Impact of an on-line health safety exam on the students of college of science laboratories

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Abstract. In spite of education institutes subject their staff and students to a compulsory health safety course; however, many events have proven that college students do not follow the correct health safety instructions in case of emergencies. In this paper, an on-line exam of health safety was designed and implemented. PhP programming language was used to design the web pages of the exam while the data base was manipulated by MySQL language. The exam consists of about 20 specialized questions for each of all College of Science departments. The user should be able to access the exam through the website of the University or the College. Also, the user should register by entering his name, email, and password. After the exam practicing, the user will be notified about his score and if he/she put the correct or wrong answer for every question individually. The user can retry the exam again until he has got the full mark, which is the only mark that allows the examinee to pass the exam and then will be authorized to access the college laboratories and other workplaces. The student can know his mark through his email directly. The admin will also know all the examined students and their marks. Consequently, the college departments could be provided with a list of practiced students. The aim of this research focuses on increasing the education level of the health safety inside university laboratories and workplaces.

Key words: Web programming, Web design, Web applications, e-Learning, OHS, HIS.

1. Introduction
In the College of Science, the students sometime deal with dangerous materials and emergency cases. Obligating students to read and follow the health safety instructions (HSI) and signposts may not give the required level of conscious, especially like these cases require a swift reaction to overcome the problems. So an e-learning procedure has been suggested here for HSI to be followed through just simple, repeatable, and educating web pages that could help to increase the level of awareness of the health safety inside university laboratories and workplaces.

In most large and intermediate enterprises, factories and our educational institutes as well, there is a responsible person caring about health safety in a specific workplace. This person is in charge to assess and recover the risks, training the representatives of entire subsections of the workplace, and monitoring how the health safety going on inside the workplace. This professional person has to be trained and educated to deal with multiple situations that associated with his enterprise environment. For example, how the nurse is educated enough to recover and minimize the risks that face the old people such as falling, lost their way, or eat from unallowable staff [1].
Nowadays, occupational health and safety (OHS) major becomes one of seriously important subjects in the most of organizations. So the organizations are seeking to be with one of standard OHS for getting a good sign mark and competitive reputation. OHSAS 18001 is considered as one standard benchmarking of OHS certifications, which can be awarded by some registered authorities for companies after passing many OHS tests, demonstration and verification of the obligations of the all safety aspects [2].

Some research teams have found there is a significant difference between large and small institutes in the area of OHS education. The blame could be pointing toward budges, the priority of the managers’ attitudes, human and technical resources quality, the effect of the workers guild, and the type of OHS management system [3].

Nowadays, health safety curriculums are adopted as one of compulsory or optional materials that must be given to students especially for children in the elementary schools in many developed and developing countries [4]. However, the geographical distance between the educational and industrial institutes has prevented the adequate communication between headmasters and teacher in vocational schools, and supervisors of OHS in workplaces. The traditional training also prevents the headmaster to follow up the teachers and students in the OHS course. In addition, it has been demonstrated a misunderstanding of each responsible person role. This lead to decline level of pupils and students knowledge about OHS in these schools and colleges [5].

2. Related Work
Most of around the world, universities and institutes practice some examinations to assess the health safety awareness of the workers inside their laboratories. Many companies and enterprises even do not admit their employees without health safety certification, whereas there are only specific third-party authorities are eligible to issue health safety cards for employees in the western countries [6].

The global financial crisis (GFC) has affected the aspect of the workplace health promotion (WHP). The GFC actually has affected the small and medium enterprises (SME) more than the larger enterprises. Involving and participating a wider workforce by including OHS professionals, managers, owners, and all other workers is a worthy proposal to be investigated to increase the level of OHS priority in SME workforce. The tool that used to achieve wider subscription was Healthy Together e-learning training course. While the problem of WHP in SME is related to the building capacity, the e-Learning method has demonstrated positive results and could overcome the issues of the building resources limitation [7].

Some surveys have been reviewed on various sized enterprises and concluded the OHS knowledge management system should be conducted through an e-learning platform. They have discovered the large and small businesses should be turned through different procedure to acquaint and retain tacit knowledge. The research has focused on small to medium-sized enterprises (SME). The suggested procedure to follow with these enterprises is to narrate the methods and instructions in simple and easy communication between workers and e-learners [8].

Another investigation based on questionnaire that has included physicians, nurses, and the professional experience people in occupational medicine for both genders who are working in variant fields of Medicare institutes shows that the occupational health that provided to employees are not enough [9].

E-Learning based OHS training and education would be an effective manner to raise the knowledge, behavior, and interaction of workers. It always reflects positive results to the workers regardless of their age, gender, level of education, language, number of employees. Instructional design factors such as motivation to learn, learning content, interaction with learners and instructors, previous experience related to e-learning are all factors that influence the degree of learning satisfaction OHS education based on e-learning procedure [10].

Vinodkumar and Bhasi have conducted a comparison of OHSAS 18001, ISO 9001, and acts managements without any health safety certification to measure the risk accidents between them. The researchers have found the management systems with OHSAS 18001 certification is safer than others.
In contrary, they have demonstrated the management systems without health safety certification could not pass the requirements of the work safety. Also they have recommended to enforcing the employees to be obligated with safety rules could give better results [11].

A comparison has been published of three OHS standards, which are OHSAS 18001, the International Labour Organization (ILO) guidelines, and Oregon state OHSA guidelines, based on many aspects such as policy, planning and implementation, evaluation, and action of improvement. This work has concluded the integration of these three health and safety benchmarks in assessments [12].

In conclusion of this survey, the facilities and benefit of learning using computer OHS software and programming management system has not demonstrated or investigated clearly toward the conventional training course in colleges and universities. This research aims to show the advantages amount of using information technology in the field of OHS. It also demonstrates the awareness acquisition of students and personnel consciousness comparing with the traditional courses of OHS.

3. Implementation of the On-Line Exam

Although there are available open-source e-Learning platforms such as Moodle, ILIAS, and Sakai specified to work efficiently with OHS environment [13]. However, this research is based on the implementation of a tailor-made web application to be more specific and suitable for colleges of science students or to the university students in general.

Instead of using the traditional method, like test on paper, we have developed this online website to test the students experience in the field of occupational health safety (OHS) system to be qualified of entry into the college laboratories. The test was designed to cover all the prospective materials, scenarios, sudden events and situations that could happen in the college of science laboratories and workplaces.

The implementation has cared two key requirements, which are the database and the security.

It can be considered that there are many database requirements as follow:

- Database system must be used to store the users’ information and the examination questions. MySQL has been used for this purpose in this research. In addition, there should be an internet browser to run the on-line Health Safety system. Finally, there is a need to install WAMP server to build the system database.

- With regarding to the security aspects, the health safety system must provide a safe way to allow the registered users to be authorized. So it provides a security mechanism to prevent the intruders from accessing system. It also provides a way to allow the users to do what they want if that is compatible with their permissions.

3.1. The Administrator-User Interaction

The system’s designer has created the structure of the user's profile which can be considered as a container of the user's information that is submitted by the user in registration process. There are three types of users: Database Administrator, System Administrator and normal user. The last two types of user can access the system via web browser, which requires the internet connection on their computers. Their requests will be sent to web server. The OHS software system displays questions from the database when a person begins the OHS test. Furthermore, the user has been enabled to review its information and result if a pre-exam had been practiced. Figure 1 shows how the system interacts with all the types of users in general.

The administrator can edit, delete, view and add any extra questions or users when it logins as seen in Figure 2.
3.2. Database Design

The database of the proposed system has been manipulated using MySQL language. Following tables illustrate how the database sections are arranged.

3.2.1. User Table

To store the data and meta-data of the system, the database has to be designed. Therefore, there are three tables have been added to the table that was created during implementation, as illustrated in Figure 3.

3.2.2. Question Table
This table has made four tables all with the same structure and to facilitate the work when one of the sections is completed information. The database was easily designed by putting all the scattered tables in one table only. See figure 4.

3.2.3. Image Table
Since the question is divided into four tables. So to facilitate the transition to the next question, the table was divided to four images. All the tables are with same form of structural. See figure 5.

3.2.4. Answer Table
Answer table is associated to the user name, so every examinee person must have his nominated answer table to evaluate his answers and record his degree. However, when the test is finished, this table will be deleted. See figure 6.
3.2.5. **Counter table**

This table counts the person trails to avoid interfering with another person who tested at the same time and also to make the site more flexibility in moving from a question to another. This table will be deleted after the test is finished.

| Column |
|--------|
| id     |
| count  |

**Figure 7. Counter Table**

4. **OHS software GUI and windows**

The OHS software exam can be logged in using a unique username, which will specify the user as an examinee or an administrator, see figure 8. However, the user can create his/her account if he/she has not registered yet, see figure 9.

![Login](image)

**Figure 8. Log in page**

![Create Account](image)

**Figure 9. Creating the account page**

The user who has entered as administrator can edit, add, and delete the questions. Also, he has the right to explore the name of examinees and their scores, see figure 10 and 11. However, he could not edit or modify the scores or names. As shown in figure 10, the administrator should enter to examinees section, while the examinee has to enter into the questions section after specifying his/her department.

There are four different sorts of questions. Every sort contains 20 questions categorized according to the departments of the college of science. The examinee must practice all the questions and select the right answer. Otherwise, he will not pass the exam and get the required certification of OHS. Anyway, the user can pause the exam and return back later. Figure 11 shows a question example for all departments’ students.
After the examinee passing the exam successfully, his/her name and email will be added to the qualified students list, as shown in figure 12.

Finally, the successful students will be notified about their result through his/her registered email and get a certification manuscript. As we mentioned, all the results can be explored by the administrator, or could be provided to the person in charge in the department.

5. Results and Discussion
Results have been obtained through making a test of two categories of students, each group contains 10 students. The first students’ category has read the health safety brochure without practicing any exam. While the second category has read the brochure then practiced the proposed on-line exam. A comparison has been made between the two students’ categories to show the degree of knowledge, which is compiled as choosing the accurate answers and how long the information is kept in mind as well. The speed of the correct reaction was the second comparison parameter, while the thirds parameter was the willingness to spread the information and participating to give help in emergency situations. Figure 13 illustrates a diagram of these results comparison between the two categories.
6. Conclusion
The person in charge who is working in our university laboratories must be responsible to take a rapid action in case of accidents. So he/she must be trained well to be able to identify the problem, control the situation, and then treat the injured persons. However, all the students inside the laboratory should have been educated enough about the health safety and way to be followed.

However, we are ambitious to make all the Iraqi institutions are going to be seeking in the same ways. So we recommend these following prospective works:
1. The project can be extended to include the colleges of Medicine, Engineering, or other colleges of the University.
2. Legislation should be put to enforce all the people working inside some dangerous workplaces of the Iraqi institutions to follow them. So we can improve the safety and keep people souls.
3. The aim of this project is educational, so we recommend being like this websites in the other educational and industrial companies.
4. The online exams can help the students to understand the curriculum topics more easily. The students in primary and high schools of Iraq must be educated very well in aspect of health safety. So this types of exam my help the mission of this field of education.

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