Using Bloom's Digital Taxonomy as a framework to evaluate webcast learning experience in the context of Covid-19 pandemic

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Abstract

Distance education has been the concern of educational institutions nowadays due to COVID 19 pandemic. The purpose of this study which was carried out during COVID-19 pandemic lockdown period in 2020 was to evaluate the effectiveness of webcast applications on teacher training. Since it was a sudden and an unpredicted transition from face-to-face education to webcast education, it was crucial to evaluate the outcome of teaching applications in order to compensate for the missing points in education. The evaluation framework in this study was based on Bloom's Digital Taxonomy. The participants' responses demonstrated that as a consequence of the webcast application in education, remembering, understanding, and analyzing skills were activated better than applying, evaluating, and creating thinking skills in the digital taxonomy. The findings would not be applicable to all webcast training but only to the course design that was delivered as an emergency remote course in a global pandemic.

Keywords Webcast education · Distance education · Bloom's Digital Taxonomy · Thinking skills · Teacher training

1 Introduction

Distance education which has various genres such as webcast learning, online learning, online education, virtual learning or e-learning is assumed to create efficient and fast-evolving modes of learning and teaching. Literature on the benefits of distance education argues that distance education which enables students to access online materials and course content can activate higher level thinking skills such as critical thinking, creativity, communication, comprehension,

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collaboration, media literacy, technology literacy, productivity among others (Bennett et al., 2008; Kirkwood & Price, 2014) and works well for mostly autonomous, self-directed, and self-regulated learners (Prensky, 2010; Seiver & Troja, 2014; Yen & Liu, 2009).

In some instances, distance education courses can be offered as synchronous through interaction with the instructor and peers studying the course or can be offered as asynchronous through pre-recorded materials without any online interaction either with the instructor or classmates (El-Seoud et al., 2013; Watson et al., 2010). The teaching which is practiced on a webcast platform through such one-way pre-recorded video is called webcast education. In webcast platforms, students are mostly exposed to passive learning with no live interaction during the course time. An alternative to webcasts is webinar which is hosted as live meetings in which students are expected to be more active on a synchronous platform. Distance education realized either synchronously or asynchronously on webinar or webcast platforms has become more popular, since it offers learning opportunities through ample resources and facilities (Bebell & O'Dwyer, 2010; Liu, 2017). It is also suggested that when education is designed through hybrid learning that is planned via both face-to-face and webcast or webinar platforms, it yields better results than merely one mode (Prantosh et al., 2012).

Webcast learning and teaching approaches have become widespread due to limitless access to the course content, since webcast approaches provide students with opportunities to access course materials anytime and anywhere (Brown, 2012; Giannoumi et al., 2017; Wang, 2008). In some studies conducted to investigate the effectiveness of webcast approaches on exam scores of students, it is advocated that webcast approach also improves students' educational achievement (Ituma, 2011; Nagy & Bernschütz, 2016; Traphagan et al., 2010). However, webcast courses are criticized due to some application weaknesses such as ineffective online discussions, failure in the internet connectivity, not being competent in using the technology, and having limited digital literacy. Therefore, there is a growing demand for well-designed websites for all users as well as for students and teachers to become digitally literate (Aizpurua et al., 2016; Hart, 2015).

In the relevant literature, it is suggested that in order to get fruitful outcomes via webcast approaches in education, online courses need to be designed to foster cognitive skills of students (Brown, 2012; Collins, 2014). Cognitive skills are classified as a range from lower order thinking skills (LOTS) to higher order thinking skills (HOTS) in Bloom's taxonomy. Bloom's taxonomy follows thinking process as a continuum from lower order skills to higher order skills ranging from knowledge to comprehension, application, analysis, synthesis, and evaluation.

Bloom's taxonomy (1956) was revisited and adapted to the issues in the digital world at the beginning of the twenty-first century by Churches (2007) and Anderson and Krathwohl (2001). In the revisited taxonomy, previously used nouns were replaced by verbs. Another change was made between two higher order thinking skills: synthesis was replaced by evaluating, and evaluation in the previous one was replaced with creating in the recent one. The corresponding actions for each skill are determined as consistent with digital abilities:

Bloom's Taxonomy	Revisited digital taxonomy
Knowledge: Remembering or retrieving previously learned material	*Remembering:* recognizing, listing, describing, identifying, retrieving, social networking, social bookmarking, local bookmarking, searching
Comprehension: The ability to grasp or construct meaning from material	*Understanding:* Interpreting, inferring, paraphrasing, classifying, exemplifying, blog journaling, twittering, categorizing and tagging, commenting,
Application: The ability to use learned material, or to implement material in new and concrete situations	*Applying:* implementing, carrying out, using, showing, loading, playing, operating, uploading, sharing, editing
Analysis: The ability to break down or distinguish the parts of material into its components so that its organizational structure may be better understood	*Analysing:* comparing, organizing, deconstructing, outlining, finding, structuring, integrating, media clipping
Synthesis: The ability to put parts together to form a coherent or unique new whole	*Evaluating:* checking, hypothesizing, experimenting, judging, testing, detecting, monitoring, reviewing, collaboration, networking
Evaluation: The ability to judge, check, and even critique the value of material for a given purpose	*Creating:* designing, constructing, planning, producing, inventing, devising, making, programming, filming, directing, broadcasting

In order to obtain the desired actions from higher order and lower order thinking skills adapted for the digital world, webcast approaches need to be designed appropriately for creating autonomous learning situations for students in the digital world. Whatever webcast approach is preferred, it must be framed with specific learning and teaching objectives as well as teachers' content and pedagogical knowledge (Aizpurua et al., 2016; Hart, 2015).

2 Webcast approaches during COVID-19 pandemic period

Webcast approaches for education have been expanding for different purposes all over the world, especially, in the countries such as the USA, Canada, Japan, Australia, Singapore, and many European countries. However, since 2020, the use of webcast approaches has become unavoidable for nations all over the world due to the COVID-19 pandemic (Anderson et al., 2020; Mulenga & Marbán, 2020). According to UNESCO reports (2020), more than 1.5 billion students and youth all over the world have been affected by school and university closures due to the COVID-19 pandemic. Therefore, alternative approaches have been employed to engage students into learning process during the pandemic period (Mian & Khan, 2020). Digital technologies have been used in the institutions such as schools, universities, and colleges (Anderson et al., 2020). In Turkey, the crucial legal arrangements for education were designed and announced by the president of the Council of Higher Education in a press release on 18 March 2020: *'as for the universities that are not capable of offering distance education, the pool of open course materials, which we have created in a short period of time, will be opened to all universities on March 23, 2020; digital facilities and distance education methods will be used in the*

theoretical courses of application-based programs and applied courses will be given at the most appropriate time, including the extension of the schedule determined by our universities.' Since the release, webcast facilities have been used in all Turkish universities like the other countries all over the world. In order to discuss and evaluate the outcomes of such webcast applications, research studies have been published in various countries; some of these studies are presented in the literature review section below.

3 Literature review

During the COVID-19 pandemic period, in the field of education, there have been paradigm shifts from face-to-face learning to online learning, and a variety of online based learning approaches have been used (Abidah et al., 2020; Chang & Fang, 2020). In a study carried out to compare online learning with face-to-face learning, it was stressed that because of the COVID-19 pandemic, online learning is not an alternative any more, but a need for the support of educational infrastructure (Fitri & Putro, 2021). The efficiency of such digitally-mediated model has been examined and discussed from teachers' and students' perspectives. In the fairly recent studies, for instance in Alkinani (2021), Khlaif and Salha (2020), Zayapragassarazan (2020), it was found out that the ways of teachers' thinking about teaching have changed. The findings of another study conducted by González et al. (2020) displayed that distance education has positively affected student success thanks to new learning methodologies. However, in some studies, it was claimed that the effectiveness of distance education mediums during the COVID- 19 is still a dilemma for teachers to determine the medium's effectiveness (Wargadinata et al., 2020). In a qualitative study designed with meta-analysis of the recently published studies on the topic, the results indicated the numerous challenges teachers face such as inadequate training, incompetence, restricted accessibility, poor web infrastructure, and modest technological assistance (Abalkheel, 2022). Similarly, in a study which examined some published papers on the advantages and disadvantages of online distance education during the COVID-19 pandemic period, it was concluded that mostly key disadvantages of online distance education such as inequality of access, inadequacy of online teaching, poor communication quality, increased workload, low technological literacy, difficulty in assessment were declared by the researchers (Abu Talib et al., 2021). Therefore, in the literature, it was suggested that to ensure the development of students' learning capacity, the aspects of access, online socialization skills, information exchange capabilities, motivation levels through the process of learning by doing, Bloom's Digital Taxonomy can be revisited for evaluating knowledge construction in terms of applying, analyzing, evaluating, creating, remembering, and understanding during and post-pandemic education (Abalkheel, 2022; Amin & Mirza, 2020; Bagchi & Parasar, 2021). For instance, in a study conducted by using an online need assessment questionnaire, it was found out that the future challenge is to develop a learning media that students can use in studying Bloom's taxonomy, and solution to learning problems is using learning media in electronic books that students can use offline (Jauhariyah et al., 2021).Thus, it has been expected that by

contextualizing Blooms' Digital Taxonomy, students might expand their knowledge and skills, and teachers might develop their course plans for using online activities and preparing assessments as a reference to each higher order and lower order thinking skills listed in the digital taxonomy.

3.1 Materials and method

The purpose of this study was to examine the impacts of webcast education on student teachers' awareness about professional development in a methodology course and to evaluate the process via Bloom's Digital Taxonomy Map revisited by Andrew Churches. The content of the course was intentionally aligned to the taxonomy to scaffold the student teachers from LOTS to HOTS. The participants were expected to remember, understand, apply, analyze, and evaluate the course content uploaded by the instructor. For creating skills, the instructor assigned them to produce their own sample teaching activities and to upload them on the webcast platform.

3.2 Research questions

1. What are the benefits of webcast education in teacher training?
2. Does webcast training help student teachers develop thinking skills as defined in Bloom's digital taxonomy?
3. Which thinking skills are activated better in the digital context?

3.3 Sample

The research was carried out with the participation of thirty-two student teachers attending the English Language Teaching Methodology course of English Language Teacher Training program at a Turkish university. The participants were third year prospective teachers who were recruited from one class. They were nearly at the same age level (ranged from 20-to 24). Of thirty-two student teachers, twenty-six were female. It is known that if the participants in a study are same on a given characteristic, that characteristic is constant, not a variable in the study (Gliner et al., 2011); therefore, the data were not evaluated according to age and gender differences.

3.4 Procedure

The webcast education was implemented for seven weeks during the early days of the COVID-19 pandemic in the spring term, 2020. For the first six weeks, the course participants attended the face-to-face sessions. However, after the pandemic announcement, they had to take the course in asynchronous webcast sessions for the remaining seven weeks. The web tool was the e-learning platform offered by the university. The webcast sessions were dominated by video content. The course was designed asynchronously through pre-recorded videos without any online interaction either with the instructor or classmates. The webcast was not constrained by a

time limit. The video recordings of the course that were uploaded each week were accessible anywhere at any time. When the participants had any questions or clarification needs for the ambiguities, they were able to send questions to the course professor for getting answers via e-mail. They were given some tasks during the process; they were responsible for reading the course notes and watch the video recordings. At regular intervals, they were asked some questions and expected to upload their answers to the platform. However, during the webcast education, the participants could not have interaction and discussion sessions as they did in the first six-week face-to-face setting.

The student teachers were also responsible for preparing lesson plans. They uploaded their work each week. All materials and resources were visible to all class members. Additionally, in the webcast education process, they were exposed to both formative assessment as mid-term exam and summative assessment as a final exam. For the assessment, they were given topics on teaching issues and wrote essays on the topics.

3.5 Data analysis process

In the study, mixed methods sequential explanatory design which is considered to be highly popular among the researchers (Ivankova et al., 2006) was selected to seek answers to the research questions addressed above. For quantitative data collection, a 26- question online survey was designed by the researcher and distributed to the participants. For quantitative data analysis, the Statistical Package for Social Sciences (SPSS) version 20 was used, and percentage and frequency values of the responses given to the questions in the questionnaires were statistically analyzed and are presented in separate tables.

For qualitative data, online interview sessions were arranged and the responses were reported. The responses of the participants were evaluated and coded by two raters; the categorized responses were presented through content analysis. Additionally, the inter-rater agreement was measured through Cohen's Kappa. During the data collection process, all participants were exposed to a consent process wherein they allowed their work to be published. Furthermore, ethical and consent procedures with the institution were accomplished.

4 Results

Table 1 displays the gathered data about the webcast education. The highlighted verbs in the questions correspond to the thinking skills defined in the digital taxonomy.

When the questions in the questionnaire are associated with so-called Bloom's Digital taxonomy in terms of lower order thinking skills and higher order thinking skills, questions 2, 11, 16, 23 correspond to 'remembering'; questions 1,4,17, 18 correspond to 'understanding'; questions 3, 7, 8, 14 correspond to 'applying'; questions 5, 9, 22, 25 correspond to 'analyzing'; questions 10, 13, 15,20,24,26

Table 1 Evaluation of webcast teaching

Items	Strongly agree	Agree	Undecided	Disag	Strongly disagree	x̄	SD
1. I was able to **interpret** the given information in order to figure out it for my teaching profession	30.8	53.4	9.0	6.8	-	4.06	0.78
2. I managed to **identify and locate** the notions of the course on my own	5.3	59.1	33.9	1.8	-	3.84	0.95
3 I felt ready to **learn in a webcast environment**	-	9.5	28.6	60.9	-	1.74	1.12
4. I felt comfortable myself while **comparing** the new topic with the previous ones in digital learning	7.0	70.9	16.8	5.3	-	4.07	0.69
5. I was able to **outline** the course content on my own	22.8	67.2	9.8	-	-	4.05	0.68
6. I could **plan** my tasks for daily access to the course content	-	67.8	9.0	21.1	7.0	3.17	0.89
7. I was motivated to **execute** my tasks in webcast platform	5.1	15.7	11.6	51.8	15.8	2.20	1.07
8. I was able to **produce** the necessary skills required for comprehending the course topics	29.1	62.5	1.0	7.5	-	4.67	0.59
9. I could **construct** meaning from uploaded material	9.8	42.1	26.5	21.6	-	2.98	1.14
10. I could easily **make judgments** on the course topic	16.3	60.9	10.3	12.5	-	4.32	0.64
11. I could **list** the novel items from my daily course materials	-	53.7	41.4	1.8	5.0	3.70	0.96
12. I was able to **plan** the schedule for accessing the course	21.1	36.1	22.3	20.5	-	3.30	1.21
13. I was able to **elicit discussions** on the topics with my classmates	1.8	12.2	11.3	30.3	44.4	1.62	1.18
14. I could **maintain my schedule** for accessing the course content	-	18.6	-	63.9	17.5	1.86	1.21
15. I was motivated to **complete** my work without getting any face to face control	-	5.2	12.6	26.0	56.2	1.85	1.22
16. I used **social networking** in order to communicate with my classmates	-	6.0	9.4	68.3	16.3	1.88	1.21
17. I preferred **consulting** the topic with my professor when necessary	-	10.4	-	53.0	36.6	1.90	1.24
18. I could **categorize** the details of the course topic	-	1.8	12.8	40.6	61.8	1.17	1.34
19. I tried to **hypothesize** about the content by judging	51.0	24.3	15.0	10.0	-	4.39	0.60
20. I could **produce** as a result of my collaborative work	1.7	3.2	17.4	77.7	-	1.87	1.16
21. I felt I was able to **obtain** coherent information for my future profession	16.3	30.9	22.3	30.5	-	3.31	0.98
22. I could **draw connections** among the course topics	34.1	60.1	8.6	-	-	4.34	0.81
23. When I had difficulty in understanding the course content, I tried to seek solutions via **googling**	80.0	20.0	-	-	-	4.80	0.51

Table 1 (continued)

Items	Strongly agree	Agree	Undecided	Disag	Strongly disagree	$\bar{x}$	SD
24. I could **explain** novel concepts from digital material	28.6	53.1	11.3	7.0	-	4.14	0.78
25. When I encountered difficulty, I tried to **find the source of the problem**	23.6	40.7	3.3	24.3	10.0	3.61	1.12
26. I could **monitor** my learning process	-	22.5	18.0	42.1	17.4	2.98	1.06

correspond to 'evaluating'; and questions 6,12,19,21 correspond to 'creating'. The responses of the participants revealed that they could develop and use some thinking skills in a productive manner. In productive manner, they declared they were able to interpret the given information for their profession by comparing the new topics with the previous ones, since they felt they were able to outline and comprehend the course content, make judgments and hypothesize on the topics by drawing connections; they admitted that when they failed to understand the given information, they tried to find the sources of the difficulties and they used search engines to understand the new concepts.

Despite such productive manners of the participants, they proclaimed that they were not ready for the webcast approach and not motivated to do their tasks and complete their assignments without face-to-face control. Additionally, most of them declared they could not have discussions, communication, and consultation with both their classmates and the professor of the course due to technology limitation. Thus, they did not participate in collaborative work during the digital learning process. They also declared some contrasting views on some specific issues; they admitted they were able to outline the course content but not to categorize the details on their own. Similarly, although most of them declared they could make plans for daily access to the tasks, they could not study the course content day by day due to the irregular education life at home. While most of the participants confirmed that they managed to interpret the given information for their teaching profession, they did not understand how to produce coherent information for their profession.

The responses were re-evaluated with the mean scores of each category to check how effective the categories were. The mean scores and standard deviations of each thinking skill categorized in line with the questionnaire were calculated and displayed in Table 2.

As displayed in the table, the participants' understanding skill was found to be the most effective category ($\bar{x}$ =4.41). This category is relatively followed by remembering ($\bar{x}$ =3.65), analyzing ($\bar{x}$ =3.20), applying and creating ($\bar{x}$ =3.14), and evaluating skills ($\bar{x}$ =3.08).

4.1 Interview reports

The reliability of the participants' responses about the webcast teaching was also checked through semi-structured interviews. Below given some sample statements:

Do you think Webcast teaching for developing professional knowledge was beneficial?

Table 2 The mean scores of the thinking skills taxonomy

	Remembering	Understanding	Applying	Analysing	Evaluating	Creating
$\bar{x}$	3.65	4.41	3,14	3.20	3.08	3.14
ss	0.84	0.67	0.90	0.87	0.91	0.90

"Webcast helped me specify appropriate professional knowledge…""I did not feel myself well prepared for webcast education and to share my tasks with my classmates…""I was able to make judgment when necessary…"

What were the common benefits of Webcast teaching in skills development?
"I was able to access to the digital courses anywhere and at any time.""I could manage to comprehend digital materials""I could interrelate the given information with the previous ones"

What were the differences between face-to-face education and webcast education?
"…we mostly faced some troubles while accessing the information via webcast, but not in face-to-face education""…not having discussions at webcast session; therefore, it was not motivating…""…webcast sessions were artificial for me…"

Did Webcast teaching help you develop appropriate educational aims?
"I could develop educational aims but could not maintain my aims…""Digital materials were intelligible but I was not aware of my learning process…""Webcast sessions provided a space for me to bring the course topics together…"

For qualitative data analysis, content analysis was carried out for interpreting interview reports, and the responses of the participants were categorized. Initially, each category was described clearly, and the categories were designed as consistent with the actions of each thinking skill in the digital taxonomy. The categories were re-checked a few times in some intervals to confirm the results and to set aside the personal perspective of the researcher. The researcher asked another colleague to interpret the original data and reflect on the categories. The colleague confirmed the analysis of the researcher. Finally, the notions of the categories were described in four themes.

The views of the participants categorized with the corresponding thinking skills were narrated and presented with the consistent themes in Table 3.

As displayed in the table, the participants felt themselves competent in professionally self-development and skills development. In professional development, they were mostly able to generate and use remembering, understanding, and analyzing thinking skills. The highlighted themes in the table reflect the difficulties they had in other thinking skills. As narrated in the table, they mostly failed to participate in interaction or namely sharing with others and in developing educational aims.

The comments about the challenges of webcast teaching made by the participants in the interview sessions were also transcribed for analyzing the rate of recurrence. For analyzing transcribed thirty-two recordings, a total number of 234 written comments (about 7.3 per participants) were documented by the researcher

Table 3 Categories of the student teachers' views about webcast education

Categories	Themes			
	Professionally self-development	Sharing others' experiences	Developing educational aims	Enhancing skills development
Remembering	identifying and locating notions	**not being able to use social networking with classmates**	drawing connections among the course topics	listing the novel items from digital materials
Understanding	interpreting the given information for future profession	**not having consultation on the course topic with the professor**	**having difficulty in categorizing the keywords**	being comfortable while comparing the new topic with the previous ones
Applying	**not being ready and motivated to learn in a webcast environment**	**not being able to share tasks with classmates**	**not being able to maintain the schedule for accessing the course content**	being able to produce the necessary skills required for comprehending course topics
Analysing	**not being able to obtain coherent information for future profession**	being able to explain the new concepts from digital material	**not being able to constructing meaning from digital material**	being able to outline the course content
Evaluating	making judgments on the course topic and googling to find solution to problems	**not being able to participate in discussion sessions**	**not being able to monitor the learning process**	**having difficulty in completing the works**
Creating	making plans to implement the individual tasks	**not being able to produce via collaborative work**	**having difficulty in planning the schedule**	creating opportunities for hypothesizing about the content

initially. The categories that were initially sorted by the researcher were coded collaboratively by two raters. The codes of the two raters were computed through Cohen's Kappa in order to measure the reliability for two raters' ratings. The inter-rater agreement ($K_{234=}0.87$) was achieved. The coded items were sorted out in 13 categories and displayed in Table 4.

Table 4 indicates that the largest proportion and percentages of the challenges transcribed were not being motivated for webcast education, not being able to use, share, and discuss with their classmates in webcast environment, having difficulty in categorizing the professional notions, and not being able to consult on the course topic with the course professor. The transcribed mentions such as not being able to produce collaborative work, to monitor the learning process, and to obtain coherent information for future profession were categorized as moderate level challenges. The other categories were at a lower level of difficulty.

5 Discussion

In this study, with the aim of exploring the efficiency of the webcast education, Bloom's Digital Taxonomy Map was taken as criteria, since in educational settings, Bloom's taxonomy has been assumed to facilitate educators' work to distinguish between higher order skills and lower order skills of students (Burns, 2011; Wedlock & Growe, 2017). In this respect, the findings of this study may highlight some issues on thinking skills development in distance education, though the findings were assumed to be applicable not to all webcast training but only to this course design that lacked interactive components and was delivered as an emergency remote course in a global pandemic.

Table 4 The documented challenges about webcast education

Categories of the challenges	F	%
not being ready and motivated to learn in a webcast environment	35	15.3
not being able to use social networking with classmates	29	12.2
not being able to share tasks with classmates	18	6.3
not being able to obtain coherent information for future profession	11	4.9
not having consultation on the course topic with the professor	33	14.9
having difficulty in categorizing the keywords	21	9.3
not being able to maintain the schedule for accessing the course content	9	4.0
not being able to participate in discussion sessions	22	9.5
not being able to monitor the learning process	16	7.2
having difficulty in completing the works	10	4.5
not being able to produce via collaborative work	17	6.1
having difficulty in planning the schedule	8	3.6
not being able to constructing meaning from digital material	5	2.2
TOTAL	234	100.00

The discussion of the findings is initially presented by addressing briefly the research questions of the study. For seeking answers to the first research question about the benefits of webcast education, the participants' responses were evaluated in a range of themes that are professionally self-development, sharing experiences with others, developing educational aims, and skills development. As the findings demonstrated, most of the participants benefited from the webcast application in terms of its accessibility, since they could access the course content anywhere and at any time without having any time limitations. Thus, they could get the opportunity of revisiting the website whenever they needed. These results are consistent with the results of the studies by Giannoumi et al., (2017) and Brown (2012). However, in some respects they criticized the webcast application. The most important criticism was that they did not feel themselves ready for such education settings and had difficulties while maintaining their educational aims. These criticisms made by the participants are consistent with the results of the other studies carried out by Wargadinata et al. (2020) and Abalkheel (2022) which pointed out some numerous challenges such as restricted accessibility, poor web infrastructure, modest technological assistance. Additionally, they admitted that face-to-face education was superior to webcast education. The most important reason for this decision was that they could not find opportunities to participate in discussions with their classmates in the webcast sessions.

The brief answer for the second question 'Does webcast training help student teachers develop thinking skills defined in Bloom's digital taxonomy?' is that the webcast training helped the participants develop some of the thinking skills better than the others. As for the third question 'Which thinking skills are activated better?' the participants' responses confirmed that they activated *remembering* skills while identifying and locating the notions, seeking solutions for the difficulties via web-searches. At the *understanding* level, they were able to interpret the information for their future occupation by comparing the new topic with the previous ones. However, they were not capable of categorizing the details. At the *applying* level, they were not not motivated to execute their tasks on webcast platform and not able to maintain their schedule for accessing the course content; however, they became competent in producing their assignments.

At the *analyzing* level, they felt themselves competent in outlining the course content, in finding solutions to problems, and in drawing connections among the course contents; but they were not competent in constructing meaning from the digital materials. For *evaluating* skills, they were found to be competent in making judgments and explaining novel concepts; however, in eliciting discussions with classmates and producing through collaborative work, and in monitoring their learning process, they were not found to be skilled enough. At the *creating* level, while planning their tasks for daily access to the course content and hypothesizing about the content they were assumed to be skilled; but when planning the schedule and in producing coherent information they had difficulty.

The participants' responses demonstrated that as a consequence of the webcast education, they tended to develop some of the thinking skills better than the others. Among the listed skills in the digital taxonomy, *remembering, understanding*, and *analyzing* skills were successfully activated. However, *applying, evaluating*,

and *creating* thinking skills were not activated adequately. The reasons for activating *remembering, understanding*, and *analyzing* skills may be interrelated with the actions implemented for those skills that mostly necessitate individual endeavor for activating thinking skills. Additionally, they were competent enough while getting the input; but in productive skills, that is, while giving output they were not evaluated as competent learners.

Moreover, they could not activate thinking skills well while collaborating with others. The reason may be that they could not create occasions to have interaction and to participate in discussion sessions due to asynchronous course sessions. Another reason for the negative ideas might be that the participants like other people all over the world were exposed to confinement due to the pandemic, and they might not have felt themselves ready for the webcast education. Moreover, the course design could be a factor in the results. Since this emergency course was not designed purposefully due to lack of time for intentional planning of a web-based course, the participants suffered a loss in depth of instruction. The findings of this study are important in terms of lessons to be learned from the pandemic. In the face of such sudden emerging situations, higher education should prepare a well-designed educational infrastructure in an attempt to take the necessary precautions for academic continuity, cope with difficulties, and provide education under all conditions. Regarding the overall results of the study, it can be noted that such webcast courses recognized as single-acting education could not contribute to all thinking skills defined in Bloom's Digital Taxonomy.

Although the results of this survey may be helpful for sharing experiences with others working through the challenges of the global pandemic, this research has some limitations. It is limited with a particular group in a particular course; it would be better done with more participants from other cohorts of learners studying similar courses in other institutions that pivoted from face-to-face to online due to the COVID-19 pandemic; or longitudinal studies comparing the next couple of years with 2020 would be designed. Thus, instructional strategies need to be designed consistent with the needs of students for effective learning via information technology, particularly for the programs that include both applied and theoretical courses like teacher training programs (Başal & Elcan Kaynak, 2020; Lan, 2014). Additionally, live broadcasting or synchronous online education may offer more facilities and benefits to students when compared to webcast.

6 Conclusion

The outcome of the webcast applications in education needs to be explored so as to assess whether the anticipated achievement has been obtained. Since the worldwide webcast applications have become obligatory for all education institutions during the COVID-19 pandemic period and this obligatory education format is a novel application, the positive and negative impacts of the applications should be investigated. In this study, the effectiveness of webcast practices was examined on teacher training. The evaluation was made on the basis of the thinking skills defined in Bloom's Digital Taxonomy. The overall results displayed that the webcast education was not very

functional for developing thinking skills. In remembering, understanding, and analyzing categories that include mostly input oriented actions, the webcast education assisted the participants to be productive; however, in productive skills which are applying, evaluating, and creating, the webcast education was not very operational for the participants.

Declarations

Competing interests There are no potential competing interests with respect to the research process, reporting the data, and publication of this article.

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