewing the audio and video system, making the video viewing screen more practical by rewind keys or by fast viewing, increasing the capacity of the system
Using new remote support software options such as Any desk
Carrying out an optimization study
Classes
Holding the lessons in either hybrid or face-to-face format
Providing no distance education
Doing the exams under the supervision of professors at school
Changing the homework system: giving homework instead of exams, giving short-term assignments, being marked on the basis of more than one homework, being assigned homework according to the facilities available
Tracking class attendance: Writing the school numbers on the chat panel, giving a questionnaire during the lesson and asking to write student numbers, accepting the students to the lesson one by one
Organizing the teaching environment: paying attention to the physical characteristics of the teaching environment, paying attention to the clothes, avoiding a dark teaching environment
Lengthening the duration of the lesson hours
Using different teaching tools: giving examples instead of reading the slides, telling a story and drawing the student into it, loading the slides to the system, making small laboratory videos
Applying the pass and fail system
Broader aspects
Increasing the facilities offered by the university such as computers
Training professors on using the system and on communication with students
Giving students and professionals psychological support
Increasing extracurricular activities
Faculty Members
System
Using a single system rather than different systems, switching to a new system, university having its own system, having a more interactive system like zoom, having a more fluid…objective system, having a system with a number of features including a quick play option, an increased visuality, an increased variety of materials, and an option for the students to talk, enriching the software, ensuring the harmony of the different systems used, system allowing students to connect to the video and audio system
Classes
Offering distance education as an option, using realistic virtual classrooms and laboratories, better coordination, planning, development of standards, offering training to faculty members for lecturing in distance education and preparing course materials, not scheduling lessons in the morning, increasing the duration of the lessons to 90 minutes, making attendance compulsory, not recording the lessons, giving one-to-one practical lessons, and standardization of the assessment system, exams being held at the university or could be conducted by careful monitoring
Broader aspects
Organizing communication skills seminars, increasing extracurricular activities, receiving psychological support, getting professional support

recording the lessons, giving one-to-one practical lessons, and standardization of the assessment system. Compulsory attendance extended to the view that the lessons needed to be interactive. However, some faculty members argued that compulsory participation either way would not make any difference.

In terms of broader areas, of particular importance the faculty members recommended offering training to faculty members for lecturing in distance education and preparing course materials as well as organizing communication skills seminars, increasing extracurricular activities, and receiving psychological support: 1"Since we are in an uncertain period for students, for us, for our country, for the world, what would it be like to get psychological help? What would happen to students and us? "

Some ways of improving distance education including improving infrastructure or technology, having more flexible evaluation and marking systems, improving course content such as preparing more engaging teaching materials have been documented by previous studies among students (e.g Han & Demirbilek, 2021). Also, among faculty members previous qualitative studies have also reported similar suggestions such as giving creative assignments and assignments that stimulate autonomy and competition, and providing opportunities for students to share their emotional experiences, interests, and future career plans (van der Meer, 2021). The ways of improving distance education identified in the present study extend the literature by providing other ways of improving distance education and therefore, may contribute towards the development of effective distance education that would be delivered in the future in similar difficult circumstances.

Conclusion

There has been a shift from face-to-face education to online education because of the measures taken to reduce the spread and burden of COVID-19 pandemic. These measures challenged universities and faculty members alike. Distance education seemed to be an indispensable tool to ensure the continuity of education in pandemic circumstances. The present qualitative study aimed to understand the views of faculty members and undergraduate students on distance education during COVID-19 pandemic in a foundation trust university in Türkiye.

Findings revealed negative, neutral and positive metaphors which described distance education during the COVID-19 pandemic. In fact, these metaphors indicated the existence of a continuum in the form of three higher order categories including the Experience of Loss, Transformation and Neutrality under which a number of themes were present. These included the nature of distance education, technical difficulties, gains, negative and positive internal states, negative and positive aspects of distance education, demotivating and motivating factors, and ways of improving distance education. Surprisingly, in general terms, views of distance education were mostly consistent across both groups. Moreover, each group was able to infer to the experience of the other group empathetically. This highlighted the two-way-process of teaching and learning.

The present findings provide a user-derived evidence base for future distance education practices in difficult times, such as COVID-19 pandemic. That is, many faculty members' and undergraduate students' views identified in the present study can be viewed as targets for systems aiming at supporting faculty members and undergraduate

students in difficult times if the aim is to offer effective distance education. Arguably, technical problems and hardware difficulties need to be reduced to a bare minimum.

However, more importantly, these systems need to promote gains, personal development which took the form of finding positive meaning from distance education. In particular, finding positive meaning took the form of for example, transcending oneself and appreciating the importance of health and developing personal qualities such as becoming less prejudiced among faculty members and appreciating the value of school, education, appreciating the concept of family, developing a desire to help humanity among undergraduate students.

These systems also need to foster positive internal states (such as self-efficacy, hope, comfort and safety) and to reduce negative internal states (such as anxiety, depression, and stress, a sense of sacrificing one's personal life, being fatigued, having a lack of sleep) as well. Another group of targets for these systems need to be negative and positive aspects of distance education. In particular, problems in assessment and measurement, cheating, teaching applied courses like theoretical courses, deterioration of balance between personal life and work, disappearance of boundaries, unhealthy lifestyle, problems in personal life, changes in family dynamics, difficulties experienced in independent learning, facing the dilemma of getting high marks and not learning properly need to be targeted. In terms of positive aspects, these systems need to promote the use of different measurement and evaluation methods and teaching in new and different ways.

These systems need also to target the demotivating factors (such as students getting others to do their homework for money or cheating, the experience of negative emotions or feelings, deterioration of the balance between personal life and work, and inability to do research). Motivating factors such as students' interest in the lessons, being able to produce and to achieve, feeling that one is useful and the use of positive self-suggestions) need to be promoted.

In terms of ways of improving distance education mentioned by the undergraduate students and faculty members in the present study, particular attention need to be given to factors such as using realistic virtual classrooms and laboratories, better coordination, planning, development of standards, offering training to faculty members for lecturing in distance education and in preparing course materials, increasing extracurricular activities and receiving psychological support. The present findings could also guide future studies in developing student-derived and faculty-member-derived questionnaires for examining the quality and the effectiveness of distance education. That is, the themes and sub-themes identified in the present study can be used to formulate questions for the questionnaires measuring the quality and the effectiveness of distance education practices in difficult times such the COVID-19 pandemic.

Ethic

Ethical approval was obtained from Istinye University, Humanities and Social Sciences Research Ethics Committe dated 05/06/2020 and numbered 2020/7 (decision number: 04).

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Conflict of Interest

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