Educ Res Med Sci. 2020 June; 9(1):e100355. doi: 10.5812/erms.100355.

Published online 2020 August 10. **Research Article**

The Comparison of the Effects of Multimedia Tools and Traditional Methods on Neurosurgery Learning

Amir Mohammad Merajikhah [1], Behzad Imani [2,*] and Nahid Nowruzi [1]

[1] M.Sc. Student, Department of Operating Room, Student Research Committee, Hamadan University of Medical Sciences, Hamadan, Iran
[2] Assistant Professor, Department of Operating Room, School of Paramedicine, Hamadan University of Medical Sciences, Hamadan, Iran

[*] *Corresponding author*: Assistant Professor, Department of Operating Room, School of Paramedicine, Hamadan University of Medical Sciences, Hamadan, Iran. Tel: +98-8138381014, Fax: +98-8138381017, Email: behiman@yahoo.com

Received 2020 February 02; **Revised** 2020 July 29; **Accepted** 2020 August 03.

Abstract

Background: Educational multimedia software as a student-oriented educational tool provides an optimal educational condition, which allows students to view surgical videos and photographs and fill the gap between theoretical and practical training.
Objectives: The present study aimed to compare the effects of multimedia tools and traditional methods on the neuroscience learning of the undergraduate students of surgical technology in Hamedan, Iran.
Methods: This quasi-experimental, interventional study was conducted on 32 undergraduate students of four surgical technology courses, who were selected via convenience sampling. Neurosurgery sessions were divided into two parts, including traditional and multimedia-based education, which were used to teach the multimedia software in the field of neurosurgical topics (movies, photographs, and atlases). The learning of the students was measured by a written test. Data analysis was performed in SPSS version 23 using *t*-test, and paired *t*-test was also used to compare the differences between the traditional and multimedia education.
Results: The multimedia education was more effective compared to the traditional method of learning in neurosurgery education ($P < 0.001$).
Conclusions: According to the results, multimedia education could be used as a new and effective educational method in operating surgical technology and training.

Keywords: Traditional Method, Multimedia Method, Learning

1. Background

Technological advancement is rapidly changing our culture (1). New teaching and learning formats based on digital and web-based technologies have greatly influenced the teaching of instructors and learning of students (1). The theorists in the field of education believe that traditional education classes are no longer effective as they largely depend on a particular place and time, which cannot provide a real and appropriate context for learning. Educational software provides reliable and abundant resources as an opportunity for learners to grow and create a collaborative environment, which allows learners and teachers to search and explore a variety of issues (2).

Today, students feel better about new technologies to increase their motivation and improve their performance. The use of communication tools in education has also been growing within the past two decades. Online learning or e-learning has been used in educational programs across the world (3). The process of education provides appropriate learning opportunities to all students to learn in various areas of educational goals (cognitive, attitude, and psychomotor levels) and develop their personality.

The main characteristics of healthcare providers depend on their communication skills, literacy, creativity, problem-solving, and proper use of technology. The use of multimedia tools and podcasts by students could also enhance these skills. Due to the expansion of research and use of multimedia tools in medical education, these multimedia tools and their benefits have been exploited by fewer institutions (4). Undoubtedly, this technology creates many opportunities for the learning environment and results in the impressive educational interaction, while they cannot enhance the quality of teaching and learning alone. In other words, the environment of learning and teaching, the performing of learning activities, learning process, and feedback process must be tailored appropriately; nevertheless, there are no guarantees for the achievement of the educational goals (2).

E-learning not only provides students with great learn-

ing opportunities in medical education, but it also expands their professional skills in their future occupations (5). The disadvantage of traditional training is that in traditional teaching, students learn and forget quickly (6); meanwhile, medical and healthcare students prefer traditional teaching methods to educational multimedia (7).

Effective learning is the result of proper teaching, which is achieved in an appropriate environment through creative and encouraging practices (8). Educational methods play a pivotal role in learning. Some of the new educational techniques (e.g., multimedia tools) over the traditional paradigm include the benefits of higher clarity and activity, being interesting and more varied, and higher learning speeds, in addition to helping students to learn more enthusiastically. Multimedia-based education could enhance educational quality and provide an excellent opportunity for education (9).

Multimedia learning (note words and pictures) is particularly important in medical education (10). The use of multimedia tools enhances healthcare knowledge, health promotion, and disease prevention (11). Therefore, media tools are considered to be a powerful tool for the dissemination of information (12), while the use of educational technologies does not necessarily make medical education more effective (13).

Medical education is improving rapidly, and students enter medical schools with a high level of technological literacy and expectation of educational diversity in the curriculum. Today, most medical schools use active learning methods and multimedia training (14). In the study by Vagg et al. (15), the participants recognized the key role of multimedia as a practical learning tool that could greatly complement and enhance traditional teaching methods although it was not considered a replacement (15). In addition, Sharif et al. stated that multimedia training facilitates the acquisition of technical and cognitive skills and is acknowledged as a training resource (16).

The studies in this regard have mainly been focused on nursing, and no studies have investigated the surgical technology.

2. Objectives

The present study aimed to compare the effects of multimedia tools and traditional methods on neurosurgery learning.

3. Methods

This study was conducted during February 2, 2019-June 27, 2019. The hypothesis of the research was that multimedia is more effective in neurosurgery education compared to traditional methods.

3.1. Sampling

This quasi-experimental study was conducted at Hamedan University of Medical Sciences in Hamedan, Iran for one semester. The sample population included the undergraduate students of Hamedan University of Medical Sciences who had completed the course of neurosurgical technology. The participants were selected via convenience sampling (total: 32).

3.2. Data Collection

To achieve the objectives of the study, the end-of-term exam was used to assess the pretest and posttest learning levels. The scores were determined in each section, and the scores of the students in each section were compared. The final exam consisted of 40 four-option questions, 20 of which were focused on multimedia teaching, and 20 were focused on traditional teaching.

3.3. Intervention

In the present study, the number of the teaching sessions in surgical technology was divided into two sections of traditional sessions and multimedia sessions to examine the related goals. The second session was taught through multimedia. The inclusion criteria were the consent of the students to participate and having a neurosurgery technology unit. The exclusion criteria were the unwillingness of the students to participate and elimination of the neurosurgery technology course. To achieve the objectives of the study, the end-of-term exam was used to assess the learning level in the traditional and multimedia methods. The scores were determined in each section, and the scores of the students in each section were compared.

3.3.1. Teaching the First Two Sessions Using the Traditional Method

The first two sessions were taught using the traditional teaching method with PowerPoint, PDF files, and lectures regarding the neurosurgery technology. The duration of each class was one hour and thirty minutes, and the sessions included brain surgery subjects, such as the general anatomy of the human brain, hydrocephalus, and transsphenoidal hypophysectomy.

3.3.2. Teaching the Second Two Sessions Using Multimedia

The second two sessions were using multimedia teaching in accordance with the neurosurgery technology unit, which lasted one hour and thirty minutes each. These sessions were focused on subjects such as craniotomy, surgical instruments, and CT-scans in surgery. In the teaching

method, the theoretical concepts regarding the relevant subjects were initially discussed, followed by teaching using various surgical videos, atlases, and color photographs of surgeries using the multimedia software. Each section of the software was composed of several features, such as the films, photographs, and atlases of surgeries, following the theoretical teaching.

3.4. Final Test

At the end of the semester, the students were tested following the neurosurgery software-based training. The final test consisted of 40 questions, 20 of which were focused on traditional teaching, and 20 were focused on multimedia teaching; the obtained scores were compared and analyzed in SPSS version 23.

3.5. Data Analysis

Data analysis was performed using the Kolmogorov-Smirnov test at the significance level of P = 0.797. In addition, various parametric tests were used, including paired *t*-test to evaluate the test results regarding the learning of the students.

3.6. Ethical Considerations

This article was extracted from a research project approved by Hamedan University of Medical Sciences (design number: 9712218075; ethics code: IR.UMSHA.REC.1397.989).

4. Results

The sample size of the study consisted of 32 undergraduate students of the fourth semester, including 17 females and 15 males. In terms of marital status, 30 students were single, and two were married. The age of 11 students was 19 years, 18 students were aged 20 years, and four cases were aged 21 years (Table 1).

Paired *t*-test was used to investigate the differences between the scores of the traditional teaching method and multimedia scores Table 2. The final exam consisted of two sections for the scores of the traditional and multimedia teaching methods. The mean difference between the two groups was estimated at 1.01, and the test result was P < 0.001. In other words, multimedia teaching was more effective in improving the learning of the students in neuroscience technology compared to traditional teaching.

Table 1. Demographic Characteristics of Subjects

Variables	N (%)
Gender	
Female	17 (53.1)
Male	15 (46.9)
Marital status	
Single	30 (93.8)
Married	2 (6.2)
Age, year	
19	11 (34.4)
20	18 (56.2)
21	3 (9.4)
Total	32 (100)

Table 2. Differences between Traditional and Multimedia Teaching Scores

Methods	Mean ± SD	P Value
Traditional	8.17 ± 1.16	< 0.001
Multimedia	9.18 ± 0.77	

5. Discussion

The present study aimed to compare the effects of using multimedia tools and traditional teaching methods on the learning level of neurosurgery technology students. According to the findings, multimedia teaching was more effective than the traditional teaching in neurosurgical technique learning. In a study in this regard, Welch et al. (17) stated that the use of multimedia tools had a significant impact on neuroanatomy education. Notably, the use of multimedia tools in medical education along with traditional methods has been reported to improve the learning of students, while it may not be effective alone. In the present study, the traditional method also affected the learning of the students. On the other hand, Hartman et al. (18) reported that multimedia teaching had no significant effect on the individual learning style. When students learn the assigned subject matter, they gain the ability to build mental models that could also address multimedia (18). In cases such as surgery education, students cannot imagine surgery only through mental processes. As such, the use of multimedia tools allows students to learn the surgical process through multimedia before actually experiencing neurosurgery.

Inconsistent with our findings, Valizadeh et al. (19) stated that the use of educational software had no significant effect on the medical knowledge of nursing students and their ability to calculate medication, while the multimedia method could reduce the lecture time and costs of

repetitive subjects, such as medication. In addition, Wang et al. (20) stated that in this method, the performance of students improved altogether, and the medical microbiology syllabus could be completed with a high quality to improve the effects of teaching. In the mentioned study, it was emphasized that we should not rely heavily on modern information teaching methods. Although multimedia provides new possibilities for teaching methods, its application has not increased, and the excessive use will reduce the communication between teachers and students, which is not conducive to the classroom (20).

Unlike the mentioned study, the students in the current research had a better relationship with the teachers. On the other hand, this method was more effective compared to the traditional teaching in the learning of the students. The results of the aforementioned studies are in line with our findings. On the other hand, the use of multimedia tools alone does not suffice, and traditional methods are also paramount in the proper education of students. In other words, the use of multimedia methods could positively influence learning in neurosurgery technology.

5.1. Limitations of the Study

In this study, special surgeries were used, and it is suggested that more surgeries be used for multimedia training in the further investigations in this regard.

5.2. Conclusions

According to the results, multimedia teaching had a positive effect on neuroscience technology learning and enhanced the learning of the students, so that it could be extended to other students or even other disciplines. Since this study was conducted on a few students, it is recommended that a wider range of students be evaluated to generalize this method. Multimedia-based education could be considered an effective teaching method in the learning of surgical technology students and the educational system.

Acknowledgments

This article was extracted from a research project approved by Hamedan University of Medical Sciences. Hereby, we extend our gratitude to the Research and Technology Department of Hamedan University of Medical Sciences for the financial support of this research. We would also like to thank the students for assisting us in this research project.

Footnotes

Authors' Contribution: Study concept and design: IB and MA. Analysis and interpretation of data: IB and NN. Drafting of the manuscript: MA. Critical revision of the manuscript for important intellectual content: IB, MA, and NNB. Statistical analysis: IB.

Conflict of Interests: There is no conflict of interest between the authors.

Ethical Approval: The ethical approval code was IR.UMSHA.REC.1397.989.

Funding/Support: Research and Technology Department of Hamadan University of Medical Sciences funded this research.

Informed Consent: Inform consent was obtained from participants.

References

1. Wallace H, VanderMolen J. Teaching Health Education Through the Development of Student Centered Video Assignment. *Frontiers in public health*. 2019;**7**. doi: 10.3389/fpubh.2019.00312. [PubMed: 31737592].
2. McCurry MK, Martins DC. Teaching undergraduate nursing research: A comparison of traditional and innovative approaches for success with millennial learners. *Journal of Nursing Education*. 2010;**49**(5):276–9. doi: 10.3928/01484834-20091217-02. [PubMed: 20055330].
3. Kowitlawakul Y, Chan MF, Tan SSL, Soong ASK, Chan SWC. Development of an e-Learning research module using multimedia instruction approach. *CIN: Computers, Informatics, Nursing*. 2017;**35**(3):158–68. doi: 10.1097/CIN.0000000000000306. [PubMed: 27811511].
4. Kim S, Choi S, Lee S, Hong Y, Cho H. The analysis of self and tutor assessment in the skill of basic life support (BLS) and endotracheal intubation: focused on the discrepancy in assessment. *Resuscitation*. 2011;**82**(6):743–8. doi: 10.1016/j.resuscitation.2011.01.031. [PubMed: 21402434].
5. Walsh S, De Villiers MR, Golakai VK. Introducing an E-learning solution for medical education in Liberia. *Annals of global health*. 2018;**84**(1):190. doi: 10.29024/aogh.21. [PubMed: 30873817].
6. Kordi M, Fakari FR, Mazloum SR, Khadivzadeh T, Akhlaghi F, Tara M. Comparison of the effect of web-based, simulation-based, and conventional training on the accuracy of visual estimation of postpartum hemorrhage volume on midwifery students: A randomized clinical trial. *Journal of education and health promotion*. 2016;**5**. doi: 10.4103/2277-9531.184548. [PubMed: 27500175].
7. Ali A, Khan ZN, Konczalik W, Coughlin P, El Sayed S. The perception of anatomy teaching among UK medical students. *The Bulletin of the Royal College of Surgeons of England*. 2015;**97**(9):397–400. doi: 10.1308/rcsbull.2015.397.
8. Alijanpour E, Amri-maleh P, Khafri S, Razzaghi F. Assessment of different cardio-pulmonary resuscitation teaching approach on quality of education in medical student, Babol 2011. *medical journal of mashhad university of medical sciences*. 2014;**56**(6):376–82.
9. Alimohammadi M, Samani LN. The Effects of Multimedia-Based Puberty Health Education on Male Students' Self-Esteem in the Middle School. *International Journal of Community Based Nursing and Midwifery*. 2019;**7**(2):109.
10. Mayer RE. Applying the science of learning to medical education. *Medical education*. 2010;**44**(6):543–9. doi: 10.1111/j.1365-2923.2010.03624.x. [PubMed: 20604850].

11. Geckle J. Use of multimedia or mobile devices by adolescents for health promotion and disease prevention: A literature review. *Pediatric nursing*. 2016;**42**(4):163.
12. Qureshi AA, Tenenbaum MM. Commentary on: Assessing the Value of a Multimedia-Based Aesthetic Curriculum in Plastic Surgery Residency: A Single-Center Pilot Study. *Aesthetic surgery journal*. 2018;**38**(12):NP225–6. doi: 10.1093/asj/sjy112. [PubMed: 29846506].
13. Yavner SD, Pusic MV, Kalet AL, Song HS, Hopkins MA, Nick MW, et al. Twelve tips for improving the effectiveness of web-based multimedia instruction for clinical learners. *Medical teacher*. 2015;**37**(3):239–44. doi: 10.3109/0142159X.2014.933202. [PubMed: 25109353].
14. McCoy L, Lewis JH, Dalton D. Gamification and multimedia for medical education: a landscape review. *J Am Osteopath Assoc*. 2016;**116**(1):22–34. doi: 10.7556/jaoa.2016.003. [PubMed: 26745561].
15. Vagg T, Balta JY, Bolger A, Lone M. Multimedia in Education: What do the Students Think? *Health Professions Education*. 2020. doi: 10.1016/j.hpe.2020.04.011.
16. Shariff U, Seretis C, Lee D, Balasubramanian SP. The role of multimedia in surgical skills training and assessment. *The Surgeon*. 2016;**14**(3):150–63. doi: 10.1016/j.surge.2015.10.003. [PubMed: 26577145].
17. Welch MC, Yu J, Larkin MB, Graves EK, Mears D. A Multimedia Educational Module for Teaching Early Medical Neuroanatomy. *MedEdPORTAL*. 2020;**16**. doi: 10.15766/mep_2374-8265.10885. [PubMed: 32181329].
18. Hartman H, Johnson P. The effectiveness of multimedia for teaching drug mechanisms of action to undergraduate health students. *Computers & Education*. 2018;**125**:202–11. doi: 10.1016/j.compedu.2018.06.014.
19. Valizadeh S, Feizalahzadeh H, Avari M, Virani F. Effect of education of principles of drug prescription and calculation through lecture and designed multimedia software on nursing students' learning outcomes. *Electronic physician*. 2016;**8**(7):2691. doi: 10.1016/j.compedu.2018.06.014. [PubMed: 27648199].
20. Wang HY, Zhang FB, Dilidaer K, Chen F, Zhao YJ, Ding JB. Using a Variety of Modern Teaching Methods to Improve the Effect of Medical Microbiology Teaching. *Procedia Computer Science*. 2019;**154**:617–21. doi: 10.1016/j.procs.2019.06.097.