A Novel Online Training Platform for Medical Image Interpretation

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Abstract

One of the major problems in the health area is false positive and negative diagnoses, especially in the interpretation of radiological images. Several papers affirm that the radiologist experience helps in accurate diagnosis, reducing inter-observer and intra-observer variability. We assume that the lack of training is causing this problem and if a good training process is on place can reduce the level of false positive and false negative diagnosis, and this training should start at the undergraduate level. Thus, this paper aims to show an online training platform applied to of interpretation imaging learning. The platform was developed using the *php* language and is hosted on the 000webhost server, consisting of an image base (format, *png, jpg, tiff and DICOM*), diagnostic imaging tests and user training quiz (students/residents) about radiographic images interpretation. The teacher can add images, prepare diagnostic tests and create questionnaires. The users perform the diagnostic tests and answer the questionnaires, obtaining a score in real time. This platform can be used inside and outside the classroom, where they can train the diagnosis by image to improve their knowledge. The platform was tested by 20 medical students that, after use it, answered the usability tests based on the SUS scale. The usability tests results showed that 90 of the users gave the maximum concept to the platform.

Keywords

Learning • Interpretation medical images • Image diagnostic

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1 Introduction

Medical error due to misinterpretation of clinical exams is a delicate issue and happens frequently [1], especially when these exams require images interpretation and it shows the difficulty of evaluating the medical images structure that leads to false positive and negative diagnoses. These misinterpretations are related to many factors, including the lack of knowledge of the professional that lead us to the importance of a good training process for the medical student.

The use of technological resources such as computers, projectors and even mobile phones to support classroom teaching has become increasingly common [2] as well the training [3]. These features enable the teacher to upload a video using the Youtube platform and share instantly with their students, or ask them to answer to a quiz, using their own mobile phone, for example. This facilitates the teacher's work, because it is practical and often more illustrative, contributing positively to improve their skills [4].

The objective of this work was to develop an online training platform that can be applied to teach medical imaging and can be used inside and outside the classroom.

In a study carried out in the United States, the researchers compared ten most used learning techniques and concluded that among them the quiz technique and the distributed study were the techniques classified as "High Efficiency" [5]. Based on this study the quiz techniques and the idea of the distributed study were added to the platform.

1.1 Background

In the recent literatures several papers directly related to this research were found.

The Table 1 shows a summary of the analysis performed.

Some important parameters were observed to develop this platform, such as:

L. Lhotska et al. (eds.), *World Congress on Medical Physics and Biomedical Engineering 2018*,
IFMBE Proceedings 68/1, https://doi.org/10.1007/978-981-10-9035-6_153

Table 1 Problems encountered on the searched platforms

Name	Lack of interactivity	Paid	Mammography images only	Quiz	Score feedback
QualIM [6]			×		
Mamodb [7]			×		
Web-based Mammography [8]			×		×
Capricorn [9]					
Radiopaedia	×			×	×
RADPrimer (Elsevier 2016)		×		×	×

(a) The importance of initiatives related to teaching medical image analysis;
(b) The importance of medical images interpretation training;
(c) All software and web sites analyzed are applied to radiologists, none were applied to use during the medical image analysis classes;
(d) The free ones are "incomplete" and have lack of interactivity, which suggests more studies of practical applications to understand their real benefits.

2 Materials and Methods

The first stage of the project was to define the learning content of the platform, therefore it was defined that the platform will have two test modules: (a) diagnostic imaging tests to mark the image area requested by the teacher. (b) questionnaires on subjects addressed by the teacher.

The actors, who will use the platform, will be the Students and Teachers and based on this, it was defined that the teacher would be allowed to insert images, prepare the tests and questionnaires with templates and the student to carry out the tests and questionnaires requested by the teacher.

The Fig. 1 illustrates this process through a use case diagram:

The platform dues were:

1. The teacher uploads the image, marks the area to be studied, confirms the marking;
2. The marking is saved in the database and only the original image becomes available to the student;
3. The student analyzes the image and marks the area of interest requested;
4. The system will check if the student's mark matches with the area of interest marked by the teacher;

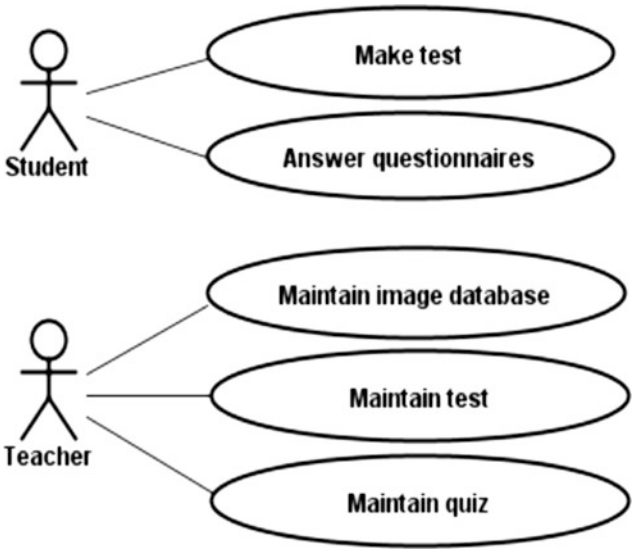

Fig. 1 Use case of the actors illustrating the interactions of each one with the platform

5. If yes, a message appears saying that the student has hit;
6. Otherwise, a message appears saying that the student has missed.

The quiz development was based on the Google Forms questionnaires, where the teacher can insert the questions, the answers, the value of each question and the system will calculate the final score.

Once the questionnaire has being saved it will become available to the student, that could answer the questions and at the end will receive the score.

2.1 Sample Description

For the platform tests were invited 20 medical students from University of Mogi das Cruzes (Brazil), attending the

discipline of medical images, which after using the platform answered the usability and functionality tests.

2.2 Usability Test

The Usability Test was applied based on the SUS (System Usability Scale) scale [10] and the purpose of this test is to measure the platform usability.

The SUS results are calculated using the answers that may be between 1 and 5, where 1 represents "strongly disagree" and 5 "completely agree". To calculate the final score, it is necessary to conduct the follow actions:

- For odd answers (1, 3 and 5): subtract one from the user response.
- For even answers (2 and 4): subtract the user responses from 5.
- Once done the items above it is necessary to add all values and multiply by 2.5.

The final calculation should be between 0 and 100 and this number will be used to classify the platform according to the grade scale F, D, C, B and A, being the scale "A" a of greater usability. See Fig. 2 [11].

2.3 Functionality Test

The Functionality Test was based on the Likert scale, being rated from 1 to 5, with 1 "completely disagree" and 5 "I completely agree". The difference is that in this case, the more questions get closer to grade 5, greater is the platform functionality.

For the data analysis, we use the statistical value of mode the statistical value.

3 Results

The platform developed addresses the two most efficient learning techniques, the questionnaire and distributed study by being online.

It is possible to upload images using *png, jpg, tiff* and *DICOM* formats. After uploading the image, the teacher can select the area of interest that he wants the student to work on, once the area of interest by the teacher is marked the image becomes available for the student use. The Fig. 3 show this process:

Likewise, the questionnaire is developed by the teacher and become available to the student. The Fig. 4 show this process:

After the student answers the questionnaire, the score is obtained in real time, that allows him to verify his performance.

The platform tests obtained a score of 90, which results in a classification A. This means that the platform has "best imaginable" rating, according to Fig. 2.

The Functionality Test shows that the platform must have more functionalities.

4 Discussion and Conclusion

According to some authors, it can be observed that there is a high incidence of medical misinterpretation in the diagnostic imaging [12–14]. The goal of this platform is to reduce these errors and could be a differential for users. A better imaging diagnoses training for the students (radiologists), will support this errors reduction.

There are several initiatives to develop technological content to help the radiologist training, however, there are some shortcomings such as: lack of interactivity, paid platforms, only mammography images available, no questionnaires available and the end results are not show right away.

Some efficient teaching techniques, such as, questionnaires and distributed practice [5] have been studied trying to relate neuroscience to the act of learning to learn. The proposal platform uses these techniques besides testing the student's skills through questionnaires and diagnostic imaging tests, that can be executed anywhere and anytime.

With this work, it was possible to develop an online training platform to aid the medical image analysis teaching. As future work, tests need to be applied to measure the teaching efficiency of the platform.

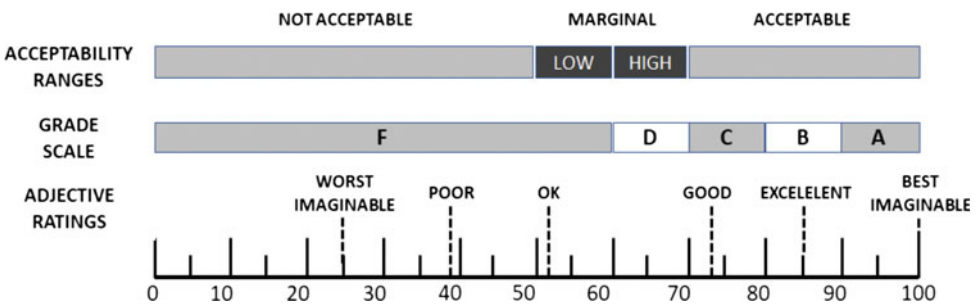

Fig. 2 SUS scale

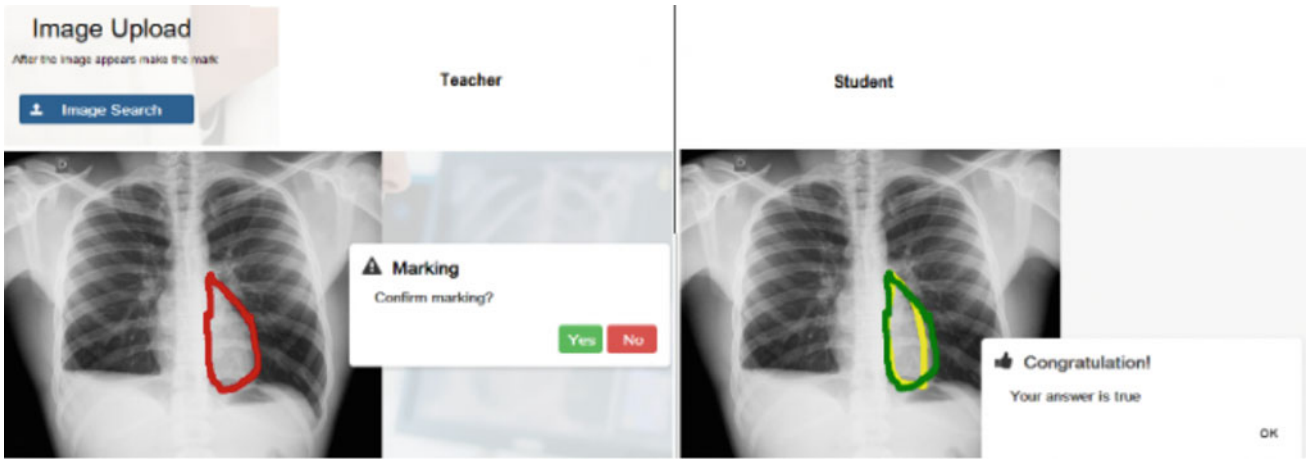

Fig. 3 Teacher and student screen

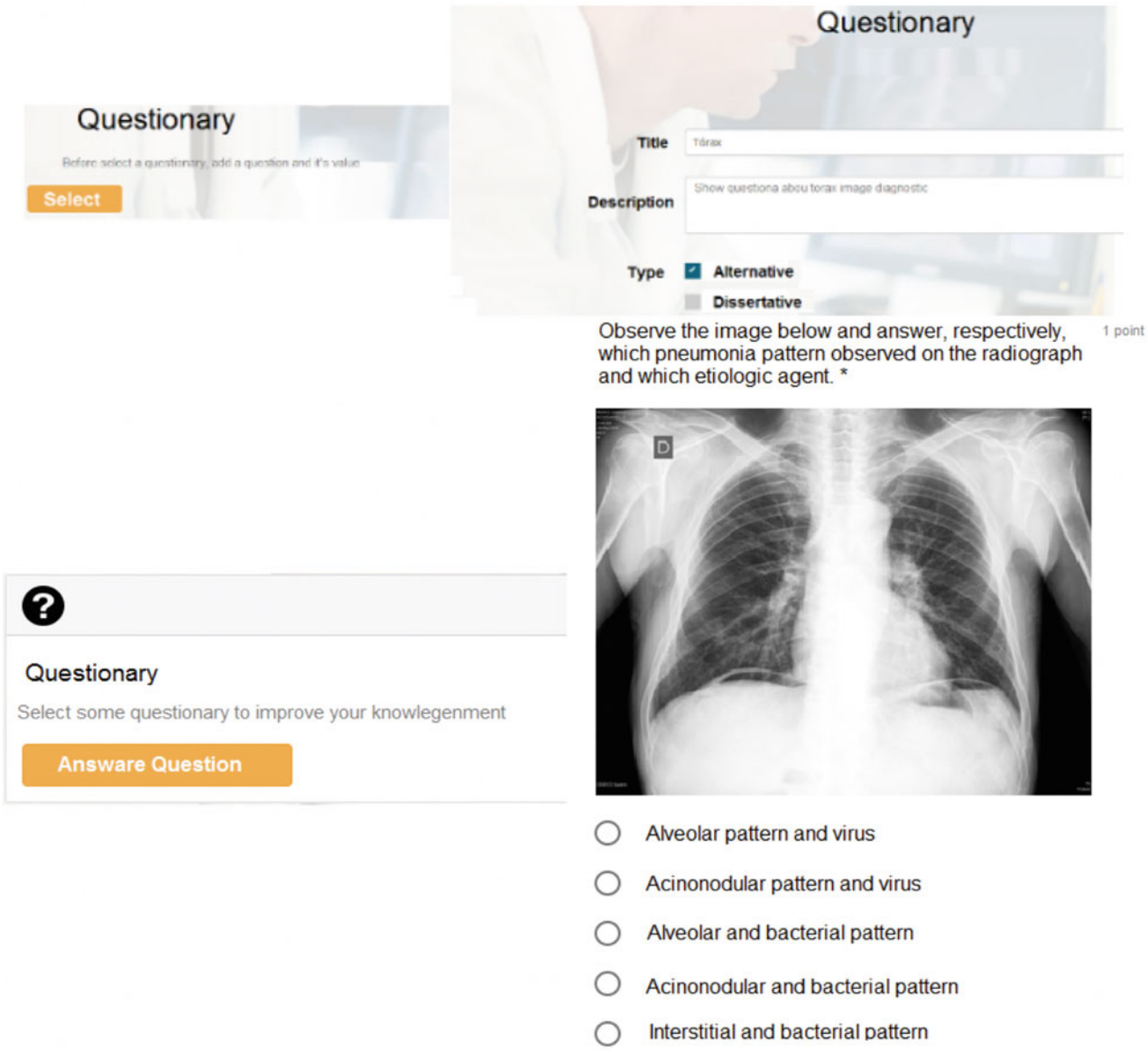

Fig. 4 Questionnaire screen

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Conflict of Interest The authors declare that they have no conflict of interest.

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