

Impact of Using Educational Multimedia on Knowledge, Skill, and Reduction of Medical Error Following Bronchoscopy

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Background: Achieving procedural skills is one of the pillars of health higher education which is in line with the social responsibility of medical education. Since it is not possible to encounter important cases in bronchoscopy during the training course, the common cases that the students encounter in their future work environment were prepared as an educational video. Therefore, the purpose of this study was to find out the impact of using bronchoscopy educational video intervention on medical assistants' knowledge, skill, and medical error comparing it with the traditional method at Dr. Masih Daneshvari Hospital.

Materials and Methods: In this experimental study, two groups were randomly assigned: the experimental and the control. Each one consists of 15 participants. The first group used mannequins (traditional method) and the second used multimedia as the experimental group. Both groups were evaluated by pre and post-tests. Multiple choices (MCQs) were given to evaluate the knowledge and a checklist for skills. A comparison of the impact of intervention before and after education in both groups was statistically analyzed using the independent t-test.

Results: There were statistically significant differences between the experimental group and the control group at a significance level of 0.042 for the skill. An average increase of 3 points was observed in the experiment group, while the control group increased by 1.4 points. No significant difference was seen for knowledge. The number of patients with pneumothorax was also decreased.

Conclusion: Results showed that the multimedia training method effectively promotes the assistants' skills and reduces medical errors following bronchoscopy Administration. It is recommended to use educational videos (multimedia) to improve assistants' skills. It is suggested to apply the new model of education rather than sticking to the traditional one.

Keywords: Bronchoscopy; Education; Multimedia; Skill; Knowledge

INTRODUCTION

Bronchoscopy is a semi-invasive tool for optimal patient management (1) performed by intensive care physicians, pulmonologists, thoracic surgeons, and pediatric, and pulmonology subspecialists for therapeutic

and diagnostic purposes (2). This procedure involves the observation of the pharynx, larynx, trachea, and upper, and lower airways through the mouth or nose. This is significant in diagnosing pulmonary diseases (3). The methods utilized in this department are various and the

number is growing. Ensuring patient safety is of utmost importance when using these methods (4). Therefore, it is recommended that learning the skills which are necessary for novice bronchoscopists, take place regarding patient safety.

Gaining skills and training are associated with several ethical and technical problems (1, 5). The acquisition of bronchoscopy skills for first-year residents in respiratory medicine is only through traditional training and mannequins; therefore, observing the correct sampling technique has some limitations (6). The correct sampling method decreases the complications that may occur during bronchoscopy including shortness of breath, bleeding, pneumothorax, cough, hoarseness, dental damage, and chest pain (3).

Choosing the teaching method is one of the important educational design measures that should be in line with educational goals, learning skills, upgrading information and inclusive experience, and providing easy access to various resources (7). One of the main goals of education is to improve the quality of education and pay attention to the importance of new technologies. Utilizing appropriate teaching tools, equipment, and educational facilities is required in the teaching process, which speeds up learning and sustains educational content in the learner's mind (8). One of the rules that is important in physicians' curriculum planning is that expected competencies must be tailored to the needs of the community (9).

Video-based learning is one way to improve educational performance (10). Most technical skills can be acquired through modern training methods and can be measured by using valid checklists and questionnaires during the procedure and on real patients (11). The problems we face in training practical skills include damage to equipment and failure of some tools, inadequate access to laboratory samples, and lack of subspecialty professors to train and supervise learners' work, all of which cause discomfort for the learners (12). The persistence of these factors places a heavy financial burden on educational hospitals and the government (13).

The question is whether educational videos can be effective in enhancing learners' knowledge and skills. To answer this question, the researchers of the present study conducted this investigation to find out the impact of using multimedia bronchoscopy training videos on knowledge and skill and the reduction of medical errors associated with bronchoscopy in the first-year lung assistants of Dr. Masih Daneshvari Hospital.

MATERIALS AND METHODS

In this experimental study, two groups of residents in respiratory medicine were trained with two different teaching methods, and their learning of knowledge and skills were compared. The population of this study was comprised of 30 first-year lung assistants in the educational research-oriented hospital of Dr. Masih Daneshvari, affiliated with Shahid Beheshti University, from 2018-2019. After submitting the proposal to the Ethics Committee and obtaining the Code of Ethics numbered IR.SBMU.SME.REC.1398.087, the research started. At a briefing for first-year assistants, the method of study and its goals were outlined and their questions were answered in detail. The consent of the learners to enter the project was obtained. All participants were randomly divided into two groups including traditional mannequin training (n = 15) and video training (n = 15) (for 46 minutes including device preparation, how to perform BAL, correct sampling technique, and entering information into the computer). Samples that had undergone bronchoscopy courses or workshops or had undergone bronchoscopy for the second time were excluded. The study's data collection tools consisted of a 9-question multiple-choice questionnaire (MCQ) to assess knowledge, as well as a validated checklist to evaluate learners' skills based on domestic and international sources, papers, reliable textbooks, and pulmonology residents' curriculum. Ten experts and specialists confirmed its validity. The content validity of MCQ and checklists was considered to be acceptable by the experts. Also, the test-retest reliability was 0.88 and acceptable. The checklist includes the items about the

evaluation of bronchoscopy device preparation, broncho-alveolar lavage sampling, bronchial biopsy specimens, TBLB sampling evaluation, and BAL sampling evaluation.

The study involved the following variables: The independent variable: represented in using multimedia in teaching to the experimental group. The dependent variables: are represented in the students' knowledge and skill achievements and also medical errors. The previous academic achievement depends on the student's scores.

In this study, an independent t-test was used to compare the mean difference between the two groups. This study was designed and implemented in three stages.

A) Pre-test: Before the start of the training, the level of knowledge and skill of the participants were evaluated by MCQ and Checklist. The results indicated that the learners were not proficient.

B) Training (experiment): The study population was divided into two groups control and experiment, using either traditional or video education methods. This training was done in the control group through the traditional method and in the experiment group by educational multimedia. The video included preparing the machine, how to take the BAL sample, and the correct TBLB sampling technique based on the curriculum syllabus. Both groups were selected by a simple random sampling method. Both groups were allowed to comment during the process in case of questions or ambiguity.

C) Post-test: After completing the training, both the control and experimental groups were assessed for improvement in their level of learning, knowledge, and skills. A pulmonology subspecialist used MCQs and checklists to measure this improvement.

RESULTS

This study was conducted in a community of 30 first-year lung medical assistants studying at Shahid Beheshti University and Dr. Masih Daneshvari Educational Hospital during 2019-2020. There were 16 female (53.3%) and 14 male (46.7%) participants. There were 15 participants in each of the experiment and control groups. The experiment

group consisted of 3 men (20%) and 12 women (80%) and the control group consisted of 11 men (73.3%) and 4 women (26.7%).

A comparison of the results obtained from each method, the traditional and the educational video, is shown in Table 1. The results indicate that the learners' knowledge scores obtained from the MCQs pre-test for the two groups were not significantly different. A comparison of learning efficacy in the knowledge domain after Training of the two groups is shown in Table 1 which indicates no significant difference.

Table 1. Mean scores of two groups based on pre-test and post-test

| Groups | | Number | Mean Score | Significant differences |
|-----------|--------------|--------|------------|-------------------------|
| Pre-test | Control | 15 | 1.15 ±4.07 | 0.833 |
| | Experiment | 15 | 1.32±4.13 | |
| Post-test | Control | 15 | 1.47±9.10 | 0.395 |
| | Intervention | 15 | 2.24±9.37 | |

To show the results of the comparison between the effect of educational video and traditional method on skill at the pre-intervention level, Table 2 was adjusted. The results show that both groups were similar at the beginning of the study in terms of skill scores and no significant difference was observed between groups. A comparison between the effectiveness of the video and the traditional method in terms of skill after intervention is shown in Table 2.

Table 2. Mean scores of groups' skills before the experiment (pretest of skills)

| Group | | No. | Mean Score | Significant differences |
|--------------------|--------------|-----|------------|-------------------------|
| Pretest of skills | Control | 15 | 1.32±3.90 | 0.135 |
| | Intervention | 15 | 1.68±3.05 | |
| Posttest of skills | Control | 15 | 1.6±5.33 | 0.042 |
| | Intervention | 15 | 1.7±6.13 | |

The above table indicates that learners' scores were significantly different from the control group after the experiment.

DISCUSSION

This study showed significant changes in skill scores in the experimental group after the intervention of educational multimedia (video). When there are not enough qualified teachers to teach, educational videos can be used instead (14). In a study comparing the effect of educational video on acquiring midwifery student's episiotomy skills, the results were similar to our study. The mean scores of students in performing an episiotomy based on all of the cases in groups had statistically significant differences. They concluded that the educational video can be effective in gaining skills. Therefore, using the mentioned methods is recommended in clinical education planning (15). Holland et al. reported that an online video improved the clinical skills of students. The educational video was also reported to positively influence all themes identified in learning (16). Visualized educational materials such as the use of educational videos are effective methods in clinical education (17). The results of the present study also indicate that the application of educational video would be beneficial.

Learning the necessary skills for a novice bronchoscopy specialist is essential and to achieve these skills, identification of various lung segments and device preparation are very helpful. The use of educational videos in medical and clinical sciences is appropriate for highly sensitive procedures or those that occur rarely (14). Training videos especially which are made in a real environment with real patients and based on appropriate sampling principles and techniques like this study video would be helpful.

In this study, there was no significant difference between the knowledge level of the two groups based on pre-test scores of MCQ but the post-test results showed that scores of both groups have increased. A study compared the effectiveness of an information leaflet with that of a multimedia program in informing patients about

third molar surgery. It showed that the multimedia approach is effective in educating patients about third molar extraction (18).

Aghajani et al. evaluated the impact of multimedia training on the knowledge and performance of surgical technology students and observed significant differences before and after the intervention (19).

In this study, the intervention method was effective. In the multimedia training method, assistants can learn better through the ability to repeat the learning many more times as they want (20).

The factors that cause inadequate performance of the healthcare team in performing correct procedures are errors in the medical field, lack of knowledge, and inadequate familiarity of the personnel regarding the use of medical tools and equipment (21). Media training makes information available at any time and reduces the negative effects of the following factors on treatment procedure: lack of uniform requirements, lack of pre-assistance bronchoscopy curriculum, lack of identical learning tools, differences in trainers' teaching ability, and differences in learners' interest and skills (11). Through educational videos, it is possible to adapt training speed, display the recording on DVD, PC, or TV, and review the recordings 24 hours a day (22, 23).

Anyway, the positive effect of educational multimedia in surgical and medical science training has been proven (24, 25). Many studies have been conducted around the world on the application of educational multimedia (video) in clinical education (25-27).

CONCLUSION

According to the findings of this study to improve assistants' knowledge and skills, video-based training is useful in comparison to the traditional method and has a significant impact on the improvement of assistants' procedural skills. Thus, the application of video (multimedia) is helpful and suggested.

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REFERENCES

1. Di Domenico S, Simonassi C, Chessa L. Inexpensive anatomical trainer for bronchoscopy. *Interact Cardiovasc Thorac Surg* 2007;6(4):567-9.
2. Amir-Alavi C, Dadgaran I, Aghajanzadeh M, Alavi SA, Dehghan A, Nematy M, et al. Comparison of the Effectiveness of Web Based Bronchoscopy Simulator Versus Traditional Education on Knowledge of Tracheobronchial Anatomy of Anesthesia Residents. *Research in Medical Education* 2016;8(4):52-60.
3. Jabbarjarani HR, Kiani A, Sheikhi N, Arab A, Masjedi MR. Balloon bronchoplasty: case series. *Tanaffos* 2012;11(2):42-8.
4. Boskovic T, Stojanovic M, Stanic J, Pena Karan S, Vujasinovic G, Dragisic D, et al. Pneumothorax after transbronchial needle biopsy. *J Thorac Dis* 2014;6(Suppl 4):S427-34.
5. Davoudi M, Colt HG. Bronchoscopy simulation: a brief review. *Adv Health Sci Educ Theory Pract* 2009;14(2):287-96.
6. Heidegger T, Starzyk L, Villiger CR, Schumacher S, Studer R, Peter B, et al. Fiberoptic intubation and laryngeal morbidity: a randomized controlled trial. *Anesthesiology* 2007;107(4):585-90.
7. Bridges S, Chan LK, Hmelo-Silver CE, editors. Educational technologies in medical and health sciences education. New York (NY): Springer International Publishing; 2016.
8. Nourozi HM, Rokhi F, Karimi Moonaghi H. Comparison of video-based instruction and instructor demonstration on learning of practical skills in nursing students. *Iranian Journal of Medical Education* 2013;13(7):571-6.
9. Laughlin T, Wetmore S, Allen T, Brailovsky C, Crichton T, Bethune C, et al. Defining competency-based evaluation objectives in family medicine: communication skills. *Can Fam Physician* 2012;58(4):e217-24.
10. Callahan W. Technology as facilitator of quality education: A model. InEdMedia+ Innovate Learning. Association for the Advancement of Computing in Education (AACE). 2001; 225-7.
11. Colt HG. Simulation in bronchoscopy training: are we there yet?. *Current Respiratory Care Reports* 2013;2:61-8.
12. Karimi-Moneghi H, Valaei N, Mortazavi F. The effect of video-based instruction versus demonstration on learning of clinical skills. *Journal of Gorgan University of Medical Sciences* 2003;5(2):77-82.
13. Ewan CE. Teaching Skills Development Manual: A Guide for Teachers of Health Workers: Learning Unit. WHO Western Pacific Regional Teacher Training Centre for Health Personnel, University of New South Wales; 1982.
14. Koohestani HR, Soltani Arabshahi SK, Fata L, Ahmadi F. The educational effects of mobile learning on students of medical sciences: A systematic review in experimental studies. *J Adv Med Educ Prof* 2018;6(2):58-69.
15. Kalani Z, Koochpayezadeh J. Comparison of the education effect in simulated environment with educational film on acquiring midwifery students' episiotomy skill. *The Journal of Medical Education and Development* 2016;11(1):91-9.
16. Holland A, Smith F, McCrossan G, Adamson E, Watt S, Penny K. Online video in clinical skills education of oral medication administration for undergraduate student nurses: a mixed methods, prospective cohort study. *Nurse Educ Today* 2013;33(6):663-70.
17. Mansouri M, Bigdeli S, Dehnad A, Sohrabi Z, Alizadeh S, Keshavarzi MH. Exploring the features of mobile phone application of anatomy in basic medical sciences: a qualitative study. *BMC Med Educ* 2020;20(1):231.
18. Mladenovski A, Kieser JA. The efficacy of multimedia pre-operative information for patients: a pilot study. *N Z Dent J* 2008;104(2):36-43.
19. Aghajani M, Ajorpaz NM, Mohammadi S, Mohammadi A. Designing Multi-media learning software (MLS): Effects on surgical technology students' knowledge, attitude and practice. *Life Science Journal* 2013;10(10s):7-11.
20. Wang L. Developing and evaluating an interactive multimedia instructional tool: Learning outcomes and user experiences of

- optometry students. *Journal of Educational Multimedia and Hypermedia* 2008;17(1):43-57.
21. Moshfeghi K, Mohammadbeigi A. Comparison the effects of two educational methods on knowledge, attitude and practices of Arak physicians about breast cancer. *Pak J Biol Sci* 2010;13(18):901-5.
 22. Rouz Behi A, Fararoei M, Almasi A. A Study Comparing The Effect Of Educational Video Films With Computer Cds On Teaching Anatomy To Medical Students. *Armaghan Danesh* 2001; 6(23): 26-31.
 23. Corbally MA. Considering video production? Lessons learned from the production of a blood pressure measurement video. *Nurse Educ Pract* 2005;5(6):375-9.
 24. Banks E, Pardanani S, King M, Chudnoff S, Damus K, Freda MC. A surgical skills laboratory improves residents' knowledge and performance of episiotomy repair. *Am J Obstet Gynecol* 2006;195(5):1463-7.
 25. Xeroulis GJ, Park J, Moulton CA, Reznick RK, Leblanc V, Dubrowski A. Teaching suturing and knot-tying skills to medical students: a randomized controlled study comparing computer-based video instruction and (concurrent and summary) expert feedback. *Surgery* 2007;141(4):442-9.
 26. Khatooni M, Alimoradi Z, Samiei-Seiboni F, Shafiei Z, Atashi V. The impact of an educational software designed about fundamental of nursing skills on nursing students' learning of practical skills. *Journal of Clinical Nursing and Midwifery* 2014;3(1):9-16.
 27. Kelly M, Lyng C, McGrath M, Cannon G. A multi-method study to determine the effectiveness of, and student attitudes to, online instructional videos for teaching clinical nursing skills. *Nurse Educ Today* 2009;29(3):292-300.