Transition to Web-Based Asynchronous Education in Biostatistics Education During The Covid-19 Pandemic: A Case of Bursa Uludag University

Covid-19 Pandemisi Sırasında Biyoistatistik Eğitiminde Web Tabanlı Asenkron Eğitime Geçiş: Bursa Uludağ Üniversitesi Örneği

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Abstract

Background: Over time, the integration of advancing technology into education gained speed due to the pandemic. Alternative education strategies to traditional education emerged. The study aims to examine whether web-based asynchronous (WBA) education can be used as an alternative to traditional face-to-face (FTF) education if the views of post-graduate students are in line with it. **Materials and Methods:** The opinions of 19 students who enrolled in the post-graduate biostatistics course in the spring semester of 2019-2020 and participated in both FTF and WBA were consulted. Students were asked 17 questions about the distance education perception scale, educational strategies and 3 open-ended questions. Post-graduate students were grouped according to their answers to the question of which type of education would prefer if the students had to take the biostatistics course once again. **Results:** Thirteen of the students (68.4%) stated that if they would take this course once again, they would prefer WBA, 5 (26.3%) students FTF and only 1 (5.3%) student prefer online education. While FTF students were more satisfied with FTF training (p=0.014), WBA students stated that they were more satisfied with the WBA education (p=0.004). WBA students thought that WBA education provides more flexibility in terms of time (p=0.046) and resources (p=0.007). WBA students stated this education would be preferred more in the future (p=0.035). **Conclusion**: WBA education is a very good alternative for courses similar to biostatistics courses where computer programs are frequently used in practice. In case students and lecturers are provided with internet and necessary hardware and software support by the state and universities, the transition to WBA education may be permanent.

Keywords: Biostatistics education; Distance education perception scale; Face-to-face education; Web-based asynchronous education

ÖZ

Amaç: Zamanla, gelişen teknolojinin eğitime entegrasyonu pandemi nedeniyle hız kazandı. Geleneksel eğitime alternatif eğitim stratejileri ortaya çıktı. Bu çalışma, lisansüstü öğrencilerinin görüşleri doğrultusunda web tabanlı asenkron eğitimin geleneksel yüz yüze eğitime alternatif olarak kullanılıp kullanılamayacağını incelemeyi amaçlamaktadır. **Gereç ve Yöntem**: 2019-2020 bahar döneminde lisansüstü biyoistatistik dersine kayıt yaptıran ve hem yüz yüze hem de web tabanlı asenkron eğitime katılan 19 öğrencinin görüşlerine başvurulmuştur. Öğrencilere uzaktan eğitim algı ölçeği, eğitim stratejileri ile ilgili 17 soru ve açık uçlu 3 soru sorulmuştur. Lisansüstü öğrenciler tekrar biyoistatistik dersini almaları gerekse hangi eğitim türünü tercih ederler sorusuna verdikleri yanıtlara göre gruplandırılmıştır. **Bulgular**: Öğrencilerin 13'ü (%68,4) bu dersi bir kez daha alacak olsalar web tabanlı asenkron eğitimi, 5 öğrenci (%26,3) yüz yüze eğitimi ve sadece 1 öğrenci (%5,3) online eğitimi tercih edeceklerini belirtmişlerdir. Yüz yüze eğitimi tercih eden öğrenciler yüz yüze eğitiminden daha memnun iken (p=0,014) web tabanlı asenkron eğitimi tercih eden öğrenciler web tabanlı asenkron eğitiminden daha memnun olduklarını belirtmişlerdir (p=0,004). Web tabanlı asenkron eğitimi tercih eden öğrenciler, web tabanlı asenkron eğitiminin zaman (p=0,046) ve kaynaklar (p=0,007) açısından daha fazla esneklik sağladığını düşünmüşlerdir. Web tabanlı asenkron eğitimi tercih eden öğrenciler, bu eğitimin gelecekte daha çok tercih edileceğini belirtmişlerdir (p=0,035). **Sonuç**: Web tabanlı asenkron eğitim, uygulamada bilgisayar programlarının sıklıkla kullanıldığı biyoistatistik derslerine benzer dersler için çok iyi bir alternatiftir. Devlet ve üniversiteler tarafından öğrencilere ve öğretim görevlilerine internet ile gerekli donanım ve yazılım desteğinin sağlanması durumunda web tabanlı asenkron eğitimine geçiş kalıcı olabilir.

Anahtar Kelimeler: Biyoistatistik eğitimi; Uzaktan eğitim algı ölçeği; Yüz yüze eğitim; Web tabanlı asenkron eğitim

Highlights

- Web-based asynchronous education is one of the first educational methods to be applied in emergencies such as a pandemic.
- Interaction with students, which is the difference of face-to-face education, can be reduced by online interaction.
- Unlike other studies, the students participating in this study first received face-to-face and Web-based asynchronous education afterward.

Introduction

Due to the pandemic, which started at the end of 2019 and affected our country since the first period of 2020, there have been changes in many areas. During the quarantine period, there were serious problems in education around the world (1). The education was continued by providing the optimal way for students while the studies related to the vaccine and drugs were accelerated due to the pandemic. While the face-to-face education (FTF) of students was suspended due to current conditions, the uncertainty in the pandemic process prevented the time to return to face-to-face education from being clarified (2).

Distance education provided a short-term and emergent solution for education that could not be done FTF. This development has led to an increase in the number of studies on distance education This development has led to an increase in studies on distance education (3–5). Video communication became popular among students and researchers and often preferred video communication (6,7). During the pandemic period, many countries used Zoom, Skype, FaceTime, etc. for video communication and instant message applications started to offer distance education to students (8). Also, education platforms, where lesson programs are announced, instant meetings, online lessons, exams, homework, and applications are made, have become one of the important elements used in distance education. These training platforms have started to take place in information and communication technology studies.

Distance education has been widely used as a compulsory alternative to FTF education during the pandemic period. Online (synchronous) education and web-based asynchronous (WBA) education come to the fore in distance education, which is offered as an alternative to FTF education. Some researchers have suggested that the flexible nature of WBA education can be accomplished through video, thus combining the effects of FTF education with the flexibility of online environments (7,9,10). Distance education differs on levels of the education system and the characteristics of the courses (Theoretical and/or practical etc.). While transitioning to distance education instead of FTF education during the pandemic period, online or WBA education preferences differed according to countries/cities/regions. The biostatistics course, which is widely given as an online course and also taught as a course in colleges and universities, depends on the developments in information communication technologies due to the use of both software and hardware tools. The biostatistics course is not only precious in theory but also in practice. It involves multi-disciplines such as medicine, public health, and nursing. While the number of medical research increases, the demand of biostatistics course increased due to the increasing requirement of medical students as well as those working in pharmaceutical companies, research hospitals, states, and universities (11).

It is an important issue whether the compulsory strategy change due to the pandemic in biostatistics education, which is at the intersection of technology use, FTF and distance education, is sustainable in the following periods. In our university, the biostatistics course is carried out as a compulsory course in the Institute of Health Sciences in post-graduate education. Considering the post-graduate education process in our country, it is common for students to work in a job or study for a master's degree from a different city/region during their post-graduate education. Considering this situation, WBA education was preferred while providing distance education to graduate students in our study instead of online synchronous.

This study aims to examine the perspectives of postgraduate students on both education methods after the emergency transition from FTF education to WBA education due to the pandemic and to compare their preferences and reasons in the following periods. After the pandemic, it will guide us in the direction of continuing the biostatistics course in post-graduate education in the traditional way or with WBA education. While comparing the views of students who were educated with different methods in similar studies conducted before, our study also examines the views of students due to their participation in both FTF and WBA education. This feature reveals the difference between our study from other studies.

Methods

Post-graduate courses at Bursa Uludag University started for the spring semester on 10th February 2020. Biostatistics courses were held face-to-face between February 10 to March 16, and distance education from 16th March 2020 (Figure-1). Ethical approval was taken from the Bursa Uludag University, Faculty of Medicine, Clinical Research Ethics Committee (Date 10 June 2020; Number: 2020-10/24). We conducted this study according to the principles of the Declaration of Helsinki. Informed consent was obtained from all the participants.

The FTF education, was held in the computer laboratory of our department. Theoretical issues and practices were carried out in the same place. There is one computer for each student in the laboratory. Thus, the students carried out the practice alone. The course was conducted by only one lecturer during the spring semester. The course was held as WBA education over Google Classroom. Google Classroom has been used frequently in distance education and has been the subject of research (12–15). It was preferred owing to the opportunities for students and faculty members such as the fee, and the capacity of the programs. In this process, the lectures were recorded on video by the lecturer and shared with the students via Google classroom on the day of the lecture every week. Students were asked to watch the video, review the topics covered, and complete their homework until the next week. During this process, the questions that were not understood by the students were conveyed to the lecturer via e-mail, telephone, and instant messaging service.

Study settings and participants

We conducted a cross-sectional survey utilizing a self-administered survey. In the study participation is on a voluntary basis and no identifying information was requested. In the 2019-2020 Spring semester, 24 master of science students attended the Biostatistics course which is a compulsory course in the graduate program of the Institute of Health Sciences. One student did not attend the course during FTF education and four students did not continue WBA education after the transition to distance education. A total of five students were excluded from the study because they took this course for the second time and they preferred not to attend the whole education since attendance is not compulsory. After the exclusion, the study was conducted out on 19 students.

Studies conducted for the optimal number of students in distance education have been generally researched for online education in the literature. Although there is no study on the optimal number of students for WBA education, the optimal number of students in online education has been considered due to the interaction with the students via e-mail, telephone, instant messaging service, etc. Although various studies have been conducted on the optimal number of students for online education courses, there is no common consensus (16). Current literature suggests that the optimal number of students for online education should be between 15 and 30, manageable for a lecturer using average levels of interaction with students (17–19). Considering this information, it is seen that the number of students enrolled in the course is within the optimal limits.

Data collection and ethical considerations

Firstly, we asked overall 19 master of science students to fill in a demographic questionnaire. The demographic questionnaire consisted of age, gender, nationality, and job status. They were also asked whether they took this course for the first time and whether they have attended an online/WBA education before. Secondly, we generated questions from published scientific literature and other questionnaires. 17 questions were asked to get students' views on FTF and WBA education. All 17 questions in these surveys were on a 5-point Likert scale (1: strongly disagree to 5: strongly agree).

A 5-point Likert scale consisting of 22 items and 4 factors, developed by Özkaya et al., was applied to measure students' perceptions of distance education (20). The scale consisting of the factors "Students' perception", "Equipment facility", "Time Management" and "Facility and support of the institution" is a five-point Likert scale (between "1: strongly disagree" and "5: strongly agree"). The high scores obtained from the scale indicate a positive perception of distance education.

Finally, 3 open-ended questions were examined in order to receive feedback from the students about the education they received. These three open-ended questions were: "What are the advantages and disadvantages of FTF education?", "What are the advantages and disadvantages of WBA education?", and "What is required for a successful learning in biostatistics course?".

Data analysis

The qualitative analysis was conducted by analyzing the open-ended responses using word cloud used as a tool to give focus on the written material. We performed a word-cloud analysis using the "tm", "SnowballC", "wordcloud", and "RColorBrewer" packages for RStudio Version 1.4.1106 (RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL http://www.rstudio.com/.). The frequencies of a specific word are reflected by the size of the text. The FTF and WBA words were excluded from the word-cloud analysis since opinions were requested about them.

Students' responses to 17 questions were statistically compared with the quantitative analysis. The data was examined by the Shapiro Wilk test to whether or not it presents normal distribution. The results were presented as mean ± standard deviation, median (interquartile range), or frequency. Mann Whitney U tests were used for nonnormally distributed data. The statistical significance level was considered as $p < 0.05$. Statistical analyses were performed with IBM SPSS ver.23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.).

Results

The mean age of the 19 students participating in the study was found to be 27.4 ± 3.5. Fifteen of the students (78.9%) were female and, 4 (21.1%) were male. Two students were foreign nationals. While 12 (63.2%) students took this course for the first time, the others took the course for the second time. Eleven students (57.9%) participated in any online / WBA education before the pandemic. Thirteen of the students (68.4%) stated that if they would take this course once again, would prefer WBA, five students (26.3%) FTF and only one student (5.3%) prefer online education (Table 1).

Table 1. Demographic variables n=19

Age (years)		27.4±3.5
Gender	Female	15 (78.9%)
	Male	4 (21.1%)
Nationality	National	17 (89.5%)
	International	2 (10.5%)
Do you have any jobs?	Yes	15 (78.9%)
	No	4 (21.1%)
Are you taking this lesson for the first time	Yes	12 (63.2%)
	No	7 (36.8%)
Have you attended any online/ web-based asynchronous education and/or courses before?	Yes	11 (57.9%)
	No	8 (42.1%)
If you want to take this course again, which one would you prefer?	FTF education	5 (26.3%)
	WBA education	13 (68.4%)
	Online education	1 (5.3%)

FTF: Face-to-face, WBA: Web-based asynchronous

Table 2 shows the results of the analysis of the answers given to the 17 questions of the students who chose the FTF education and the WBA education if they had taken this course again. There was no statistically significant difference between the FTF and WBA students in terms of internet access (p=0.117). WBA students were more motivated in WBA education than FTF students (p<0.001). WBA students found the course easier than FTF students in terms of the difficulty of the course (p=0.002). While students who preferred WBA education did not prefer to teach theoretical courses FTF (p=0.003), there was no significant difference between the two groups in terms of giving the practices in the form of WBA education (p=0.143). The score given to the question "It was easier to ask and discuss the incomprehensible issues in face-to-face education" was found to be higher in FTF students (p=0.019). There was no statistically significant difference between the two groups in terms of their answers to "In WBA education, I can ask questions to the lecturer at any time." (p=0.924) and "It is important for me to attend classes with my friends in face-to-face education." (p=0.289) questions. WBA students thought that the skill of the lecturer was important in choosing the type of education according to FTF students (p=0.002). WBA students agree more with the notion that "I can learn with WBA education without FTF education" (p=0.014). While FTF students were more satisfied with FTF training (p=0.014), WBA students were more satisfied with the WBA education (p=0.004). WBA students thought that WBA education provides more flexibility in terms of time (p=0.046) and resources (p=0.007). WBA students had more analytical thinking opportunities with WBA education (p=0.019). The WBA education influenced positively their opinions about this education (p=0.035), and it would be preferred more in the future (p=0.035).

Table 2. Comparison of the opinions of students who preferred FTF and WBA education*

If you want to take this course again, which one would you prefer?	FTF (n=5)	WBA (n=13)	p
1. I can easily provide internet access required for web-based asynchronous education.	3 (3-4)	5 (4-5)	0.117
2. I am more motivated in web-based asynchronous education than face-to-face education.	2 (1-2)	4 (4-5)	<0.001
3. Web-based asynchronous education was easier than face-to-face education in terms of the difficulty of the lesson.	2 (2-2)	4 (3-5)	0.002
4. I prefer face-to-face education in theoretical lectures.	4 (3-5)	2.5 (2-3)	0.003
5. I prefer web-based asynchronous education in applications.	2 (2-2)	4 (2-4)	0.143
6. It was easier to ask and discuss the incomprehensible issues in face-to-face education.	4 (3-4)	3.5 (3-4)	0.019
7. In web-based asynchronous education, I can ask questions to the lecturer at any time.	4 (4-4)	4 (4-4)	0.924
8. The lecture ability of the lecturer is important in choosing the education style.	4 (3-4)	4.5 (4-5)	0.002
9. I can learn with web-based asynchronous education without face-to-face education.	3 (2-3)	4 (3-4)	0.014
10. It is important for me to attend classes with my friends in face-to-face education.	3 (3-4)	2.5 (2-4)	0.289
11. I am satisfied with the face-to-face education.	4 (4-4)	3 (3-4)	0.014
12. I am satisfied with the web-based asynchronous education.	3 (3-3)	4.5 (4-5)	0.004
13. Compared to face-to-face education, web-based asynchronous education provides us with flexibility in terms of time usage.	4 (4-4)	5 (4-5)	0.046
14. Compared to face-to-face education, web-based asynchronous education provides us with flexibility in terms of resource use.	3 (2-3)	5 (4-5)	0.007
15. In the web-based asynchronous education environment, students get the opportunity to think analytically.	3 (3-4)	4 (3-4)	0.019
16. My experiences in web-based asynchronous education have positively changed my perspective on web-based asynchronous education.	3 (2-3)	4 (4-4)	0.035
17. I believe that in the future, web-based asynchronous education will be more preferred than traditional education.	2 (2-2)	4 (2-5)	0.035

*Descriptive statistics were given as median (interquartile range). FTF: Face-to-face, WBA: Web‑based asynchronous

When the four factors and total score of the scale applied to the students were compared between the groups, "Students' perception" (p=0.027) and "Time Management" (p=0.019) were found to be statistically significant, while there was no statistically significant difference in terms of "Equipment facility", "Facility and support of the institution" and total score. Both "Students' perception" and "Time Management" factor scores of WBA students were found to be higher. Responses from students were taken in a written form, which was quantified based on the frequency of occurrence and visualized in Figure 2. As shown in figure 2, the students' thinking can be viewed as wildly divergent. Some of the answers given by students to open-ended questions about FTF and WBA were given below. The reasons for the positive and negative thoughts of the students against these educational strategies can be seen in the below sentences.

"…Although it provides usefulness for the employees in terms of the problem of creating time, I believe that WBA education is not likely to be as educational as FTF education..."

"…In WBA education, we had the chance to watch the lecture videos on the internet at any time and place with the opportunities provided by our teacher. We were able to access the lecture videos whenever we wanted and as many times as we wanted, without time constraints. At the same time, it provides advantages such as watching the lesson by dividing it, rewinding or advancing…"

"…Thanks to the WBA education, the time to go to university, the status of taking leave for the employees, the expenses, the problem of absenteeism, and missing the course are all gone…"

"…I think that in FTF education at school, there is a more disciplined study, more active listening to the lesson, and fewer distractions…"

Table 3. Comparison of distance education perception scale of students who preferred FTF and WBA education*

Distance education perception scale	Score Range	FTF (n=5)	WBA (n=13)	p
Students' perception	12-60	31 (26-32)	40 (34-45)	0.027
Equipment facility	5-25	16 (13-18)	15 (14-18)	1.000
Time Management	3-15	8 (7-8)	9 (9-10)	0.019
Facility and support of the institution	2-10	10 (9-10)	10 (6-11)	0.775
Total	22-110	65 (56-66)	70.5 (63-84)	0.328

*Descriptive statistics were given as median (interquartile range).

Figure 1. Timeline of the process

Figure 2. Word-cloud visualization of open-ended responses of post-graduate students

Discussion

The integration of technology in education offers qualitatively different learning experiences in higher education; provides a new way of collaborating among education stakeholders (student, lecturer, etc.) and diversity in access to resources, and improves information exchange (21). Also, Taft et al. presented the importance of 4 factors which consist of the information revolution, the competitiveness of higher education, changes in student lifestyles and characteristics, nationalities and geographical locations, and personal situations in the speed of transition to online education (16). Also, Allen and Seaman, and Seaman et al. emphasized the increase in online education in higher education in their studies (22,23). As a result, studies comparing it with traditional education to examine the effect and success of online education came to the fore (24–29).

With technological progress, students want to take distance education where they can choose alternative different programs that they can access without the constraints of time and space (30). With WBA education, students have opportunity to access more courses (31). Considering the working time, time spent with family, travel time and expenses,
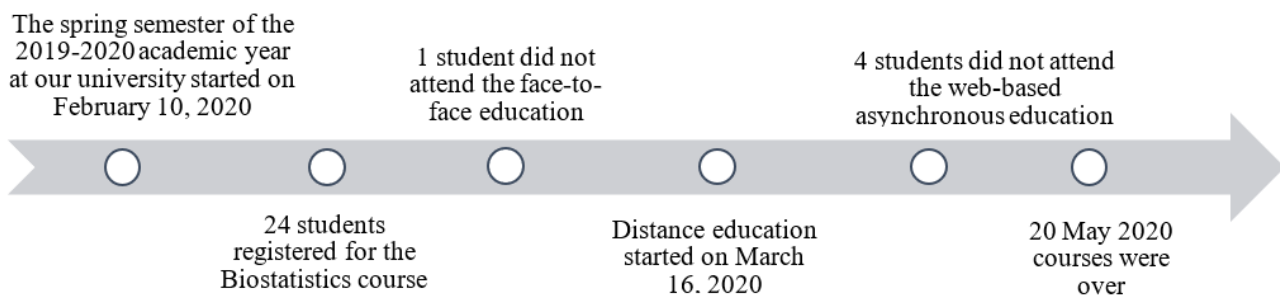
students prefer a freer education program. They prefer the program where they can communicate online with their lecturers and friends, access course materials over the internet, and submit their homework. (32). In FTF education, students can instantly interact dynamically with their friends and instructor, while they must be in the classroom at a certain time. As a result of this, new and different questions can be asked by students in situations that are not understood. In FTF education, the discipline in learning is provided by the trainer, while in WBA education, it is the student's responsibility. Research shows that online students are more likely to drop out if they don't like the instructor, the format, or the feedback (33). Students' predisposition to technology can also be a factor in their education type preferences. Students who are prejudiced against technological innovations may prefer face-to-face education. As a result, both FTF and WBA education have pros and cons. Williams et al. suggested that FTF education should be considered as a supplement rather than a complete replacement due to poor performance in WBA education (34). In their study, Atchley et al. supported FTF education as online education students would drop out more easily and could lack feedback for both students and lecturer (35). On the other hand, Westhuis et al. stated in their study that students who received online education performed at least as much or even better than students who received FTF education (36).

As in higher education, the provision of distance education has increased also in the post-graduate education of universities. Biostatistics courses are not offered as standard at universities (i.e. they are frequently taught in undergraduate and post-graduate studies of health-related faculties and institutes. The "Biostatistics" course is a particularly attractive course to be offered via distance education. Various studies have also been conducted on the online delivery of biostatistics education. McGready and Brookmeyer compared the results of students who taught 16 weeks of biostatistics at a public health college in the online and on-campus format (37). Varghese et al. compared the academic performance of post-graduate dental students studying video-based learning and blended module-based learning in a biostatistics and research methodology course at a post-graduate program at a dental college in India (38).

The difference in our study is that after FTF education was interrupted due to the pandemic, the same students continued to study with WBA education. Of the 19 students in our study, 13 (68.4%) preferred WBA, five FTF (26.3%), and one online education (5.3%) if they would take this course once again. During the WBA education, Google Classroom was used for information, document, and video sharing. Google Classroom was chosen because of its prevalence, usefulness, and freebies. An element that seems to be a disadvantage due to the cost of distance education was provided to students free of charge. The video recorded at the time of the application, the data sets to be used in the applications, the analysis files related to the subjects were shared using this platform. There was no difference between the two student groups' thoughts on choosing WBA education in practice. The exercises made using the statistical package programs were recorded on video. It was seen that both groups preferred to use video while making the applications because there was no time and place constraints. When examined in terms of theoretical courses, students who prefer WBA education want to take courses with WBA, and students who prefer FTF education want to take courses with FTF. The students stated that they were more satisfied with the education system they preferred than the other group. WBA students stated that they have more flexible, motivated, and analytical thinking opportunities.

When the scale developed by Özkaya et al. was applied to measure the distance education perceptions of the students, the "students' perception" and "time management" scores of the WBA students were found to be higher positively (39). There was no difference between WBA and FTF students in terms of "Equipment facility", "Facility and support of the institution" and an overall score of the scale.

According to the open-ended questions, the most important emphasis of the students who prefer WBA education is flexible time, the possibility to watch it again and the cost of travel, etc. spending decreased. Employees shared that they do not have to worry about taking leave and absenteeism. They stated that if they could not understand the lecture videos, watching them again relieved them. In the answers given by the students who preferred FTF education, they stated that they made this choice because they had to be able to communicate with the lecturer instantly and they had to listen to the lesson.

Limitations

The limitations of the study are related to the student's skills/abilities and the student's predisposition to distance education. While comparison groups are divided according to students' preferences, students who prefer WBA education are likely to be more prone to computer, internet, and distance education than FTF students, and vice versa. There are also limitations for variables such as student intelligence, skill level, and gender. Considering the sample size obtained to provide education in the number of optimal students, these variables were not considered. Also, the ability of the lecturers to use technology is an important element of WBA education. Besides, the ability of the lecturers to use technology is an important element of WBA education. In this study, although the lecturer did not have any problems with the use of technology in WBA education, it is limited to generalizing these results according to the characteristics of the lecturers. Another important constraint is that the students' computers, mobile phones, and internet communication services are limited. Depending on the income level of the students, there may be students who cannot benefit from these opportunities.

Conclusion

In some cases, crises that occur further accelerate the current development. The emergence of the epidemic has accelerated the process of integrating technology into education. Educators, students, and educational institutions had to adapt to the new order. The question is, will there be a return to pre-pandemic in the education system from now on? WBA education is a very good alternative to courses similar to biostatistics courses where computer programs are frequently used. The transition to WBA education can be permanent if the state and universities provide internet, necessary hardware, and software support to students and faculty members and if a dynamic interaction is provided, which is the advantage of FTF education. Anxieties of students who prefer FTF education can be relieved by increasing instant interaction. WBA education is very attractive to graduate students and lecturers because of the advantages it

provides in terms of time, place and resources. It is seen as the first preferred method in cases where traditional education is interrupted. The progress in information and communication technologies works in favour of WBA education. It will most likely be shaped in the future, in line with the advancement in technology and the demands of students and lecturers.

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