

## ORIGINAL ARTICLE

## Triage live lecture versus triage video podcast in pre-hospital students' education



Hamidreza Aghababaeian<sup>a,b</sup>, Ladan Araghi Ahvazi<sup>b,a</sup>, Ahmad Moosavi<sup>c</sup>, Sadegh Ahmadi Mazhin<sup>a</sup>, Noorollah Tahery<sup>d</sup>, Mohsen Nouri<sup>e</sup>, Maryam Kiasi<sup>a</sup>, Leila Kalani<sup>a,\*</sup>

<sup>a</sup> Department of Nursing, School of Nursing & Emergency, Dezful University of Medical Sciences, Dezful, Iran

<sup>b</sup> Department of Health in Emergencies and Disaster, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

<sup>c</sup> Dept. of Health and Community Medicine, Dezful University of Medical Sciences, Dezful, IR, Iran

<sup>d</sup> Department of Nursing, School of Nursing & Midwifery, Abadan School of Medical Sciences, Abadan, Iran

<sup>e</sup> Tabriz University of Medical Sciences, Tabriz, Iran

## ARTICLE INFO

## Keywords:

Triage  
Lecture  
Podcast  
Pre-hospital  
Education  
Emergency

## ABSTRACT

**Introduction:** Triage is the process of determining the priority of patients' treatments based on the severity of their conditions. The aim of the present study was to survey the effect of triage video podcasting on the knowledge and performance of pre-hospital students.

**Methods:** Sixty pre-hospital students were randomly divided into two groups of a 30-subject control group and a 30-subject intervention group. A pre-test was administered among all students. Afterwards, for the first group, triage education was offered through lectures using PowerPoint, while for the second group, audio and video podcasts tailored for this training program were employed. Right after the training as well as one month later, post-tests were run for both groups, and the results were analysed using an independent *t*-test and covariance.

**Results:** No significant difference was observed between the effects of both types of education on knowledge and performance, either immediately, or one month after training.

**Discussion:** We suggest that video podcasts are ready to replace traditional teaching methods in triage.

## African relevance

- The use of traditional methods of teaching for triage cannot keep up with our fast-changing needs.
- This type of study is a first-of-its-kind design used in training triage as a podcast.
- The results show the effectiveness of the participatory triage podcast method in both learning and retention, and the methods are applicable to low-resource settings.

## Introduction

Disaster triage is the process of prioritising patients in treatments and based on the severity of the condition. It is generally used when the number of hospitalised patients or pre-hospital injured patients exceeds the capacity of admission and service provision [1–4]. Generally, in critical stages, triage is the approach that maximises the benefit for the greatest number of patients [1,5]. According to the evidence provided by

the research conducted in Iran and some other parts of the world, the level of knowledge or performance of medical students and staff about triage is unsatisfactory [4,6–12]. This situation is a reminder that the knowledge and performance of medical and pre-hospital students or personnel about triage is inappropriate, or that the level of knowledge and performance of medical students and groups involved at the first line of treatment is often weak and unacceptable [1,2,5,13]. Considering the current spate of accidents and disasters, despite all modern and advanced emergency medical equipment and technology, the most important component is still the lack of experienced and expert human resources. People who have learned to manage crisis situations on a regular basis can control the flow of massive emergencies using their knowledge and problem-solving skills [4,5]. On the other hand, the best solution is to provide efficient human resources to meet the community's needs [5]. Education is the foundation of all types of learning, and today, in educational planning, the training and improvement of human resources is considered as a strategy for increasing human capital and positive adaptation to changing conditions [14]. Education refers to a purposeful

Peer review under responsibility of African Federation for Emergency Medicine.

\* Corresponding author.

E-mail address: [lili\\_1980@ymail.com](mailto:lili_1980@ymail.com) (L. Kalani).

<https://doi.org/10.1016/j.afjem.2018.12.001>

Received 8 January 2018; Received in revised form 22 August 2018; Accepted 4 December 2018

Available online 04 February 2019

2211-419X/ 2019 African Federation for Emergency Medicine. Publishing services provided by Elsevier. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

and pre-designed activity that is aimed at providing opportunities for facilitating and speeding up learning within the educational system [15,16]. In this regard, the educational method is divided into virtual and face-to-face teaching methods. Face-to-face teaching methods (such as lectures) are teacher-centred. In contrast, virtual education is student-centred in which professors and learners are separated. Media is the source of the intangible relationship between these two important components of education [15–17]. Bloomberg classifies behaviours into cognitive, emotional, and psycho-emotional domains which can be experienced simultaneously. The cognitive domain is also called the domain of thought. Hence, there are various types of educational methods and tools for the development of cognitive abilities. The most important teaching methods that are often used to stimulate learning in the cognitive domain are believed to be lectures and person-to-person training, which are almost exclusive and complete in teaching cognitive behaviours. In more specific terms, the teacher teaches according to the curriculum in the classroom and the students also listen to the teacher's words in order to learn [16–18]. So far, different teaching methods have been used to help learners in different fields. However, there are multiple problems such as the lack of experienced and expert teachers, the availability of new educational facilities in the region, and the accessibility of new educational technologies. One further challenge is the need for students to be physically present in face-to-face classes, which has led to the development of virtual learning strategies using educational technologies and software. In fact, e-learning has been shown to increase learning by 20–30%, compared to traditional classroom teaching [19–21]. Thus, it seems that traditional methods of teaching, which are currently implemented, do not meet the fast pace of knowledge and the constantly changing needs of societies in the world of informatics. Besides, training medical students should continue beyond the university level into their professional lives.

The use of modern methods of education is extremely important in a way that some education experts have attached more importance to teaching methods than scientific knowledge and information [22]. Medical science teachers are always looking for new teaching methods, technologies, and tools. In this regard, recent innovative teaching tools in the fields of medical sciences take advantage of information technology. These tools can be classified into four groups, namely audio, video, computer-based, and combined [23,24]. In this regard, a new IT-based technology that has recently garnered a lot of attention in the field of education is podcasting [25]. A podcast is a form of mobile learning in which a device is used to hear audio or watch video. Programs are put on the internet and downloaded automatically on the computer (laptop/desktop). The learner can select when, where, and how to hear or see them [26]. From an educational perspective, a podcast is one of the most balanced and most formal educational methods. In fact, via using podcasts and transferring their lectures from their classrooms, teachers get numerous opportunities to improve communication and interaction [27]. In addition, a podcast is a powerful and complementary, not a replacement, tool for common educational resources, and frequent communication between teachers and students also increases the motivation of learners. The most important advantage of podcasts is related to its accessibility [28]. It can be played on mobile and portable devices such as the iPad and other tablets, computers, and even digital audio (MP3) players [29]. Podcasts, having a dynamic paradigm and educational potential, can help in improving teaching and learning in the classroom. Simplicity, comfort, time saving, and ease of use at any time and place are the other important benefits of podcasts [25,27,30]. In addition to the theoretical bases of multimedia, experimental research in the field of educational podcasts shows that podcasts have effects on various aspects such as learning and academic achievement of learners [25]. They lead to increased motivation in learners [27,29] and can be used as a powerful complementary tool alongside conventional training methods [27].

For years, nurse educators have used non-traditional methods such as audio and video tools, and computer-based e-learning tools are also

growing in popularity [31,32]. In a quasi-experimental study comparing the effects of the methods of e-learning and lectures on nursing students' level of learning in maternal and child health courses in Tehran, Zolfaghari et al. concluded that e-learning can be used as an effective tool in some nursing courses [33]. In this respect, Dennis et al. state that the use of multimedia enhances the overall positive attitudes of the learners since they can benefit from it [34]. A meta-analysis of 26 nursing studies investigating teaching in lecture form and e-learning showed that the electronic method had positive impacts on education [35], and this effect is much more effective when videos are used [36–41]. Fahy (2015), in a study that examined the impact of electrocardiogram education via video podcast method, stated that video podcasts can have a greater impact on increasing students' awareness than the lecture methods of teaching [42]. On the other hand, podcasts have a number of demerits. For example, the student-teacher interaction that can improve learning in other methods of training is not present in podcasts, and students cannot directly ask the professor questions and answers, while in other methods such as lectures student can ask the teacher questions, increasing direct interaction [40]. Owing to technological advances and the request of academics for the use of new tools and modern methods which can be used in distance and offline or online trainings, these tools and methods are being used in training larger populations of learners. On the other hand, there is a decrease in the number of appropriate professors and teachers, coupled with the reluctance of universities to attract more faculty members due to financial problems [43]. In this study, besides the effectiveness of triage training in managing crisis, the effects of imparting education through podcasts or lectures are compared as well.

## Methods

This study adhered to a quasi-experimental design to compare the effects of triage training via two methods, namely video podcasts and lectures before and after intervention in 2016–2017. The study was conducted after necessary coordination with the authorities and obtaining permission from the university's research council and ethics committee with the code DUR 116, considering all educational points. This research was conducted in the School of Nursing and Medical Emergency of Dezful University of Medical Sciences, Iran. The study had two independent variables of podcasts and lectures and two dependent variables of knowledge and performance, and it was conducted using two interventional groups. The study sample consisted of Bachelor degree students of the third semester majoring in Pre-hospital Emergencies. Sixty students (of 63 in the class) expressed their consent to participate in the project were included in the census. The students were then randomly assigned to two groups: control ( $n = 30$ ) and intervention ( $n = 30$ ) (Fig. 1).

Immediately before, immediately after, and one month after the training both groups were tested using a triage questionnaire derived from the study of Sedaghat et al. (2013) [44] and in accordance with the contents taught. Its validity and reliability were measured once more in the context of the present study.

The included students were in their third semester of Bachelor degree studies in a Pre-hospital Emergency program, lacked work experience in clinical wards and had already received specialised training in triage, and were familiar with computers and mobile e-learning software. Exclusion criteria were inability to participate in one of the stages of the test.

At the start of each training session and before the pre-test, the participants were assured that the test and questionnaire data would be kept confidential. In the first training group, basic and main triage issues in crisis (definition, history, classification, types of triage, triage start principles, equipment needed in triage start, and relevant examples of triage) were presented by a triage expert providing lectures on the topic at university using PowerPoint software, in lectures lasting 110 min (in two 50-minute sessions with ten-minute a break between the sessions). It should be noted that during the lecture, the students

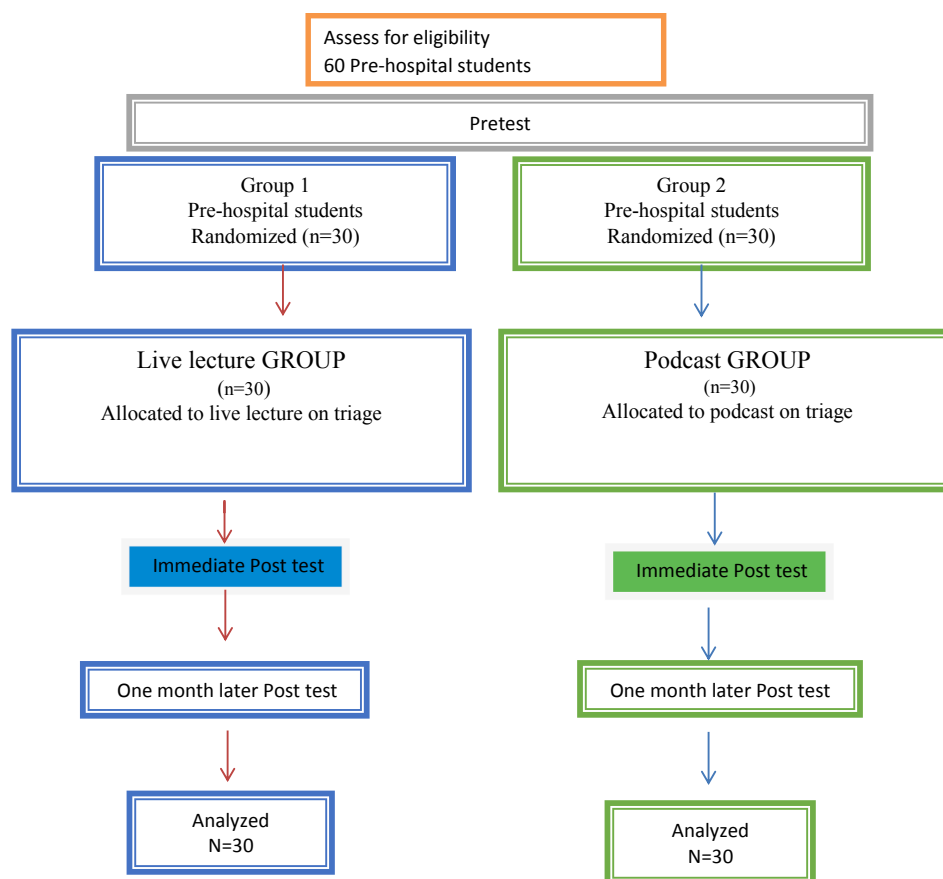


Fig. 1. Flow diagram of student assignment and grouping.

were also allowed to raise their questions or provide verbal feedback for which the professors responded accordingly.

Also of note, well before the start of training using the lecture method, a video camera was placed at the back of the classroom with a fixed tripod to capture PowerPoint slides. From the beginning of the course, the record button was pressed by one of the partners and fixed to a board of 1.5 to 2.75 m size. The entire lecture including the professor's voice, the slide pages, the appearance of the professor on the frame for emphasising specific slides, the points and tips drawn on the board (i.e. slides), and the explanations on the slides were video captured and recorded. Meanwhile, the students' feedback and questions, even when they were repeated, were also recorded. Finally, the product resulting from the filming of the class in the first group (which was originally a PowerPoint presentation with voices of the teacher and the students) was used as an audio and video podcast in the second group.

The next day, the training was held for the second group in the same room. At the beginning of the class, a ten-minute briefing session was held to explain how to use the podcast, access the computer, use the files on a laptop, mobile phone, or personal computer, as well as how to download files online and use them offline.

Then, in a free class that lasted about 140 min, with the aid of a central computer and a projector installed in the classroom, the podcast produced by the first method of training was downloaded from the internet by the students in Group 2 and other collaborators in the project. It was then broadcast to all students of Group 2 offline (Windows Media Player was used for the playback of the podcast). The only difference was that the professor was not present in the class. In fact, the professor left the site at the beginning of the class following the provision of some disciplinary instructions on the class flow in his absence. It is noteworthy that the students were allowed to stop or roll back the podcast player and take short breaks on their will.

To reduce the curiosity of the first group with regard to students' podcast treatment in Group 2, they were promised to receive the podcast one month after the final lesson.

All students were also told that they did not require any further study until the next session of triage program which was due to be held one month later. They were asked to refrain from attending any extra triage program.

It should be noted that till the next meeting (one month later), the students were unaware of the re-test, and all attended the class with the purpose of further pursuing their education.

One data collection tool comprised a three-part questionnaire. Part I: to gather demographic information with three questions including information such as age, sex, level of education; Part II: to evaluate the safety awareness of triage including 15 multiple-choice questions targeting the information about the basic concepts of triage, especially start-style triage, and how the patient was investigated in triage using the start style; Part III: to evaluate personnel's performance. It included a scenario with 19 injured cases that required triage.

The video podcast was created via a tripod-supported digital camera (Canon P301331, full HD, Tokyo, Japan) in movie mode using optical 20X, 10-megapixel resolution. The video podcast was recorded in motion JPEG format with an AVI wrapper. It was edited using Windows Live Movie Maker (Windows 7, Microsoft Corporation, Redmond, WA, USA). Videos were shown to the participants through the use of a laptop and video projector. The video podcast was displayed using Windows Media Player, and the students could pause or rewind the video podcast as required. With the aid of a laptop and a projector (Dell Corporation, Round Rock, TX, USA), the video was projected onto a suspended viewing screen in the classroom.

To determine the content validity of the questionnaire, a content validity index was used. After making questions with the help of ten

faculty members and experts in Dezful University of Medical Sciences, they were evaluated and modified using the provided comments. Next, the test-retest method was used to determine the consistency and external reliability of the questionnaire (in case of 30 pre-hospital students within ten days). The correlation coefficient between the scores of the questionnaire at the first and second time was found to be 0.85, and then the reliability and internal consistency of the questionnaire were determined. Cronbach's alpha was used as an indicator of reliability, which was shown to be 86% in awareness scale and 89% in performance scale.

Using SPSS software, the normality and distribution of the data were evaluated. Then, the variance equality was confirmed using Levene's test, and an independent t-test was conducted to ascertain the consistency of the experimental and the control group in the pre-test. Other assumptions including the intra-group difference between control and experimental groups in the pre- and post-test were checked with the help of *T*-dependent. Finally, ANCOVA was used for examining the effect of the superiority of one method over other methods.

## Results

The mean scores of the awareness of performance in the two groups, before and after the test (immediately after training) and in the follow-up study in the form of delayed post-test (one month later), showed a significant increase after the training (Table 1).

In order to compare the normal distribution of the data derived from the study, the Kolmogorov–Smirnov test was used. The analysis showed that the distribution of the data related to the study assumptions was normal. The results also showed that the *F*-value in Levene's test (equal variances) of all variables was not significant at 0.05. Hence, the similarity (equality) between variances of awareness and performance scores in the two groups of lecture and videos was established. Besides, the homogeneity of variances was observed in the data. Given the results of our preliminary analyses, we were allowed to continue with running covariance analysis.

The results of Table 2 show a significant difference between the scores of awareness and performance in the two groups before and after the interventions ( $p = 0.001$ ). Based on the significant difference between awareness and performance before and after the treatments, it can be concluded that training via both methods had effects on awareness and performance.

The results of univariate analysis of covariance (ANCOVA) for analysing the stage of immediately-after-training on awareness and performance scores in the two groups of video podcast and lecture showed that, in case of no adjustments to the mean values, there is no significant difference between them. The difference between means with and without adjustment was not significant: Awareness (before the training):  $F = 0.036 - p > 0.05$ , performance (before training):  $F = 1.853 - p > 0.05$ .

Moreover, when the effect of the difference before training was removed and averages were adjusted, significant difference could not be observed in the stage of immediately after training which did not reach equilibrium. In other words, there was a significant difference between awareness and performance scores after training in both

groups: Awareness (after the training):  $F = 2.817 - p > 0.05$ , performance (after training):  $F = 2.853 - p > 0.05$ .

The results of univariate analysis of covariance (ANCOVA) on awareness and performance scores in the two groups of video podcast and lecture in the follow-up stage (one month later) showed that the difference between adjusted and non-adjusted mean values was not significant. Awareness (before the training):  $F = 4.00 - p > 0.05$ , performance (before training):  $F = 3.641 - p > 0.05$ .

Moreover, when the effect of the difference before training was removed, and the means were adjusted in the follow-up phase (one month later), significant differences was not observed in the stage immediately after the training. In other words, there was no significant difference between scores of awareness and performance in the follow-up stages of both groups: Awareness (before the training):  $F = 0.833 - p > 0.05$ , performance (before training):  $F = 0.156 - p > 0.05$ . It means that the two methods of video podcast and lectures were almost identical in affecting the awareness and performance of students in the follow-up phase (Table 3).

## Discussion

The aim of this study was to evaluate the effects of audio-video podcasts in Start Triage Education in case of pre-hospital students as well as to compare them with the traditional lecture method of education. The results showed that, with a confidence level of 95%, there has been a significant difference between awareness and performance before and after training (immediately after and one month later) due to the use of podcasts, that shows the effectiveness of podcasts in both stages of learning and reminding in case of awareness and performance. The results correspond to different previous research outcomes including Vakani (2016) [45], Fahey et al. (2015) [42], Fernandez et al. (2009) [28], and Rahimi et al. (2011) [25]. These studies have shown that the use of podcasts promotes learning. Vatovec (2009) and Dale (2007) stated that the use of podcasts increases students' learning outcomes [25,28,46,47].

Moreover, there was no significant difference between the mean score of the two groups in terms of knowledge and performance of the students, which means that both teaching methods had approximately the same effect on increasing the mean of knowledge and performance immediately after and a month later.

In other words, using podcasts as an educational method in pre-hospital triage topics had the same effect on students' learning and memory as the lectures method did. In this regard, Vakani (2016) compared the effect of video podcast education and lecture training and stated that the two teaching methods had similar effects on the performance of students. [45].

There have been contradictory results with respect to the impact of audio-video podcasts on training. For example, some reports have suggested that the picture is also seen in dire need of an audio podcast [48,49]. In a study using audio and video podcasts, Lazari (2009) suggested that learning increased and led to a better understanding of theory and practical skills [50]. Chang and Rim (2008) also stated that, compared to the traditional method, the use of e-learning in training led to better performance [50–52].

**Table 1**

Central and distributive indices of awareness and performance scores in the two groups of lecture and video podcast.

| Groups      | Number        |    | Pre-test |         | Post-test (Immediately after training) |         | Delayed post-test (One month later) |         |
|-------------|---------------|----|----------|---------|----------------------------------------|---------|-------------------------------------|---------|
|             |               |    | Mean     | SD      | Mean                                   | SD      | Mean                                | SD      |
| Knowledge   | Video Podcast | 30 | 9.1667   | 1.74363 | 14.1000                                | 0.99481 | 13.6667                             | 1.12444 |
|             | Lecture       | 30 | 9.0667   | 1.72073 | 14.5000                                | 0.82001 | 13.8667                             | 0.68145 |
| Performance | Video Podcast | 30 | 9.5333   | 2.64879 | 16.9000                                | 1.15520 | 16.0667                             | 2.47656 |
|             | Lecture       | 30 | 9.5667   | 2.41666 | 17.5667                                | 1.83234 | 16.3333                             | 2.69525 |

**Table 2**

Dependent *t*-test results for evaluating mean differences (effectiveness of education) of awareness and performance scores before and after the training for the groups exposed to lectures and video podcasts.

| Groups     |             |        | Number | Mean    | SD      | Mean Difference | df | T-test  | P     |
|------------|-------------|--------|--------|---------|---------|-----------------|----|---------|-------|
| Video cast | Knowledge   | Before | 30     | 9.1667  | 1.74363 | −4.9333         | 29 | −14.561 | 0.001 |
|            |             | After  | 30     | 14.1000 | 0.99481 |                 |    |         |       |
|            | Performance | Before | 30     | 9.5333  | 2.64879 | −7.3667         | 29 | −14.236 | 0.001 |
|            |             | After  | 30     | 16.9000 | 1.15520 |                 |    |         |       |
| Lecture    | Knowledge   | Before | 30     | 9.0667  | 1.72073 | −5.4333         | 29 | −14.200 | 0.001 |
|            |             | After  | 30     | 14.5000 | 0.82001 |                 |    |         |       |
|            | Performance | Before | 30     | 9.5667  | 2.41666 | −8.0000         | 29 | −16.855 | 0.001 |
|            |             | After  | 30     | 17.5667 | 1.83234 |                 |    |         |       |

**Table 3**

Results of ANCOVA for awareness and performance scores in the immediate and delayed post-tests in two groups receiving video podcasts and lectures.

| Groups                                    |                         | SS     | df | MS     | F     | P     | Eta2  | Power test |
|-------------------------------------------|-------------------------|--------|----|--------|-------|-------|-------|------------|
| Knowledge scores in immediate post-test   | Effect before education | 0.036  | 1  | 0.036  | 0.043 | 0.837 | 0.837 | 0.055      |
|                                           | Between groups          | 2.381  | 1  | 2.381  | 2.817 | 0.099 | 0.099 | 0.379      |
| Knowledge scores in delayed post-test     | Effect before education | 3.291  | 1  | 3.291  | 4.00  | 0.052 | 0.052 | 0.503      |
|                                           | Between group           | 0.685  | 1  | 0.685  | 0.833 | 0.365 | 0.365 | 0.146      |
| Performance scores in immediate post-test | Effect before education | 4.284  | 1  | 4.284  | 1.853 | 0.179 | 0.179 | 0.268      |
|                                           | Between groups          | 6.595  | 1  | 6.595  | 2.853 | 0.097 | 0.097 | 0.382      |
| Performance scores in delayed post-test   | Effect before education | 23.331 | 1  | 23.331 | 3.641 | 0.061 | 0.061 | 0.467      |
|                                           | Between groups          | 1.001  | 1  | 1.001  | 0.156 | 0.694 | 0.694 | 0.067      |

The findings of studies conducted in the field of dental education by Khorramian (2015) [53], Engom et al. (2003), Hagen Holtz (2008), Davis (2007), Paltz (2010), and Vogt (2010) showed that podcasts' impact on students' scores was not significant [54–58]. Kalludi et al. stated that video podcasts, when used after the theory-oriented class and compared to traditional text-based teaching, had a significant impact on dental students' learning [59]. Hill et al. suggested that, although the scores before and after podcasts did not show significant differences, video podcasts as a source of review and evaluation were effective. In this study, the students stated that video podcasts could help them recall knowledge with images [60]. However, other studies have shown that video podcasts have no additional benefit for students [61]. According to Fleming's model for medical education, learners can benefit from the use of multi-sensory skills (such as visual, auditory, reading/writing, kinaesthetic). Audio-visual channels can also be used in video podcasts in which case the number of learning channels and the options for students can increase [62]. To our best knowledge, this type of study (using PowerPoint with an audio-visual teacher along with feedback from students) was a pioneering attempt to offer training on triage using podcasts, at least in the Iranian context. In the method used in the present study, the video podcasts were produced. In addition to taking advantages of media, the course instructor employed audio feedback of students, and added important gestures and points throughout the presentation sessions. The results showed that this model of podcast could significantly affect knowledge learning and retention.

Given that this type of media is the newest form of educational tools, extensive studies have been conducted to examine their various aspects. Future research can focus on different aspects such as comparing it with other educational media, the effects of using it on special individuals (for example, learners with physical and motor disabilities), comparing its application in virtual and real-time environments, the means to enhance its effectiveness along with other media types, application of learning theories in it, and designing instructional patterns in its construction. With the help of these findings, educators are recommended to use podcasts in order to support and complement traditional teaching methods.

The use of podcasts in different areas could help us appreciate

diverse uses of podcasting on teaching and learning. Teachers should be able to determine their objective in using podcasts, while learners need to become familiar with how to use and download podcasts.

In this study, the effects of two educational methods, namely traditional teaching methods and video podcasts, on learning and retention of triage have been investigated. The results showed the effectiveness of the participatory podcast method in both learning and the retention of triage knowledge. In other words, the use of video podcasts, as a new media vehicle in the field of teaching triage, had a positive effect not only on learning but also on the knowledge retention rate on the part of students, suggesting that the application of video podcasts for training in triage could be a cost-effective and practical method. This may result in less dependence on college classes, re-teaching, and commuting to universities due to the use of podcasts. Finally, the findings of this study posit that, based on the impacts of podcasts, medical educators can use a combination of traditional teaching methods, educational podcasts, and other new media in order to promote learning and ensure learner retention of triage knowledge.

### Acknowledgements

This paper is the result of a research project (code: DUR-116) approved by Dezful University of Medical Sciences in 2016. The authors wish to thank the pre-hospital students of Dezful University of Medical Sciences and all of the pre-hospital students who participated in this study. This study was supported in part by a research grant (DUR-116) from the Research Branch of Dezful University of Medical Sciences.

### Conflicts of interest

The authors declare that there is no conflict of interest.

### Dissemination of results

Results from this study were shared with staff members at DUMS emergency centre through an informal presentation.

## Authors' contributions

HA, LK and LAA contributed to the conception and design of the work; MN, NT, LAA and AM contributed to the acquisition, analysis, and interpretation of data for the work; All authors contributed to drafting the work and revising it critically for important intellectual content; All authors approved the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.afjem.2018.12.001>.

## References

- Benson M, Koenig KL, Schultz CH. Disaster triage: START, then SAVE—a new method of dynamic triage for victims of a catastrophic earthquake. *Prehosp Disas Med* 1996;11(2):117–24.
- Göransson KE, von Rosen A. Interrater agreement: a comparison between two emergency department triage scales. *Eur J Emerg Med* 2011;18(2):68–72.
- Knight JF, Carley S, Tregunna B, Jarvis S, Smithies R, de Freitas S, et al. Serious gaming technology in major incident triage training: a pragmatic controlled trial. *Resuscitation* 2010;81(9):1175–9.
- Sedaghat S, Aghababaeian H, Taheri N, Araghi Ahvazi L, Sadeghi Moghaddam A. Study on the level of knowledge and performance of North Khuzestan medical emergency 115 personnel on pre-hospital triage. *Iran J Crit Care Nurs* 2012;5(2):103–8.
- Aghababaeian H, Taheri N, Araghi Ahvazi L, Sadeghi Moghaddam A. Fundamental of triage. Tehran: Jameh Negar; 2012.
- Abbasi E, Nosrati A, Nabipour I, Emami SR. Assessment of the level of knowledge of physicians in Bushehr Province about preparedness and response for nuclear emergency. *ISMJ* 2005;7(2):183–9.
- Aloyce R, Leshabari S, Brysiewicz P. Assessment of knowledge and skills of triage amongst nurses working in the emergency centres in Dar es Salaam, Tanzania. *Afr J Emerg Med* 2014;4(1):14–8.
- Göransson KE, Ehrenberg A, Ehnfors M. Triage in emergency departments: national survey. *J Clin Nurs* 2005;14(9):1067–74.
- Haghigh S, Ashrafizadeh H, Mojaddami F, Kord B. A survey on knowledge level of the nurses about hospital Triage. *J Nurs Educ* 2017;5(6):46–52.
- Hatekimana C, Shoveller J, Tuyisenge L, Kenyon C, Cechetto DF, Lynd LD. Correlates of performance of healthcare workers in emergency, triage, assessment and treatment plus admission care (ETAT+) course in Rwanda: context matters. *PLoS One* 2016;11(3):e0152882.
- Hedayati H, Mogharrab M, Moasheri N, Sharifzadeh G. Studying of BUMS 'students' knowledge about hospital triage in 2011. *Modern Care J* 2013;9(3):237–44.
- Tuyisenge L, Kyamanya P, Van Steirteghem S, Becker M, English M, Lissauer T. Knowledge and skills retention following emergency triage, assessment and treatment plus admission course for final year medical students in Rwanda: a longitudinal cohort study. *Arch Dis Childhood* 2014. archdischild-2014-306078.
- Aghababaeian H, Sedaghat S, Taheri N, Mousavi SA, Habibi-Moghadam M, Pourmotahari F. Evaluating knowledge and performance of emergency medical services staff regarding pre-hospital triage. *Iran J Emerg Med* 2017;4(2):63–7.
- Nouhi E, Haghdoust A, Farajzadeh S. The impact of teaching methodology workshops on knowledge, attitude and practice of the medical teachers 2002. *J Qazvin Univ Med Sci* 2002;22:5–7.
- Dent J, Harden RM, Hunt D. A practical guide for medical teachers. Elsevier Health Sciences; 2017.
- Thomas PA. Curriculum development for medical education: a six-step approach. JHU Press; 2015.
- Shabani H. Educational skills. Tehran: SAMT Company; 1992. p. 137.
- Whitton D, Barker KL, Nosworthy M, Humphries J, Sinclair C. Learning for teaching: teaching for learning. 2016.
- Fallon C, Brown S. E-learning standards: a guide to purchasing, developing, and deploying standards-conformant e-learning. CRC Press; 2016.
- Clark RC, Mayer RE. E-learning and the science of instruction: proven guidelines for consumers and designers of multimedia learning. John Wiley & Sons; 2016.
- Hasanzadeh M. Electronic learning. Tehran, Iran: Tadbir Publication; 2002.
- Thiele JE. Learning patterns of online students. *J Nurs Educ* 2003;42(8):364–6.
- Copley J. Audio and video podcasts of lectures for campus-based students: production and evaluation of student use. *Innov Educ Teach Int* 2007;44(4):387–99.
- Sanders J. Twelve tips for using podcasts in medical education. *Med Teach* 2009;31(5):387–9.
- Rahimi M, Asadollahi F. Iranian students' readiness for using podcasting in higher education: access, familiarity, and experience. *Proc Comput Sci* 2011;3:197–202.
- Evans C. The effectiveness of m-learning in the form of podcast revision lectures in higher education. *Comput Educ* 2008;50(2):491–8.
- Abdous Mh, Facer BR, Yen C-J. Academic effectiveness of podcasting: a comparative study of integrated versus supplemental use of podcasting in second language classes. *Comput Educ* 2012;58(1):43–52.
- Fernandez V, Simo P, Sallan JM. Podcasting: a new technological tool to facilitate good practice in higher education. *Comput Educ* 2009;53(2):385–92.
- Bolliger DU, Supanakorn S, Boggs C. Impact of podcasting on student motivation in the online learning environment. *Comput Educ* 2010;55(2):714–22.
- O'Bannon BW, Lubke JK, Beard JL, Britt VG. Using podcasts to replace lecture: effects on student achievement. *Comput Educ* 2011;57(3):1885–92.
- Dickerson S, Reinhart AM, Feeley TH, Bidani R, Rich E, Garg VK, et al. Patient Internet use for health information at three urban primary care clinics. *J Am Med Inform Assoc* 2004;11(6):499–504.
- Jeong SH, Kim J, Kim T, Park S, Shin Y, Lee S. Survey on the consumer preference for the internet health information of the patients' online community members. *J Korean Soc Med Inform* 2007;13(3):207–20.
- Zolfaghari M, Mehrdad N, Parsa Yekta Z, Salmani Barugh N, Bahrani N. The effect of lecture and e-learning methods on learning mother and child health course in nursing students. *Iran J Med Educ* 2007;7(1):31–9.
- Wiksten DL, Spanjer J, LaMaster K. Effective use of multimedia technology in athletic training education. *J Athlet Train* 2002;37(4):213–9.
- Cohen PA, Dacanay L. A meta-analysis of computer-based instruction in nursing education. *Comput Nurs* 1994;12(2):89–97.
- Rogers DA, Regehr G, Yeh KA, Howdieshell TR. Computer-assisted learning versus a lecture and feedback seminar for teaching a basic surgical technical skill. *Am J Surg* 1998;175(6):508–10.
- Brooks P, Renvall M, Bulow K, Ramsdell J. A comparison between lecture and videotape inservice for certified nursing assistants in skilled nursing facilities. *J Am Med Direct Assoc* 1999;1(5):191–6.
- Bertsch TF, Callas PW, Rubin A, Caputo MP, Ricci MA. Applied research: Effectiveness of lectures attended via interactive video conferencing versus in-person in preparing third-year internal medicine clerkship students for clinical practice examinations (CPX). *Teach Learn Med* 2007;19(1):4–8.
- Cardall S, Krupat E, Ulrich M. Live lecture versus video-recorded lecture: are students voting with their feet? *Acad Med* 2008;83(12):1174–8.
- Schreiber BE, Fukuta J, Gordon F. Live lecture versus video podcast in undergraduate medical education: a randomised controlled trial. *BMC Med Educ* 2010;10(1):68.
- Haney M, Silvestri S, Van Dillen C, Ralls G, Cohen E, Papa L. A comparison of tele-education versus conventional lectures in wound care knowledge and skill acquisition. *J Telemed Telecare* 2012;18(2):79–81.
- Fahy BG, Bensalem-Owen M, Vasilopoulos T, Cibula JE, Ozrazgat-Baslanti T, Chau DF. Podcast model for medical student electroencephalogram instruction. *Med Sci Educ* 2015;25(2):113–7.
- Stainburn S. The case of the vanishing full-time professor. *NY Times* 2010.
- Aghababaeian H, Sedaghat S, Tahery N, Moghaddam AS, Maniel M, Bahrani N, et al. A comparative study of the effect of triage training by role-playing and educational video on the knowledge and performance of emergency medical service staffs in Iran. *Prehosp Disas Med* 2013;28(06):605–9.
- Vaccani J-P, Javidnia H, Humphrey-Murto S. The effectiveness of webcast compared to live lectures as a teaching tool in medical school. *Med Teach* 2016;38(1):59–63.
- Dale C. Strategies for using podcasting to support student learning. *J Hosp Leisure Sport Tourism Educ* 2007;6(1):49–57.
- Vatovec C, Balser T. Podcasts as tools in introductory environmental studies. *J Microbiol Biol Educ JMBE* 2009;10(1):19.
- Treleash RB. Diffusion of innovations: anatomical informatics and iPods. *Anat Rec* 2006;289(5):160–8.
- Narula N, Ahmed L, Rudkowski J. An evaluation of the '5 Minute Medicine' video podcast series compared to conventional medical resources for the internal medicine clerkship. *Med Teach* 2012;34(11):e751–5.
- Lazzari M. Creative use of podcasting in higher education and its effect on competitive agency. *Comput Educ* 2009;52(1):27–34.
- Chang W-Y, Sheen S-TH, Chang P-C, Lee P-H. Developing an e-learning education programme for staff nurses: processes and outcomes. *Nurse Educ Today* 2008;28(7):822–8.
- Reime MH, Harris A, Aksnes J, Mikkelsen J. The most successful method in teaching nursing students infection control—E-learning or lecture? *Nurse Educ Today* 2008;28(7):798–806.
- Khoramian Tusi S, Sheikh Fathollahi M, Rahnamaye Tamrooyee F, Akbari Javar M. Study of the effect of podcasting on learning and satisfaction in dental students. *J Mashhad Dental School* 2015;39(3):229–38.
- Engum SA, Jeffries P, Fisher L. Intravenous catheter training system: computer-based education versus traditional learning methods. *Am J Surg* 2003;186(1):67–74.
- Davis J, Chrysafidou E, Zamora J, Davies D, Khan K, Coomarasamy A. Computer-based teaching is as good as face to face lecture-based teaching of evidence based medicine: a randomised controlled trial. *BMC Med Educ* 2007;7(1):23.
- Hugenholtz NI, De Croon EM, Smits PB, Van Dijk FJ, Nieuwenhuijsen K. Effectiveness of e-learning in continuing medical education for occupational physicians. *Occup Med* 2008;58(5):370–2.
- Platz E, Goldflam K, Mennicke M, Parisini E, Christ M, Hohenstein C. Comparison of Web-versus classroom-based basic ultrasonographic and EFASST training in 2 European hospitals. *Ann Emerg Med* 2010;56(6). pp. 660–7. e1.
- Vogt M, Schaffner B, Ribar A, Chavez R. The impact of podcasting on the learning and satisfaction of undergraduate nursing students. *Nurse Educ Pract* 2010;10(1):38–42.
- Kalludi S, Punja D, Rao R, Is Dhar M. Video podcast supplementation as a learning aid beneficial to dental students? *J Clin Diagn Res* 2015;9(12):CC04.
- Hill JL, Nelson A. New technology, new pedagogy? Employing video podcasts in learning and teaching about exotic ecosystems. *Environ Educ Res* 2011;17(3):393–408.
- Dupagne M, Millette DM, Grinfeder K. Effectiveness of video podcast use as a revision tool. *J Mass Commun Educ* 2009;64(1):54–70.
- Fleming ND, Mills C. Not another inventory, rather a catalyst for reflection. 1992.