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Distance Education Satisfaction During COVID-19: Engineering Students' Opinion According to the Six Thinking Hats Technique

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ABSTRACT

This study aimed to investigate the distance education satisfaction during COVID-19 Pandemic from engineering students' opinion according to the six thinking hats technique. The study sample consists of 209 students from the faculties of engineering in Turkey. A qualitative analysis was performed using the NVivo12 software upon taking opinions with a questionnaire administered in the online environment. Considering the prominent themes in the six hats, students feel incompetent for their future career; exams are not conducted fairly in distance education; yet students have had the opportunity to improve themselves during this period. Furthermore, while proposing suggestions on the improvement of distance education, students also drew negative conclusions regarding the distance education delivered during the pandemic. With this study, a multidimensional investigation of the distance education received by students from the faculty of engineering in a situation such as a pandemic has been carried out.

Keywords: Distance Education, Covid-19, Faculty of Engineering, Six Thinking Hats

INTRODUCTION

An epidemic disease, which used to be the nightmare of mankind in the Middle Ages, has spread all around the world unexpectedly today when there is advanced medicine. The World Health Organization declared this disease called COVID-19 as a pandemic on March 11, 2020 since its spread could not be prevented even though gradual measures were taken in the all over the world. To date, there have been 464,809,377 confirmed cases of COVID-19 worldwide, including approximately 6,062,536 deaths (WHO, 2022). As a result, according to the March 2022 data, Covid-19 still affects the educational status of 43,518,726 students in total (UNESCO, 2022). Since this situation is a dead end for educational institutions, the way to salvation was found as the globalization of education and provision of learning in the home environment in order to alleviate the educational gap of the educational institutions (Aktay, 2002).

Distance education was used by institutions providing education on a global scale without one of the solutions in education for the pandemic period (Aydin, 2021). However, after the pandemic, it became essential and virtual classroom systems were adopted very quickly. In this case, the academic gap tended to deepen among students with different socio-economic status (Sözen, 2020). Many countries including Turkey have made technological investments in education against this situation. In distance education, unlike their relevant roles in face-to-face learning, students need to be active in the process while educators go beyond guidance towards objectives (Stephenson & Sangrà, 2013). For learning to be interactive in online environments, students, under the guidance of the educator, improve their prior knowledge and experiences by connecting with and learning from their classmates in the process of acquiring new skills and abilities (Torras, 2015). It can be stated that ensuring this interaction requires more effort in online courses compared to face-to-face education. Since the pandemic environment occurred all sudden, the infrastructure required in distance education, the experience of the educators and the availability of the family environment, etc. could not be achieved at once (Murgatrotd, 2020). As the problems arose due to this situation, included vital elements in online education, such as adequate preparation regarding teaching materials, curriculum, and assessment (Ali, 2020).

There were some hesitations about how to make a fair exam in the assessment step of education. Even though e-exams are cost-effective in terms of work, time, and money (Vasupongayya et al., 2010). Unfortunately, they may not give the desired results when the right tools are not selected. It is believed that the effect of the COVID-19 pandemic will continue for years in the future (Brion, 2021), and distance education services will be retained, and traditional education will never be fully adopted again (Ahmed et al., 2021). In this case, investments in

digitalization are expected to increase gradually. Despite the major developments worldwide in the last 50 years, COVID-19 has been the biggest problem encountered in education (Daniel, 2020). One of the reasons for this is that online courses lack students' interest and communication compared to face-to-face courses (Gürer, Tekinarsan & Yavuz, 2016). As in all applied sciences that require master-apprentice relationship, engineering education is one of the fields that have faced this problem the most.

While the rapid development of technology increased the need for engineers, engineering education also gained importance, and many engineering institutions were established in the 19th century (Özçep et al., 2003). Kasapoğlu (1998) focuses on the quality approach in engineering education in detail. In the study conducted with university students by Ripoll, Godino-Ojer and Calzada (2021), students achieved very successful results with cooperative learning experience, requiring little help from the instructor in online asynchronous education. Improving teamwork and communication skills are important achievements for engineering students, and their curriculum should include these subjects (Mills & Treagust, 2003). However, it can be stated that the quarantines experienced during the Covid-19 pandemic have had adverse effects especially on communication skills. Critical and creative thinking or problem-solving activities may have positive effects on students in an environment where human communication skills are lacking (Mathee&Turpin, 2019). One of the creative thinking methods is the 6 thinking hats method (Karadag et al., 2009).

Six Thinking Hats method was developed by Edward De Bono in 1985. It enables reaching a conclusion through multidimensional evaluation of an opinion (Chien, 2021; Tamura & Furukawa, 2007). In the thinking process, white hat refers to objective facts and figures; red hat to anger, passion, and emotions; black hat to pessimistic and negative thoughts; yellow hat to optimistic, hopeful and positive thoughts, green hat to creativity and new ideas, and blue hat regulates and controls the thinking process (De Bono, 1997; Ekahitanond, 2018). In the 6 thinking hats technique, situation or event can be evaluated by adopting viewpoints from different emotional themes. Participants who can see the different sides of an event in the same environment have the chance to examine their own opinions each time. With the data from individuals who can think in a multidimensional way with different thinking structures in different colors, more accurate results can be achieved.

LITERATURE REVIEW

There are many studies on the emotional state of students during the Covid-19 pandemic. Baloran (2020) conducted a study with 530 high school students in the

Philippines to investigate their attitudes, concerns, and coping strategies during the pandemic. The study revealed that the students had sufficient knowledge and high-risk perception, and that they were satisfied with the government's distance education policies. Many studies conducted during the Covid 19 process have concluded that it has psychological effects and mental health on students (Cao et al., 2020; Camacho-Zuñiga et al., 2021; Goldman & Bell, 2022; Guessoum et al., 2020; Gullo, 2021; Masalimova et al., 2022; Yang et al., 2020; Zhai and Du, 2020).

Tolares et al. (2020) examined the effects of Covid-19 on social psychology, recommended that various measures should be taken for the psychological effects of the isolation emerging in society. Pan et al. (2021) conducted a study with a sample of 5783 participants to investigate the effects of Covid-19 on vocational high school students. The study revealed that the function of the family would have an impact on mental health in cases such as a pandemic. Rahimi and Vallerand (2021) investigated the role of academic passion in academic procrastination in two separate studies involving 210 master's students in the first study, and 303 students in the second. One of the studies was carried out during the Covid-19 period. The results revealed that negative emotions positively affected academic procrastination whereas positive emotions prevented it. In the second study, it was observed that emotions regarding non-academic activities influenced academic procrastination.

Studies on the difficulties brought by the Covid-19 period were also reviewed in the literature (Dorsey-Elson et al., 2021; Elsalem et al., 2021; Hewitt et al., 2020; King & Dahal, 2022; Kotok, 2020; Mphahlele & Jikpamu, 2021; Wang et al., 2020;). Comas-Forgas et al. (2021) conducted a study to investigate the scope of information requests for cheating in the exams in Spain during the pandemic. The results of the study indicate a significant increase in information requests regarding cheating in online exams during the Covid-19 and Spain's quarantine period. Apart from these studies, there is a great deal of research concluding that the Covid-19 pandemic has many effects on individuals (Guessoum et al., 2020; Liu et al., 2020; Zhang et al., 2020).

There are also studies in the literature that aim to determine both the positive and negative aspects of the Covid-19 period (Fatoni et al., 2020; Yolcu, 2020). Kaden (2020) carried out a study on high school students in Alaska to investigate the effects of the pandemic period, and stated that distance education increased the teacher's workload, and that it should be well planned in order not to increase social divisions and inequality.

There are some studies on the education of engineering students during the Covid-19 pandemic. In the study conducted by Jamalpur et al. (2021), on the learning of engineering students during the Covid-19 period, it was observed that they allocated more time to learning during the pandemic compared to the pre-

pandemic period, and that most of the students had self-consciousness and cared about their careers while focusing on the progress of their learning and making learning a habit. Scholes (2021) examined the works of chemical engineering students during the Covid-19 period. As a result of the study, it was observed that the design project performed during the distance education period was successfully completed. Gregory & Masters (2012) emphasize that thinking with virtual hats plays an important role in improving the education activities in Second Life. Asgari et al. (2021) reported that distance education on engineering affected students adversely in terms of logistic/technical problems, learning/teaching difficulties, privacy and security concerns, and lack of adequate hands-on training. Instructors, on the other hand, drew attention to the perception of cheating. Grodotzki et al. (2021) conducted a study on engineering students and manufacturing engineering professors at the University of Dortmund to examine how the pandemic affected engineering education. As a result of the study, it was stated that engineering education adapted quickly to the new online teaching approach inspired by the concept of flipped classroom. In addition, it was suggested that virtual laboratories could be established to increase the efficiency of engineering education in the distance education environment. In their study on the effects of the pandemic on engineering education, Khan and Abid (2021) noted that there were some limitations of distance education due to the lack of internet network in the whole country, and that the relevant policies should be renewed.

PURPOSE AND IMPORTANCE OF STUDY

The purpose of this study is to investigate the satisfaction of undergraduate engineering students with distance education during the Covid-19 pandemic to be reflected objectively with the 6 thinking hats technique. In the present study, students were asked questions that would provide different perspectives, and it was ensured that they made comments accordingly. The purpose here is to give them a critical perspective. For this purpose, answers to the following questions were sought:

Q1: What are the negative aspects of the education received during the pandemic period according to the engineering students? (Evaluation in the context of the black hat).

Q2: What emotions (feelings) have the engineering students experienced with the education received since the first day of the pandemic? (Evaluation in the context of the red hat).

Q3: What are the positive aspects of the education received during the pandemic period according to the engineering students? (Evaluation in the context of the yellow hat).

Q4: What are the specific solutions offered to the engineering students to prevent the negative effects of the pandemic on the education received? (Evaluation in the context of the green hat).

Q5: What would be the opinions of engineering students regarding their pandemic-era education if they evaluated it objectively? (Evaluation in the context of the blue hat).

The literature review has revealed that even though there are studies on the evaluation of education in the Covid-19 period, a multidimensional technique such as 6 thinking hats has never been utilized. Therefore, this study can bring a new perspective to literature.

RESEARCH METHOD

Research Design

This study aims to find out the satisfaction of engineering students having to attend university courses remotely during the Covid-19 pandemic, is based on qualitative data analysis. The opinions of 230 students from 15 universities in different regions of Turkey were taken online due to the pandemic conditions. A total of 209 data could be included in the evaluation since qualitative data analysis could not be performed on 21 of them. These results were evaluated in the context of black, red, blue, green, and yellow hats. The informed consent forms of the participants were included in the data collection tool prepared. Moreover, publication and ethical rules were followed in the study.

Participants

The study was limited to 230 engineering students across Turkey due to the adverse pandemic conditions. However, 21 of them were excluded from the study as they were not suitable for the analysis. The responses received from students of 6 different engineering departments at 15 state universities in Turkey were included in the evaluation. The data of the participants are presented in detail in Table 1.

Table 1
Distribution the based-on department and year of study

Dep.	Dep. Code.	1	2	3	4	4+
Civil Engineering	CE.	8	18	47	35	10
Civil and Geomatics E.	CGE.	-	-	-	2	-
Electrical and Electronics E.	EEE.	-	2	13	2	1
Mechanical E.	ME.	2	3	18	24	12
Metallurgical and Materials E	MME.	-	3	1	3	-
Railway Systems E.	RSE	1	1	1	2	-

The students participating in the study were coded according to their departments and sequence numbers. While determining the study sample, the criterion sampling, which is one of the purposive sampling methods, was preferred. It is because the participants meeting the criteria determined prior to the study are selected in the criterion sampling method (Yıldırım & Şimşek, 2012). In this study, engineering students from various years of study were selected as participants.

Data Collection Tools

In the study, a questionnaire developed by the researchers to examine the engineering student's satisfaction about the education during the pandemic period in the context of 6 thinking hats technique was administered. The questionnaire form was prepared in a digital environment and made available online for the participants to answer. During the development of the tool, 4 experts including two from instructional programming and evaluation, one from engineering, and one from information technologies were asked for their opinions. The form consisted of 2 questions for demographic information, 3 scoring items and 7 open-ended questions. The open-ended questions addressed to the participants are as follows:

1. What do you think the negative effects of the pandemic are on the education that you have received? (Answer by considering the course process, assessment and evaluation, your future, and the future practice of your profession).
2. What emotions (feelings) have you experienced as a student with the education that you have received since the first day of the Covid-19 pandemic?
3. What do you think are the positive aspects of the education that you have received during the Covid-19 pandemic? (Answer by considering the course process, assessment and evaluation, your future plans, and the future practice of your profession).

4. What are your suggestions for the education that you have received during the Covid-19 pandemic to be more effective and efficient?
5. If you should conclude (make inference) based on your answers to the questions above, what would it be?

Numerical objective Covid-19 data complying with white hat were presented to the students through the form. The answers given according to the black, blue, red, green, and yellow hats were coded in the NVivo 12 software, divided into themes and analyzed.

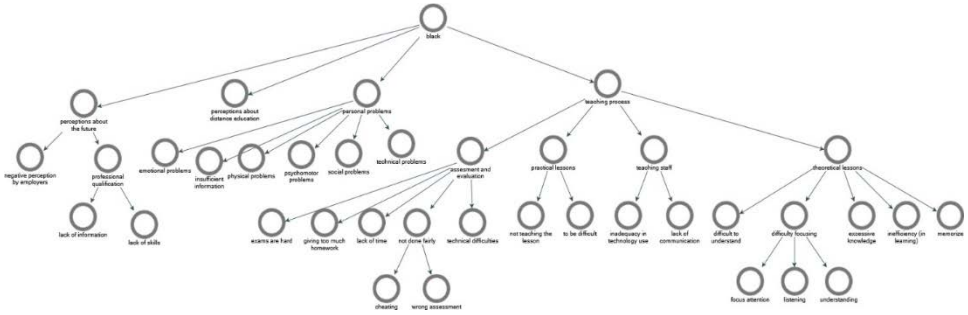
RESULTS

This study contains the evaluation of opinions of university students who must receive distance education during periods such as natural disasters or pandemics, based on 6 thinking hats method.

1. Black Hat Theme

The students who received engineering education were asked what the negative effects of the pandemic on their education were. When the answers are analyzed, the opinions in the black hat theme are examined in four main themes, which are negative perceptions about the future, personal matters, learning process and distance education. These nodes are presented in Figure 1.

Figure 1
Black hat theme



13 students (6%) have negative perceptions about the future. These include negative perception of employers in the future, and lack of knowledge and skills that they will experience in their profession. The applied courses that could not be received during the pandemic period, the internship period that could not be experienced, and the theoretical courses that could not be taken properly due to

technical problems have caused some engineering students to worry about their competences. A student express relevant his/her opinion as follows:

"Sector agents will see us as pandemic graduates and consider us inexperienced." (ME.152.,2021)

22 students (10%) participating in the research shared their negative opinions about their personal problems in this period. These students, who could not go to school, meet with their friends, and who had to be at home all the time, state that they have had emotional, physical, psychomotor, social, technical problems and lack of knowledge. Under the theme of personal matters, a student expresses his/her opinion as follows:

"I think it is a period that is close to socialization and personal development. Although we can access many things through a widespread system such as the internet, I think that we will encounter great problems in the future since we cannot practice effective communication techniques that we mainly need."(ME.150., 2021)

Sixty-six of the students (31%) have reported their negative views about the teaching process in this period. The relevant opinions are examined in three themes as assessment and evaluation, theoretical courses, and applied courses. The students express their opinions about the fact that assessment and evaluation is not performed due to cheating or misevaluation, too much homework is assigned, exams are difficult, time is insufficient and there are technical difficulties. The opinions of a student who think negatively about assessment and evaluation is as follows:

"Assigning homework taking too long as if we must study in a closed room all day and being unfair in evaluations of achievement affect us negatively. There are even times when I think of leaving my education." (CE.11., 2021)

In the study, nineteen students (9%) have expressed negative opinions about the theoretical courses delivered during the distance education period. These include excessive accumulation of knowledge; parrot-fashion instruction; difficulty in comprehension, attention and focusing on listening; inefficiency in learning, and difficulty of the courses. A student express negative his/her opinion about theoretical courses as follows:

"Lessons are covered faster in distance education, and we are having a lot of trouble with it. This situation increases the number of subjects that we need to study." (MME.16., 2021)

Twelve of the students (5%) in the study have reported negative opinions about the applied courses regarding whether they could not be covered or were difficult. The views of A student are as follows.

"Since there are no face-to-face applications and demonstrations, it is very difficult to understand the course content." (ME.149.,2021)

Seventeen of the participants (8%) have expressed their negative views about distance education. One relevant view is as follows:

"Distance education did not help at all. In my opinion, it is just a waste of time. For one and a half years, the system has not settled yet..." (CE.119., 2021)

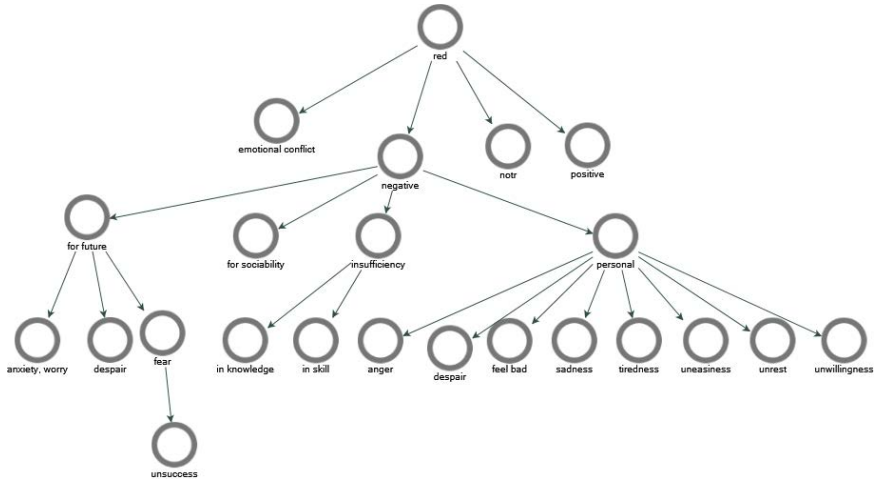
In the light of these findings, it is observed in the black hat theme that students generally describe distance education as useless, inefficient, difficult to understand, unfairly evaluated, asocial, and close to personal development. In addition, students have negative perceptions about the future.

2. Red Hat Theme

The satisfaction of the students in the red hat theme are evaluated under four main headings, which are emotional conflict, and negative, neutral, and positive nodes. Figure 2 presents these main nodes and their sub-nodes.

Figure 2

Red hat theme



Eleven percent (24) of the opinions included in the red hat are evaluated under the positive node. The views under this node consist of positive perceptions developed despite the negative environment of the pandemic. The relevant opinion of the student is as follows:

"In general, I think that the students who are committed to the department have made use of this distance education in a wonderful way." (EEM.183., 2021)

Five percent (10) of the students are in the opinion that the pandemic environment has affected them neither positively nor negatively. The relevant statement is as follows:

"Pandemic or not, I always have the same feelings." (EEM.224., 2021)

Seven percent (16) of the opinions evaluated in the red hat theme indicate that the students have experienced an emotional conflict in the pandemic environment. While these students were happy for a certain time, they experienced unhappiness at another time. A view under this node is as follows:

"I liked it at first, but later I realized that I had not learned anything." (CE.1., 2021)

Negative opinions are divided into four main nodes, which are opinions about the future, sociality, personal matters, and incompetence. Ten percent (21) of the student state that they have negative views about the pandemic period in terms of sociality. A view is as follows:

"...I feel distant from the social environment, and I think the quality of education has decreased, I feel lonely." (CE.12., 2021)

Ten percent (22) of the students have negative opinions about their future during the pandemic period. These views are divided into three nodes. 7% of the students are worried about their future. The relevant opinion is as follows:

"Online exam makes students worry unnecessarily." (CE.115.,2021)

Thirty percent (64) of the students have negative opinions due to some personal matters. The views here are evaluated under the nodes of tiredness (3), uneasiness (3), unwillingness (3), restlessness (1), feeling bad (3), anger (1), despair (1) and sadness (3). Some relevant opinions are as follows:

Tiredness: *"Because we have so many lessons, the overlapping of quizzes and exams or very short periods of time between them makes us tired and worn out."* (ME.157., 2021)

Unwillingness: *"I am not eager to have any lessons; I am trying to keep pushing myself."* (CE.205., 2021)

Seventeen percent (37) of the student state that they have felt incompetent during the pandemic period. These views are examined under two nodes as incompetence in knowledge and skill. The respective opinions are as follows.

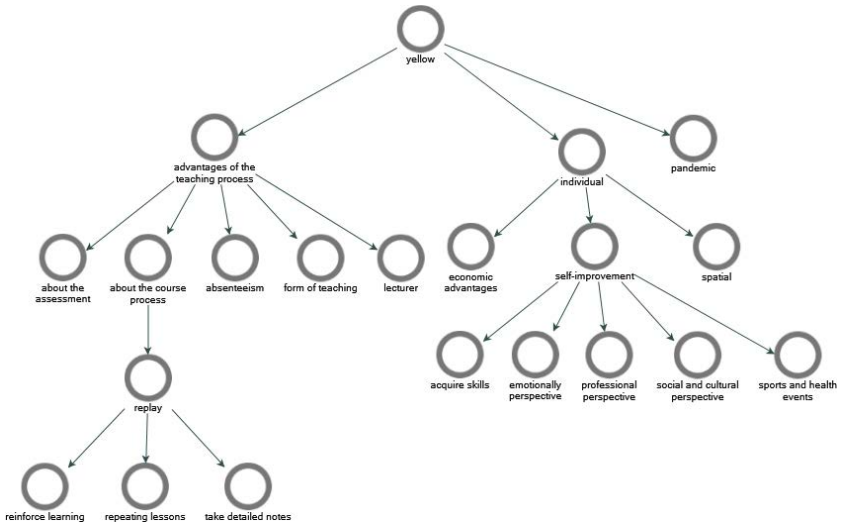
In skill: *"As a mechanical engineering student, I only feel the lack of opportunity to see and examine the necessary workbenches closely."* (ME.171., 2021)

In knowledge: *"I think I have no knowledge of the department that I am studying."* (EEE.222., 2021)

3. Yellow Hat Theme

The opinions in the yellow hat theme are examined under three main headings, which are advantages of the teaching process, the pandemic and individual benefits. Figure 3 presents these main nodes and their sub-nodes.

Figure 3
Yellow hat theme



Under the yellow hat theme, 18% (39) of the students think that there are individual advantages, which are divided into economic (5), spatial (4) and self-improvement (30) advantages. Some of the views on economic and spatial advantages are as follows:

Economic advantages:	*"...I got relieved financially due to distance education, it was very good for me because the city where I studied was expensive"* (CE.125., 2021)
Spatial:	*"...I think it is an advantage that lessons are covered comfortably in the home environment"* (ME.162., 2021)

Fourteen percent (30) of the students think that the pandemic period has had advantages regarding self-improvement. The node of self-improvement is divided into five nodes including skill acquisition (7), and affective (5), professional (12), social and cultural aspects (6), and sports and health activities (1). Some relevant opinions are as follows:

Professional aspect:	"*There are positive aspects that enable us to carry out more detailed research on our future profession*." (CE.106., 2021)
Skill acquisition:	"*My research skills have improved thanks to the assignments replacing exams*." (ME.155., 2021)
Social & cultural aspect:	*"We are able to devote more time to ourselves and our self-improvement*." (RSE.108.,2021)

Twenty percent (43) of the students think that the pandemic has had advantages regarding the teaching process. These advantages are examined under five nodes including the course process (26), absenteeism (1), instructor (3), way of teaching (6) and assessment and evaluation (7). The node of replaying the lessons under the course process is divided into three as reviewing the lessons (5), taking detailed notes (1) and reinforcing learning (4). Some student opinions are as follows:

Course process:	"*Subjects are covered faster*" (CE.105.,2021)
Reviewing the lessons:	"*Asynchronous lessons are useful to repeat the subjects that we miss or forget*." (ME.144. ,2021)
Reinforcing learning:	"…*I can say that watching the lessons again when I do not understand has reinforced my learning even more*." (CE.11., 2021)
Absenteeism:	"*It was good for me regarding my absenteeism problem."* (ME.152., 2021)
Instructor:	"*With distance education, our instructors were more organized in instruction and shared very good resources*." (ME.168., 2021)
Way of teaching:	"*We learned about the distance education system, and ability to have lessons anywhere*" (CE.1.,2021)
Assessment & Evaluation:	"*When it comes to exams, assignments help me learn more because while preparing for regular exams, I try to learn all the subjects in one day, but for assignments, I do research for a few days and better remember what I learn*." (CE.13., 2021)

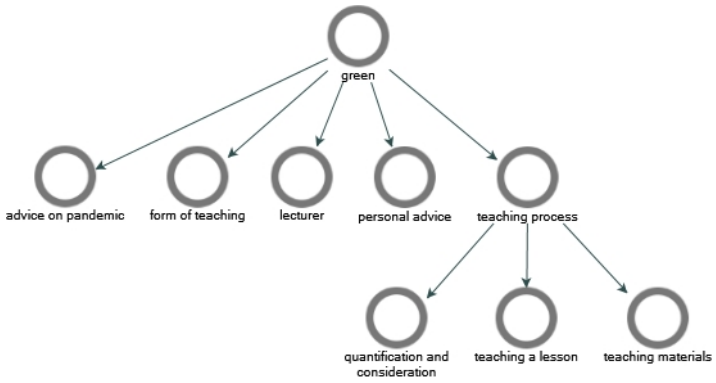
Under the yellow hat theme, 3% (6) of the students state their positive opinions about the pandemic. The relevant opinions are as follows:

"As the positive aspect of the education we have received during the pandemic, I can say that the spread of the virus in the Covid-19 period was prevented to some extent..." (CE.100., 2021)

4. Green Hat Theme

The opinions in the green hat theme are examined under five main headings, which include personal suggestions, instructor, way of teaching, teaching process and advice on the pandemic. Figure 4 presents these main nodes and their sub-nodes.

Figure 4
Green hat theme



Four percent (9) of the students propose personal suggestions. The relevant statement is as follows:

"Since we can access the internet at any time, we can make up for the lack of experience by doing a lot of research." (CE.105., 2021)

Nine percent (19) of the students have suggestions about the course instructors. The respective opinion is as follows:

"All the instructors should give live lessons and assign homework. We should be in direct contact." (CE.104., 2021)

Twenty two percent (48) of the students have made recommendations regarding the teaching process, which are divided into three nodes as course instruction (24), teaching materials (9) and assessment and evaluation (23). Some opinions are as follows:

Course instruction:	*"Hands-on programs can be developed."* (RSE.107., 2021)
Teaching materials:	*"It may be more efficient if the equipment such as microphone and camera used by the instructors during online teaching were of higher quality, and if the programs better serving the lectures were preferred."* (CE.116., 2021)
Assessment & Evaluation:	"*There may be interim evaluation exams without highlighting the student, other than midterm and final exams."* (CE.101., 2021)

Eight percent (18) of the students offer suggestions on the way of teaching. The relevant opinion is as follows:

"Hybrid education model can be adopted at schools." (CE.1., 2021)

Two percent of the students (5) have recommendations regarding their education environment and health conditions during the pandemic. The respective opinion is as follows:

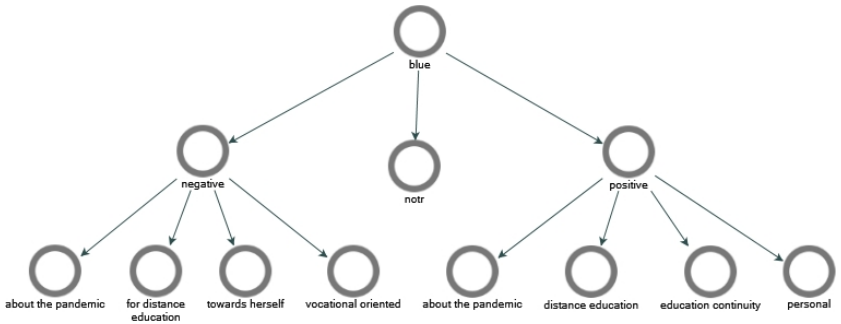
"…the capacity of the engineering faculties should be reduced to 10/15 students. Since this quota enables the achievement of social distance, I do not think there will be any problems in face-to-face and applied lessons." (RSE.120., 2021)

5. Blue Hat Theme

In the blue hat theme, the opinions were initially divided into three main nodes, which are negative (89), neutral (55) and positive (54). Figure 5 shows these main nodes and the sub-nodes associated with two of these nodes.

Figure 5

Blue hat theme



13% (27) of the students have drawn negative conclusions as regards to distance education, 22% (47) to themselves, 2% (5) to the profession, and 5% (10) to the pandemic. The respective views are as follows:

Distance education:	*"As the whole country, we cannot achieve the distance education system."* (CE.1., 2021)
Oneself:	*"I need to improve myself and I have to work hard, but my psychology is not alright."* (CE.104., 2021)
Profession:	*"There are difficulties of being an engineer through distance education."* (ME.188., 2021)
Pandemic:	"*…the pandemic has considerably slowed down the pace of progress and development of the world."* (MME.14., 2021)

Twenty six percent (55) of the students have reached a neutral conclusion regarding education during the pandemic. The respective opinion is as follows:

	"...there is no difference between distance and regular education." (CE.100., 2021)

Students have made a positive judgment about the education given during the pandemic period, regarding education continuity (9%-19), personal matters (5%-11), the pandemic (6%-12), and distance education (6%-12). The relevant opinions are as follows:

Education continuity:	*"Although the conditions of distance education are difficult for engineering students, instructors and students can get through this difficult period by dedicating more time."* (CE.122., 2021)
Personal matters:	*"If I have to speak based on my own perspective, I think distance education has been more productive for me; I have not missed any of my lessons."* (ME.128., 2021)
Pandemic:	*"...it is an undeniable result that the increase in the cases in the young age group has been prevented during the pandemic."* (CE.100., 2021)
Distance education:	"*I believe that online education is more efficient than formal education in many ways*." (ME.135., 2021)

DISCUSSION AND CONCLUSIONS

During the Covid-19 pandemic that we have experienced recently, various methods such as distance education and hybrid education have been adopted as attempts to prevent information loss. In the studies conducted in higher education institutions, academicians state that distance education has positive aspects as well as negative ones (Şeren, Tut & Kesten, 2020). Asynchronous education opportunities have allowed students to review the courses by accessing information whenever they want, and thus making the course more understandable. This study has evaluated the satisfaction of engineering students with asynchronous education based on 6 thinking hats. In the context of black hat, the students in the study have dissatisfaction on asynchronous education during the Covid-19 due to the problems that they will experience in the future. They think that they will face difficulties especially in working life. Another finding under the black hat theme is that students have experienced many personal problems. They have faced a great number of emotional, physical, and social problems. In the context of the black hat, several findings have revealed negative emotions in opinions about anti-sociality. There are many studies consistent with these findings (Cao et al., 2020; Guessoum et al., 2020; Masalimova, 2022; Torales et al., 2020; Wang et al., 2020; Waterhouse et al., 2022). Another finding obtained from the

opinions of the students within the scope of the black hat is the inefficiency in learning as a result of the fact that a fair evaluation could not be made, and the lessons have been only theoretical in distance education during the pandemic. In line with this finding, Comas-Forgas et al. (2021) note that students' level of cheating has increased during the Covid-19 period. Furthermore, Elsalem et al. (2021), state in their study that measures should be taken to prevent exam fraud during the Covid-19 period. Other findings of the black hat are about the difficulty of the courses and the ineffectiveness of distance education.

Considering the views in the red hat, it is observed that most of the students have satisfaction towards the education process in the Covid-19 period, whereas it is identified that there are negative emotions, nearly as many as the positive ones, and a few neutral emotions. This can be due to the fact that they have time to improve themselves. Rahimi and Vallerand (2021) state in their study that students with academic anxiety have negative emotions regarding the pandemic period, while students who want to improve themselves in different areas have positive emotions. Another emotion revealed under the red hat is emotional conflict. Students state that they enjoyed distance education at first, but it became boring later. In addition, some of the students express that they have experienced feelings of unwillingness, uneasiness, sadness, etc. during this period, and others indicate that they have felt professionally incompetent.

When the students' opinions on the pandemic are evaluated under the yellow hat, most of the student's state that this situation has provided individual advantages. According to many students, the opportunities for their self-improvement especially have increased with the technological facilities. This finding is in line with the advantages specified in the study by De Paepe, Zhu and De Pryck (2018). Another finding in the study is that distance education is advantageous because it is independent of place and, accordingly, it provides economic benefits. In their study, DeNeui and Dodge (2006) emphasize that the greatest advantage of distance education is that it is independent of place. Fatoni et al. (2020), who examined distance education during the Covid-19 pandemic on university students, also list the advantages in this period as that the classroom environment is not limited to space, students can listen to lessons anytime and anywhere, and they can receive a comfortable education.

Another finding is the advantages regarding the teaching process. These mostly include the advantages of the course process with the opportunity to re-watch the lessons and take notes. Yolcu (2020) has conducted a study with students and mentioned these advantages regarding the course process. Other findings obtained under the yellow hat are that there is no problem of absenteeism; reinforcement of learning is facilitated, assessment and evaluation process is easier, and distance education has enabled the protection of public health against

the pandemic. In the context of the green hat, the students have made some suggestions for distance education during the Covid-19 pandemic. These are mostly related to the teaching process. The students are of the opinion that distance education should be improved by trying different methods in instruction, teaching materials, and assessment and evaluation. Kaden (2020) emphasizes that distance education should be planned well so that there will be no negative consequences. Khan and Abid (2021) draw attention to the importance of nationwide planning of distance education.

In the context of the green hat, the students also suggest that all instructors should give live lessons rather than recordings and assign homework. There are also suggestions stating that half of the teaching may be face-to-face. The opinion that the quota for face-to-face education in the school can be reduced for a healthier environment constitutes another finding of the study. The blue hat involves the final decisions of the students considering the distance education during the pandemic.

Most of the students evaluate the distance education during the pandemic with a negative conclusion sentence and include a self-criticism by stating that this negative situation mostly about their dissatisfaction. Other views in this context are related to distance education, the profession, or the pandemic. The second conclusion consists of neutral opinions. In these findings, students state that there is no difference between pre-pandemic and post-pandemic periods. Finally, the findings on positive conclusion contain the views that education continuity has been provided, the education received during the pandemic has been good, and the distance education has been successful.

This study, which evaluates the satisfaction on distance education delivered to engineering students during the pandemic from their opinion based on 6 thinking hats, is believed to present a multidimensional perspective. In future studies, the 6 thinking hats method may be enlightening for such critical cases.

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