

## Case Report: Impact of Educational Flash Cards on Improved Learning of Skull Radiotherapy Techniques

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### ABSTRACT

Learning skull radiography techniques is time consuming and difficult, due to the variety of these techniques. Each year, poor employee performance of the radiology unit, impose repetitive radiographs, and a heavy burden on the health system, as well as double exposure of patients and staff. According to the results of the current investigation, comparing student's opinions revealed that the use of flash cards could facilitate and accelerate learning of radiographic techniques. Moreover, it is demonstrated that using flash cards could help maintain long-term radiographic techniques and are effective in the education process. This report highlights that the use of flash cards not only facilitates and accelerates the learning of the skull radiographic techniques, but also can reduce the repetitive radiographs, the costs imposed on the health system and double exposure of patients and staff.

### 1. Introduction

Today, with the development of various academic disciplines, new teaching methods are needed to facilitate and accelerate long-term learning. One of the best methods in this regard is the use of flashcards for instructional lessons that play an important role in long-term remembering of contents and

improved learning. Since learning skull radiography techniques is often time-consuming, difficult and short-lived due to the variety of these techniques, the use of new training methods is a necessity. Usually, learning is a complex process influenced by various factors [1].

All efforts in the training cycle are based on learning enhancement and it can be said that learning improvement is the main activity focus of all educational institu-

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tions [2]. Today, medical imaging plays a major role in detecting nearly 70% of the known diseases. However, some of the images taken do not have desirable quality and have no diagnostic value, therefore they must be repeated and will result in heavy financial costs and double exposure of patients and employees [3].

On the other hand, in developing countries, including Iran, which are importers of consumables and expensive radiological equipment, about 80 percent of the importing cost is spent on consumables, like purchasing films and drugs for the emergence and fixation times. Accordingly, redundancy cost can impose heavy financial pressure on the health system of the country each year, due to repetitive stereotypes [4, 5].

In addition, previous studies have emphasized that double exposure of patients and staff, can increase the incidence of genetic and carcinogenic radiation induced by radiation in the community [6]. Radiographic techniques and manpower skills are important factors in the frequency of a repetitive radiation [7], which, training the staff and improving the learning process of these techniques, may reduce the number of repetitive radiographs and radiation exposure of patients [8].

Considering the importance of using flash cards in improving the learning process of radiation techniques and its direct impact on the principles for protection of patients as well as reducing the consumption of radiographic films and performing higher quality radiographies the contributions made should be of wide interest. Therefore, the purpose of this study was to evaluate the effect of educational flash cards on learning improvement of skull radiography techniques in undergraduate students of Radiology Technology in Isfahan University of Medical Sciences.

## 2. Case Report

This study was conducted in the Al-Zahra hospital (Isfahan, Iran) using traditional radiography and darkroom system. After obtaining informed consent from the undergraduate radiology students of Isfahan University of

Medical Sciences, forty students, including 30 women (75%) and 10 men (25%), were randomly selected. IN the following step, educational flash cards designed to teach skull radiography techniques, were provided to the subjects. In order to improve learning of conventional techniques in skull radiology, key points including patient's specific position and special radiation conditions were explained in flash cards.

In order to evaluate students' viewpoints about the content of flash cards and the impact of those on improving learning process of skull radiographic techniques, a questionnaire based on a five-point Likert scale of totally agree to totally disagree (with score of 1 to 5) (Figure 1) were distributed among them, after completion of one semester. The student's entrance year and gender were recorded in the first part of the questionnaires. The questionnaire design was confirmed after consulting with the experts of the Medical Education and its reliability was determined using Cronbach's alpha ( $\alpha=0.82$ ). Finally, the collected data were analyzed using SPSS software.

Evaluation of the results of students' responses to the role of flashcards in learning the techniques of skull radiography showed that the flashcards had a significant role in learning and remembering these techniques for long-term and therefore, the use of flash cards in learning is recommended (Figure 2).

From the results of questionnaires assessment, it was clear that the contents of pre-designed flash cards were as follows: 34 students (83%) argued that educational flash cards were eloquent and understandable, 35 students (87.5%) stated that the scientific and practical point of skull radiography techniques offered were brief and helpful, 32 students (80%) mentioned that appropriate images has been selected for training each technique, 33 students (80.5%) believed that scientifically classified notes written in flashcards had the potential to facilitate and accelerate learning of skull radiography techniques, 33 students (80.5%) stated that they did not find the use of flash cards to learn the skull radiography techniques, boring, 35 students (87.5%) reported that reviewing the

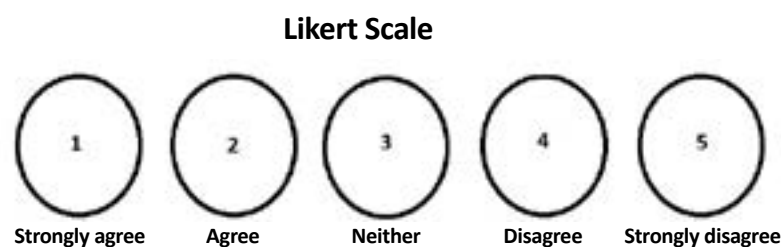


Figure 1. Likert scoring scale which used for assessment of educational flashcard

**Table 1.** The results of student response evaluation on the content of flash cards

The Number of Students With a Fully Agreeable View (Percentage)	The Questions Related to the Evaluation of the Content of Flash Cards
34(83)	Flash cards written rationally?
35(87.5)	Can flash cards be understood?
35(87.5)	Are the scientific and practical aspects of skull radiography techniques presented in a concise and useful way?
32(80)	Are there any suitable images in flash cards?
33(80.5)	Flash cards are not boring to learn skull radiography techniques.
33(80.5)	The classification of the content is presented in great form.
35(87.5)	Content, color and flash card design are appropriate.
31(79.5)	Flash cards are suitable and portable.
33(80.5)	The use of flash cards is an innovative way of learning.
33(80.5)	So far, they have not used flash cards.
30(75.5)	The use of flash cards to learn radiological techniques in other parts of the body will also be effective.
22(55)	The use of flash cards is cost effective.
35(87.5)	The browse of flash cards, will accelerate learning process.

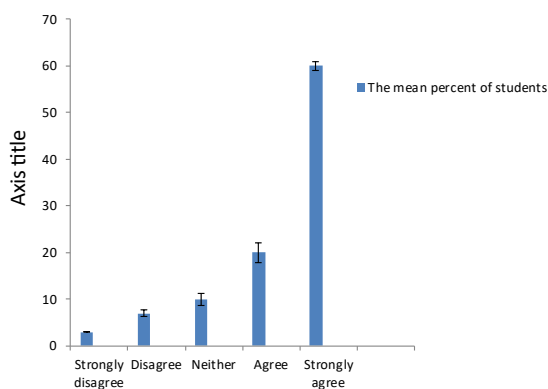
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flash cards were effective in long-term memorization of skull radiography techniques, 35 students (87.5%) recognized the content, color and design of flash cards as appropriate, 31 students (79.5%) found the flash cards convenient and in portable size, 33 students (80.5%) affirmed that the use of the flash cards was a creative way to learn, 33 students (80.5%) declared that it was the first time they have ever seen educational flash cards, 30 students (75.5%) mentioned that the flash cards were effective in learning radiologic techniques for other parts of the body as well and 22 students (55%) found the flash cards affordable. The study results in terms of evaluating students' responses to the content of flashcards are summarized in Table 1.

### 3. Discussion

Medical imaging refers to techniques that provide valuable health information and contribute to creation of a database of anatomy and natural physiology to detect abnormalities. Additionally, in some cases, they are used to evaluate therapies. Although medical imaging is a useful diagnostic process, nearly 50% of the total ionizing radiation is caused by this type of imaging [9]. Therefore, X-rays are only safe when the lowest possible radiation is used to achieve the best results, which requires appropriate training of radiographic techniques.

Using an educational system based on the use of flash cards is one of a cutting edge method to improve the learning process of medical imaging techniques. When preparing the flash cards, it is important to choose key points of a specialized university course. Based on findings of the current study, the scientific and practical points presented in flash cards, were presented in a correct, comprehensible and brief form, and as the students skills to learn techniques increases through observation, the use of pictures for each technique played a major role in the advancement of learning that technique.



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**Figure 2.** The assessment of educational flash cards effects on learning process

A significant number of students strongly agreed with effectiveness of educational flash cards on learning process ( $P \leq 0.001$ )

A main fundamental in memory intervention is the principle of relationship between the content presented. The relevant and interconnected materials are better recorded in human memory, and as a result, easier to be remembered and memorized. In this study, 80.5% of the students believed that classification of the flashcards contents was done correctly, and therefore learning improvement reported in this study was closely related to the correct classification of materials.

One of the most important ways to study efficiently is to take notes and summarize texts. Usually, students become discouraged and bored shortly after studying books of great interest, thus refraining from continue studying. One of the benefits of using flash cards is improving fatigue during studying. In the present study, about 80% of students suggested that the use of flash cards is a favorable way to overcome fatigue. Since a limited number of students have already used flash training cards, the use of flash cards is an innovative way of learning the contents.

Another important feature of flashcards is the design, including color, font, and size of each card and easy portability of those. According to the survey results, most students found dimensions, design and fonts of flashcards appropriate. In addition, most students believed that flashcards prices were not acceptable. Results of a prior study indicated that each dollar of investment in education, would raise 3\$ in profits [10]. Therefore, it is necessary to adopt policies that allow students buy flash cards at lower prices. At the end of the study, most students appealed the use of flash cards in learning other radiographic techniques.

#### 4. Conclusion

Overall, in preparation of flash cards, few points must be considered, such as summarizing the key content of the lessons, the use of appropriate images, colors and interesting designs, contemplating portable dimensions and reasonable prices for the cards. According to the results of this survey, the use of educational flash cards, improves the learning process of skull radiography techniques. Thus, the prevention of radiography repetition, will reduce the patient's radiation and the costs imposed to the health system of the country.

#### Ethical Considerations

##### Compliance with ethical guidelines

All procedures were approved by the Ethics Committee of Isfahan University of Medical Sciences.

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#### Conflicts of interest

The authors declared no conflict of interest.

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