Telepresence In Medical Education: Technology and Educational Effectiveness

Tıp Eğitiminde Televaroluş: Teknoloji ve Eğitim Etkinliği

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ÖZET:

Amaç: Televaroluş teknolojisi, mesafelerle ayrılmak yerine aynı masada birlikte oturmuş gibi, bizzat orada olmak için en iyi yöntemlerden biridir. Bu çalışmada, televaroluş teknolojisinin tıp öğrencilerinin başarısı üzerindeki etkilerini, patoloji dersinde yüz yüze öğretim yöntemiyle karşılaştırarak alternatif bir öğretim yöntemi olarak araştırılması amaçlanmıştır.

Gereç ve Yöntem: Araştırma nicel yöntemle Yüz Yüze Öğretim Grubu için 53 öğrenci ve Televaroluş Öğretim Grubu için 40 öğrenci ile toplam 93 kişilik bir öğrenci grubu ile yapılmıştır. Veri toplama araçları olarak "Konu Sonu Testi" ve "Final Sınavı" kullanıldı, ve videoların tekrar süreleri kaydedildi. Veriler ANCOVA, tek yönlü ANOVA, Bonferroni düzeltme testi, korelasyon ve t testi ile analiz edildi.

Bulgular: Konu Sonu Testi notları incelendiğinde, Yüz Yüze Öğretim Grubu'nun ortalama puanlarının ortalaması Televaroluş Öğretim Grubu'nun ortalama puanlarından 12.86 puan daha yüksekti. Final Sınavı için Yüz Yüze Öğretim Grubu'nun ortalama puanları Televaroluş Öğretim Grubu'nun ortalama puanlarından 1,12 puan daha yüksekti. Ders tekrarı süreleri incelendiğinde, Televaroluş Eğitim Grubunun Yüz Yüze Eğitim Grubundan 19,75 dakika daha fazla geçirdiği ve her iki grubun da öğrencilerin başarısını iyileştirici bir etkisi olduğu görülmüştür. Korelasyon analizi Televaroluş Eğitim Grubunun başarısının% 32,5'inin ve Yüz Yüze Öğretim Grubunun başarısının% 28,6'sının ders video tekrarından kaynaklandığını göstermiştir.

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Sonuç: Sonuçlar, yüz yüze ders alan ve televaroluş yöntemi ile başarı oranları ile derslerin devamındaki tıp öğrencilerinin tutulması arasında istatistiksel bir fark göstermemektedir. Aynı zamanda "tekrar zamanlarının" öğrencinin başarısı üzerinde önemli bir etkisi olduğu görülmüştür.

ABSTRACT:

Aim: *The telepresence technology is the next best thing to being there in person as though sitting together at the same table instead of separated by distances. In this study, it is aimed to investigate the effectiveness of telepresence technology on medical students' success as an alternative teaching method comparing with face-to-face teaching method in the pathology course.*

Methods: *A quantitative method was used in this study with (totally N 93) 53 students for the Face-to-Face Teaching Group and 40 students for the Telepresence Teaching Group were used. Measurements were done by "End of Subject Test" and" Final Exam" and repeat times of videos were recorded. The data were analyzed by ANCOVA, one-way ANOVA, Bonferroni correction test, correlation and students' t test.*

Results*: When End of Subject Test grades was analyzed, the average of the Face-to-Face Teaching Group's average points was 12,86 points higher than the Telepresence Teaching Group's average points. For the Final Exam, the average points of the Face-to-Face Teaching Group were 1,12 points higher than average points of Telepresence Teaching Group. When course repeat times were analyzed it was seen that the Telepresence Teaching Group had spent 19,75 minutes more than the Face-to-Face Teaching Group and have an improving effect on both groups students' success. And correlation analysis showed that 32,5 % of the success of Telepresence Teaching Group and 28,6 % of the success of Face-to-Face Teaching Group result from course video repetition.*

Conclusions: *The outcomes show no statistical difference between success rates and retention of medical students having courses face-to-face and via telepresence method. And it was seen that "repeat times" had a significant effect on student success.*

INTRODUCTION

The modern age requires information society to produce, to use, and to learn with new technologies. New technological systems, learning-teaching processes, educational media, and program design methods show themselves as the human power in education (1).

With learning applications supported by technological systems, participants can join the learning environment remotely and the information content can be shared without by time and location limits (2). When learning is carried out by telepresence, the new version of video conferencing, blended learning can be used effectively. Telepresence is really an entirely new technology and surpasses video conferencing with quality, simplicity, and reliability. Blended learning is a suitable approach to provide education for individuals supported by e-learning and classroom-based tools (3).

Technologies that use emerging theories and paradigms emphasize experiential and collaborative learning. Telepresence no longer limits students and teachers to be in the same place. Participants at multiple sites are able to see, hear, and interact with each other in real time (4). Additionally, it includes codecs that increase bandwidth and provide high definition. When telepresence systems provide a high degree of immersion they are called immersive

telepresence. Immersion provides users feel actually participating even though apart (5).

Students studying in remote areas sometimes have limited chances for education. Telepresence can be used to lessen this problem by providing effective education that would not have otherwise been possible. In this context, an effective telepresence system requires adequate conferencing equipment and initiative, attainable and available internet connection to be used for medical education (5).

In order to evaluate the use of the telepresence system in medical education the sub-problems of the research are as follows:

(1)What are the elements of telepresence systems which can facilitate learning and teaching in medical education activities?

(2)What are the effects of online course videos repeat times (in minutes) on students'final exam success?

(3)Is the telepresence based medical education effective when compared with traditional face-to-face medical education?

TELEPRESENCE TECHNOLOGY IN EDUCATİON

Today's technology, making remote or virtual collaborations, has never been important as in our time. Presence is the ability to authentically engage the hearts and minds of others. The concept of presence can be a powerful differentiator that improves leadership skills, relationships, and careers. Presence is closely related to student satisfaction and believes for the effectiveness of a course. Presence is an important practice for an online course. Garrison, Anderson, and Archer (6, 7) described three types of presence. These are Social Presence, Cognitive Presence, and Teaching Presence.

Social Presence: Social presence is "achieved in the community of inquiry model by faculty and students project their personal characteristics into the discussion so they become 'real people'". It encourages the expression of feelings, perspectives, and openness (6).

Cognitive Presence: Cognitive presence is sharing how our brain is adapting, integrating, thinking and sometimes struggling with concepts, ideas, and structure. It is a way of gaining insight into learners' individual zones of proximal development. Cognitive presence is cultivated by students' expressing a desire to understand ideas by dialogue that discerns patterns, connects ideas, and identifies relationships (7).

Teaching Presence: Teaching presence is defined as the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes. It consists of two major categories of teaching direction. The first is the course materials that are prepared before the course begins: the syllabus, concept introductions, discussions, assessment plans, and lists of required and recommended resources. The second is the monitoring, mentoring, questioning, and shaping of the growing knowledge of particular learners in a course. The first is developed on the assumptions of what students probably know and understand. The second is customized to a particular set of students (6).

TELEPRESENCE TECHNOLOGY IN COURSE PREPARATION

While preparing a telepresence course for teaching, the content of the lesson should not be the subject of the lesson. Effective telepresence presentation should be emphasized in order to make the course more fluent. The design process for telepresence course is as follows:

• Collect information to be presented,

• Design activities and interaction,
• Develop visual teaching materials,
• Review and time planning (7).

For telepresence-based teaching, course goals should be well defined for each telepresence sessions separately. The objectives should not be more than three or four . The content should be structured in a logical order according to course objectives. The visual and audial effects on structure and presentation should be considered (7).

When designing a course for telepresence, each material affects the length of the course (7). 30-50% of course time (20-30 minutes of each hour) should be dedicated for presentation and the rest should be used for activities. Five to eight minutes of each main session should be spared for an introduction of the covered subject. Course slides should not be left open for more than five minutes (8).

Using face-to-face educational materials and communication technology tools together are expressed as "Blended Learning" (3). Blended learning has advantages like providing interaction between student-student and student-teacher, student-content enhancing students' behavior with feedback, providing help and morale, controlling the level of the student and possibility for getting ready for the exams (9). It has been stated by the researchers that Blended Learning aproach has five key points. These are; real situations, learning on own pace, coordination, evaluation and performance support tools (10).

In telepresence based education multimedia presentations are vital. In multimedia learning theory, individuals selectively put the objects that are sensed as visual and audial items in short-term memory, structures the information here and sends them to the long-term memory after joining them in running memory. Student's learning by images and words are better than learning only by words (7).

Mayer's Multimedia Learning Theory states that when a message is presented with text, audio and visual items (video, image or graphics) learning is improved and provides learners with deep and conceptual understanding. Using words and voice separately is less effective. Thus, Mayer associates cognitive theory with three assumptions in multimedia. These are dual path assumption, limited capacity assumption and active process assumptions (11).

Individuals learn better by using learning materials that contain verbal and visual information about the subject than materials that contain only verbal or only visual information (11). Thus, Dual Coding Theory emphasizes that memory has two different representation systems as verbal and visual. Individuals learn by joining previous information with new information (12).

Telepresence requires evaluations that will determine student success and the quality of teaching and learning. Using a lot of technologic source and technique during teaching may result in losing focus on teaching/learning. There are different tools to measure the methods that are used. Most commons are the test, survey, interview and observation records. Experiments, presentations, multiple choice and written pre-test/post-test exams are also for student evaluation. Evaluation should be more oriented on the success of all students than the success of individual students. Evaluation can be done for effectiveness, interest, and productivity dimensions (13).

TELEPRESENCE ENVIRONMENT

Telepresence environment determines student success and the quality of teaching and learning. Depending on the type of telepresence, various

equipment and software may be required to build the system. The tools are becoming much easier to use than in the past and the cost is decreasing as well (4). Basically, telepresence is synchronous transmitting of audio and video using mutual connections between two or more locations that are physically separate from each other. There are three basic components in an interactive telepresence system (14). These are near end, remote end, communication systems, and interconnections.

The telepresence systems generally evolve into three distinct types: Integrated Systems, Desktop Systems, and Portable Units.

Integrated Systems: Room-size setups integrated and physically fixed into the classroom design. The teacher usually has access to a variety of multimedia equipment and peripherals right at their fingertips. Multiple monitors and microphones are available. In this environment, a lecturer presents from a high-tech classroom to students attending both locally and remotely.

Desktop Systems: Advances in technology with Voice over IP systems, such as Skype have turned any IP connected device with a camera and microphone into individual video conferencing stations. Most laptops, video tablets, such as the iPad have a built-in camera and have a built-in microphone. Document sharing and the relatively low cost of desktop systems make this an ideal tool for tutoring, just-in-time learning, and short meetings.

Portable Units: The equipment is loaded onto a rolling cart and moved to which-ever location needs it. Mobility may be an advantage in some settings if there is not space and money for a full-featured integrated system. These units are suitable for either formal or informal settings (14).

Basic Equipment and Operation Concepts

The telepresence equipment can be segregated on the basis of application, web and audio conferencing equipment, virtual desktop infrastructure, mobile integration tools, and robotics telepresence equipment. Based on the product type, the telepresence equipment can be immersive telepresence equipment and room-based telepresence equipment. The telepresence system is anticipated to the technology initiates integration with multiple media devices and adjacent arcades. The devices and Technologies are listed by Parlakkilic (15) and Lichtman(16) as follows:

- Codec
- Camera
- Monitor and Screen Placement
- Sound and Acoustics
- Lighting
- Collaborative Tools
- Document Cameras and Ceiling Mounted Visualizers
- Interactive Whiteboards, and Digital Flipcharts
- The Digital Microscope

METHODOLOGY

A quantitative method was used in this study. In the study, Face-to-Face Teaching Group and Telepresence Teaching Group were used. Both groups (N=93 students) consist of 3rd-grade students in Medicine School. The participants were 53 students for the Face-to-Face Teaching Group and 40 students for the Telepresence Teaching Group. Measurements had been carried out on both groups as “End of Subject Test” and” Final Exam”.

The study was carried out in twelve weeks as four hours per week. Telepresence Teaching Group took the course with telepresence teaching method in a remote multidiscipline laboratory. Face-to-Face Teaching Group took

the course in original multidiscipline laboratory with the same standards and equipment. After each course over, students of both groups had the same "End of Subject Test" as multiple choice tests. When the term was over, both groups had the same "Final Exam". The data were analyzed by ANCOVA, one-way ANOVA, Bonferroni correction test, correlation and t test. A website for pathology course was developed including general information about telepresence conferencing, course notes, resources, announcements, important links, assignments, contact information, course time schedule, teacher information and recorded videos of past courses. And it was accessible for both groups. When the students visit the website, a session was opened for each student, student's visit time (as date, hour, minute, second), the pages visited, the video material watched. Also, the entrance-exit times for the sessions were recorded in a log file. The course repeat times were evaluated by using the log file for each student.

RESULTS

In this study, we focused on student outcomes at the end of subject tests and the final exam. The participants were 93 students that were separated into two groups as 53 students (57%) for Face-To-Face Teaching Group and 40 students (43%) as for Telepresence Teaching Group. Descriptive statistics are in Table 1.

Table1 Definitive Statistics

Method	Variables	N	Lowest	Highest	Average	Standard Deviation
Face-to-Face Teaching Group	End of subject test	53	32	90	69.04	15.811
	Final exam	53	40	92	66.57	13.538
	Repeat times(min)	53	7	98	55.40	22.661
Telepresence Teaching Group	End of subject test	40	28	80	56.18	11.976
	Final exam	40	38	88	65.45	13.496
	Repeat times(min)	40	45	98	75.15	12729

Table 2. Relationship between Final Exam Grade and Repeat Times

	Groups		r	p
Final Exam Grades	General		0.236	0.023
	Face-to-Face Group	Teaching	0.286	0.038
	Telepresence Group	Teaching	0.325	0.041

The end of subject test grade avarage for Face-to-Face Teaching Group was evaluated as 69.04 ± 15.81, and 56.18 ± 11.97 for Telepresence Teaching Group. The end of subject test grades was not fit into the normal distribution (p=0.006) for Face-to-Face Teaching Group. It was found that the end of subject test grades was fit into normal distribution (p=0.532) for Telepresence Teaching Group. This showed that there was a significant statistical difference between the two groups' for the end of subject test grades.

The difference between the median of Face-to-Face Teaching Group (56.66) and the median of Telepresence Teaching Group (34.20) was statistically meaningful (Z=3.978; p<0.001). Face-to-Face Teaching Group has higher end of subject test grades than Telepresence Teaching Group.

When the results are analyzed for the final exam, the average of grades for the Face-to-Face Teaching Group and the avarage for the Telepresence Teaching Group fit for the normal distribution and coherence (p>0.05). After the analysis of final exam grades, the Face-to-Face Teaching Group and the Telepresence Teaching Group was not statistically important (t=0.394; p=0.694).

When the course repeat time was analyzed it was observed that the average repeat times of Face-to-Face Teaching Group was 19.75 minutes more than the Telepresence Teaching Group. It was observed that as the repeat times increases, the final exam grade increases as well.

When the relation between the course repeat times and final exam grade were analyzed using Pearson correlation analysis, there was a statistically significant effect as shown in Table 2 (r=0.236; p=0.023). While 28.6% of final exam grade of Face-to-Face Teaching Group can be explained using repeat times, remaining 71.4% results caused by other sources. While 67.5% of final exam grade of Telepresence Teaching Group resulted from other factors, 32.5% was depended on repeat times. Telepresence Teaching Group final exam grades were more dependent on course repeat time than Face-to-Face Teaching Group final exam grades.

DISCUSSION

All results support the results of MacLaughlin et. al (17) that shows no statistical difference exists between success rates of medical students having courses face-to-face and via videoconferences. Furthermore, this study supports Guidera's evidence about education over the internet which makes learning easier and the evaluation results equal to or higher than results in a conventional environment (18).The outcomes of this study show similarity with other recent studies in terms of effectiveness and efficiency in medical education (19). Flexible and easily maintainable open-source software platforms are essential for growing. The dependence on proprietary software architectures should be avoided if the object is to make telepresence more practical and pervasive (20) .

When the end of subject test grades was analyzed, it was seen that the average grade of the Face-to-Face group was 12,86 points higher than the Telepresence Teaching Group's average grades. This finding showed that there was a significant statistical difference between groups in end of subject test averages. When the final exam grades were analyzed, it was observed that the average of the Face-to-

Face Teaching Group was 1,12 points higher than Telepresence Teaching Group. This showed that there was no significant statistical difference

between groups in final exam grade averages. It was seen that Telepresence Teaching Group repeat averagely 19,75 minutes more than Face-to-Face Teaching Group. It means that "repeat times" had a significant effect on student success. Also, correlation analysis showed that 32,5 % of the success of Telepresence Teaching Group and 28,6 % of the success of Face-to-Face Teaching Group resulted from course video repeat times. Since telepresence was used as a blended teaching method, it is proposed to use blended learning with interactive telepresence teaching method. Also, it was seen that the telepresence system includes the audiovisual quality, resulting in intimacy, convenience, and ease of use had positive effects on teaching remotely. Participants were able to set up and implement a telepresence supported educational activity with limited/no assistance.

REFERENCES

1. Keser,H. Çağdaş Eğitim Teknolojileri Ve Okulda Etkin Kullanımı. Yönetici Adaylarının Eğitimi Semineri. Ankara. 1999.

2. Butler.L., Kisber, L. Teaching and Learning in the Digital World: Possibilities and Challenges. Spring 2013 Vol. 6 No. 2

3. Várallyai,L., Herdon, M., Burriel, C., Tamás, J., Riczu,P., Pancsira. P.). A Collaborative Virtual Learning Environment for Agro-Forestry Trainings, 2015

4. Theobald, D., Ittelson, J. C. Facing the world: Telepresence in education. Berkeley, CA: The California State University. 2012.

5. Telepresence24. The difference between Video Conference, Telepresence and Immersive Telepresence. 2012. http://www.telepresence24.com/2012/10/28/the-difference-between-video-conference-and-immersive-telepresence/

6. Garrison, D. R., Anderson, T., Archer, W. Critical thinking, cognitive presence, and computer conferencing in distance education. American Journal of Distance Education. 2001, 15(1), 7–23. doi:10.1080/08923640109527071

7. Mason, S., Davis M. Teacher's Guide To Videoconferencing, Northwest Regional Educational Laboratory, 2000

8. The Northeast Texas Consortium (Netnet). Guide To Internet Course Design And Development. 2003. http://www.Netnet.Org

9. Singh, H. Building Effective Blended Learning Programs. 2003. http://www.bookstoread.com/framework/blended-learning.pdf

10. Teaching and Learning Centre. Blended Learning, 2004. http://commons.ucalgary.ca/documents/blendedlearning_2.pdf

11. Clark, R. C., Mayer, R. E. E-learning and the science of instruction. San Francisco:Pfeiffer. 2011

12. Sadoski. M.. Applications And Extensıons Of Dual Codıng Theory Challenges And Controversıes, 2009 http://www.education.com/reference/article /dual-coding-theory/

13. University Of Malta.. A Guide to Videoconferencing .Version 3.0. 2013. http://www.csc.um.edu.mt adresinden

14.Therese, O.B. Multimodal student interaction online: an ecological perspective. ReCALL, 2009. 21, pp 186-205.

15. Parlakkilic, A.. Bridging the gap with distance education students: Telepresence. In: E. Gulsun & Y. Volkan (eds.). Handbook of research on emerging priorities and trends in distance education: Communication, pedagogy, and technology. Hershey, PA: IGI Global, 2014, 294–307.

16.Lichtman, H.S.Creating telepresence environments, 2013. http://www.webto-rials.com/main/resource/papers/telepresence/paper5/Creating_Telepresence_Environments.pdf

17.MacLaughlin, E. J., Supemaw, R. B., & Howard, K. A. (2004). Impact of Distance Learning Using Videoconferencing Technology on Student Performance. American Journal of Pharmaceutical Education, 68(3).

18.Guidera, S. G. Perceptions of the effectiveness of online instruction in terms of the seven principles of effective undergraduate education. Journal of Educational Technology Systems, 2004, 32(2& 3), 139–178.

19. MacLeod, A., Kits,O.,Mann, K., Tummons, J., & Wilson, K., W. The invisible work of distributed medical education: exploring the contributions of audiovisual professionals, administrative professionals and faculty teachers, Advances in Health Sciences Education, 2016

20.Allan,R, Telepresence In Medicine. 2008. http://www.electronicdesign.com/displays/telepresence-medicine