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Implementation of Web-Based Education in Egypt through Cloud Computing Technologies and Its Effect on Higher Education

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Abstract

The information technology educational programs at most universities in Egypt face many obstacles that can be overcome using technology enhanced learning. An open source Moodle eLearning platform has been implemented at many public and private universities in Egypt, as an aid to deliver e-content and to provide the institution with various possibilities for implementing asynchronous e-learning web-based modules. In this paper the use of web-based education through cloud computing is presented. The evaluation showed that it has strongly contributed to the effectiveness of e- learning by improving the quality of students' comprehension.

Keywords: cloud computing, e-learning, higher education, moodle, web-based evaluation

1. Introduction

Web-based education is a solution to problems such as over-crowded classrooms, high prices of traditional educational books, transportation problems, need for continued education and specialized training, interaction with the international educational community and the enhancement of the level of national education.

E-learning has been widely used as a tool in the learning process in most of the Egyptian universities. In spite of its importance, still many of the academic staff in these universities tends to avoid using it or using it only to upload materials and neglect the interactive activities offered by such systems. Although the term e-learning has been used for over a decade now, still the field of educational research has not given enough attention to the effect of e-learning on students' motivation.

Figure 1 (M. Elkhouly, 2010), shows that 46% of individuals using the Internet for educational purposes, while 25.7% of individuals using the Internet in Egypt engage in communication-related activities, including sending and receiving e-mail, chatting and Internet phone communication. While Figure 2 (MCIT, 2013) shows the Internet users growth in Egypt.

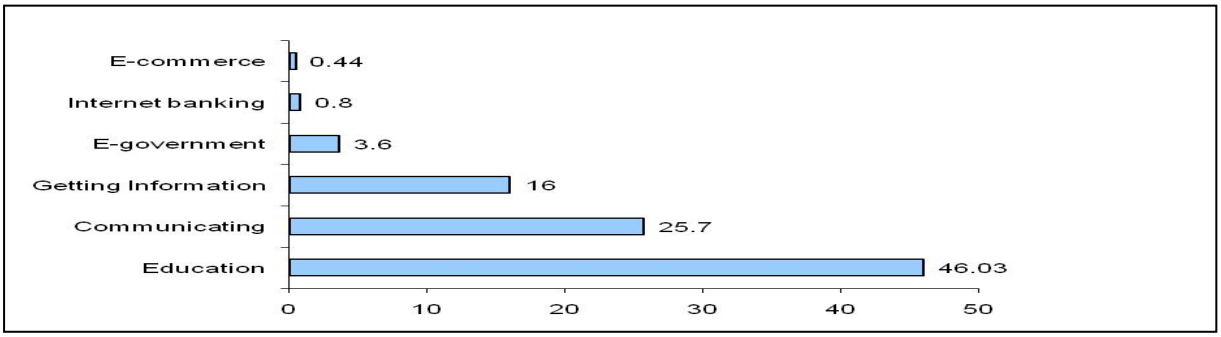

Figure 1. Purposes for individuals using the Internet in Egypt

Indicator	Unit	February 2012	January 2013	February 2013	Monthly Growth Rate (%)	Annual Growth Rate (%)
Internet Users	Million User	29.37	32.49	32.67	0.55	11.24
Internet Penetration	%	36.06	39.19	39.34	0.15	3.29
International Internet Bandwidth	Gbps	183.21	214.40	214.40	..	17.02
Proportion of households using Internet from home	%	38.18	44.59	45.12	0.53	6.94

Figure 2. Internet users in Egypt

Cloud computing has many benefits in education, (e.g., providing educational resource storage and databases, e-mails, educational applications and tools for students and teachers and clients located all over the world involving in an educational program). The main advantage is cost effectiveness for the implementation of the hardware and software and this technology can improve quality of current system of education at an affordable cost (Ghazizadeh, 2012).

A Google cloud enabled online quiz application is developed and deployed. This application allows students to answer an online quiz from any location, it also allows faculty to conduct online quizzes without having to worry about the quiz evaluation because correction is done instantly by the application and the score generated instantly (Shetty, Vadivel & Gandhi, 2012).

1.1 Web-Based as a Subcomponent of E-Learning

Web-based learning is a tool for education delivery. In academic institutions, web-based learning systems are housed either locally in IT department or externally using cloud services. Many such systems offer new ways for learners to interact with the learning source at any time. The phrase "anytime, anywhere learning" is frequently used with distance education systems, even if the topic or learning goal cannot be achieved "anytime" using that delivery method (Mirabella, Kimani & Tiziana, 2004) (Brodersen, Christensen, Grønbæk, Dindler & Sundararajah, 2005).

Using Web-based education has many benefits, such as: use the web as an electronic library, encourage the students to learn about IT implementation, having experience about document information management, such experience is needed for other disciplines, increase the ability of auto-training (Esnault & Zeiliger 2000).

There are four steps must be considered when developing a web-based module:

1. Analysis: Is it worthy to develop that module?

2. Planning: How to use the benefits of the web interactivity to make the module educationally sound?
3. Module Development: How to implement the planning steps? How to present the content? How to decrease confusion and answering possible questions of students?
4. Running the module: Management, maintenance of the module, and online interaction with the students.

1.2 Cloud Environment Learning Architecture

Cloud Computing is a new model for hosting resources and provisioning of services to the students. It provides a convenient, on-demand access to a centralized shared pool of computing resources that can be deployed by a minimal management overhead and with a great efficiency. Cloud environment resources are available to the students with no need of having deep knowledge about the cloud computing concepts. The students can start using the cloud environment resources as soon as connecting to the server where applications have been installed to them. (Hayes, 2008). Resources of cloud environment are classified into two categories, namely public clouds and private clouds. The former one is externally owned and offer access to external students, while the later one is internally owned. Cloud computing providers depend on the Internet as the intermediary communications medium leveraged to deliver their IT resources to their students on a pay-as-you-go basis (El-Sofany, Alghatani, Al Tayeb, Alqahtani & El-Seoud, 2012).The private cloud is built for the access within the company (Buyya, Yeo & Venugopal, 2009). Cloud computing will have a significant impact on the educational environment (Tuncay, 2010).

1.2.1 Cloud Computing Services that Support Education

There exists several cloud computing services providers that support educational system. Colleges benefits from many of online tools and applications in the clouds such as email, contact lists, document storage, calendars, photo sharing, creation and sharing (spreadsheets, word processed documents, presentations etc), and the ability to create websites (Knorr & Grumman, 2008). Google is considering as one of largest agents in the business of cloud computing; it offers many applications such as Google Apps, Maps and Gmail which all based in the cloud (Google App Engine). IBM is another player in the cloud computing business, with its self contained CloudBurst application (Bein, Bein & Madiraju, 2009) (IBM Smart Cloud). Also, Amazon introduced a new component called Amazon Elastic Compute Cloud (or EC2) that allows Amazon processing power to be rented to students (Amazon Elastic Compute Cloud). Finally, Microsoft spent allot of money on Azure platform that becomes live since 2010; it is a flexible cloud computing platform that lets students focus on solving many education problems and giving the flexibility to education IT departments (Cloud Computing For Education).

1.2.2 Learning Actors in Cloud Computing

A Learning Actor is any entity involved in the learning process (i.e., management, students, instructors, lab staff, etc…). There are four types of resources that can be provisioned and a Learning Actor can consume over the Internet (El-Sofany, Alghatani, Al Tayeb, Alqahtani & El-Seoud, 2012). First, Infrastructure resources (i.e., computing power, storage, etc…). Second, Software resources (i.e., cloud-centric operating systems, application servers, databases, development tools, testing tools, and deployment tools). Third, Application resources (i.e., SaaS model). Fourth, Learning processes (i.e., applications exposed as utilities, learning-driven application outsourcing that supports provisioning, reuse and composition). Learning Processes will be greatly benefited by the following two key technologies (virtualization technology, and Service-Oriented Architecture (SOA)) (El-Sofany, Alghatani, Al Tayeb, Alqahtani & El-Seoud, 2012). The virtualization technology manages: the imaging of the operating systems, middleware, and applications, the pre-allocation of all the resources to the right physical machines or server stack slices, the licensing mechanism of all software layers in the cloud computing platform. The Service-Oriented Architecture (SOA) supports component-based software development improving reusability, extensibility, and flexibility. When new learning objects are needed we should be able to consume, reuse with the least effort, existing resources and assemble new courses running on a Unified Cloud Computing Educational infrastructure (El-Sofany, Alghatani, Al Tayeb, Alqahtani & El-Seoud, 2012).

1.2.3 A Cloud Education Architecture Based on Cloud Computing

The model consists of, physical hardware layer, virtualization layer, education middleware layer, application program interface layer; management system and security certification system (see Figure 3).

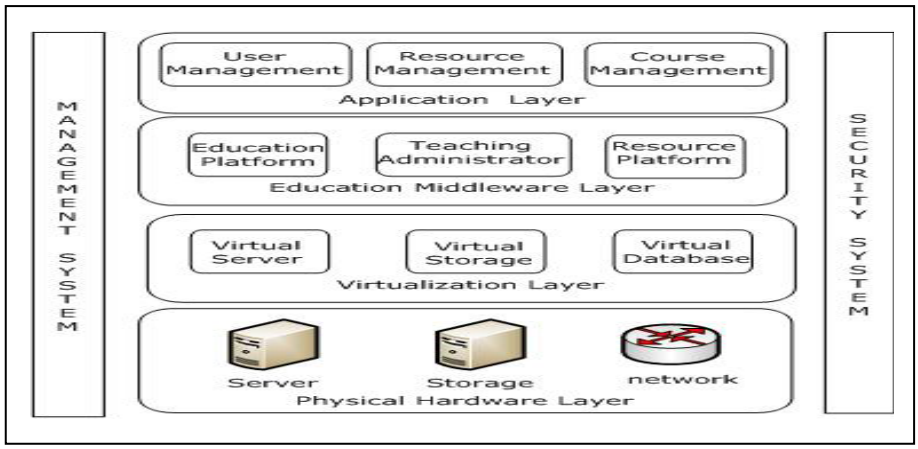

Figure 3. Architecture of Cloud Education model

Physical hardware layer includes servers, storage equipments, and network equipments. Virtualization layer consists of three parts: virtual servers, virtual storages, and virtual databases. The goal of virtualization layer is to break completely information islands based on existing regional through the distributed technology and virtualization technology. Dynamic configuration, distributed deployment and fee measurement realizes the five characteristics of cloud computing, would help in achieving the previously mentioned goal. Education middleware layer is the core layer; it is the basic business platform. All necessary information, including ordinary file and database, attached to it on different computing node. Application program interface layer provides the necessary interface, hosting service and model's scalability. Management system monitors physical condition, virtualization software, hardware and software, open API and enhance the safety of the software platform. Security system monitors identity authentication and authorization, single point login, virtualization software and hardware access control and audit, the education middleware and open API access control (El-Sofany, Alghatani, Al Tayeb, Alqahtani & El-Seoud, 2012).

1.2.4 Advantages of Cloud Computing Technology

- Cheap: as we do not need a real server just fees for the service provider
- More reliable than traditional local servers (as e-learning server machine at BUE)
- Full maintenance
- Services: use the e-learning solution given by the provider
- No more worries about hardware failures as we experienced before
- Widely used and spreading anonymously across the universe
- Data backup archiving
- Full integration of services needed by e-learning
- Snapshots from the whole virtual machine (in case of system recovery)
- No hardware upgrades needed (everything will be managed virtually, for example we can increase the hard disk size instantly as you go)

2. Method

The participants of the study are students at the British University in Egypt. BUE uses Moodle version 2.4. E-learning has been used as an essential tool for the learning process across the university for more than seven years. All the academic staff uses Moodle mainly to upload materials as well as to post announcements to the students. Few of them use it for online as well as interactive assignments. The population of the research was natural groups, (i.e., the learners were already there before the research and not formed specifically for this study). The examples in this article are based on modules taught at the (BUE) in the fall of 2012. The modules have been conducted at BUE as e-learning modules and traditional classroom modules. BUE encourages creativity and innovation, both in its area of specialization and in related areas. The motto of the (BUE) is (Learn How to Think...not what to Think) (**The British University in Egypt**).

At The Interactive assessment, students will be provided with instruments to let the instructor know the advantages and disadvantages in terms of their performance and their perceptions of the teacher's performance.

Intellectual stimulations in classroom education can be irreplaceable using web-based education system. It is critical for educators to obtain module evaluation to determine how successful and effective a module is taught in the classroom. American Board Engineering and Technology (ABET) accreditation guidelines recommend engineering education evaluation as a three-loop process (Standard Process 00, 2003). First, teachers evaluate students. Second, students evaluate teachers. Third, employers evaluate students.

Most universities can determine the outcome of second process. This evaluation is direct and could be conducted in two ways. First, paper based. Second, web-based. Currently, BUE conducted paper-based evaluation and at the end of the semester. This process is slow, time consuming, questionnaires are often outdated, and results are often too late to make changes in the classroom.

Web-based evaluation has the advantage of instant feedback, and appropriate questions could be added, and ease of statistical analysis. However, there exists a disagreement that web-based survey could improve teaching styles of the faculty members (Theall, 2003). Web-based are gaining popularity because of its appeal to students. The paradigm change from students as passive receptors of data to students as active learners, well explored in "Seven Principles for Good Practice in Undergraduate Education" (Chickering & Gamson, 1987), can be facilitated by a Web-based learning environment provided by a module management system like Blackboard, WebCT, or Moodle.

There is one problem with the statistical evaluation of the student response to determine how effective is an instructor is in a module. The students do not often learn what should be learned, rather learning for mostly an acceptable grade. The education goal is sometimes compromised due to this problem. That is why faculty members tend to inflate students' grades, because of the fear that bad grades may make students respond unfavourably in a module evaluation. It is a problem in many university campuses that faculty members are unable to truly evaluate the students' performance. That is why an improper analysis can hurt an instructor reputation if the responses are biased, especially in a smaller sized survey.

The goals and aims of this study are to better explain the need for web-based modules and its effectiveness based on the existing e-learning system. A Paper-based Survey among the (BUE) students at the campus had been conducted and reported on their assessments. Eighty five students from different faculties had been engaged at the paper-based survey. The students are at early twenties of their ages, and from different academic years, with online learning experience mainly from the BUE.

Here below is the questioner that has been given to eighty five students who participated in the study. The students belong to different colleges at BUE, namely Engineering, ICS and BAEPS. The students are randomly distributed over all four academic years at BUE. Students were asked to rank ten e-learning system's activities according to their importance and relevance to them. This ranking has five Likert **scale** ranging from least to very much relevant (i.e., 1=Least, 2=Little, 3=Moderate, 4=Much, 5=Very Much).

E-learning questionnaire:

E-learning questionnaire for students 2011/2012 (semester 2)

Faculty:

Department:

Year:

- Do you access E-learning regularly?

Yes no never

- How much time do you spend on E-learning per day?

15 minutes 30 minutes 1hour others

- Is it well organized/easy to access your content? Explain please

Yes no I don't care

- Does it provide a mean of interaction between you "as a student" and your instructor? Explain please

Yes no I don't care

- Does it provide a mean if interaction among students (collaboration interaction)? Explain please

Yes no I don't care

Please rank the following activities according to their importance and relevance to you:

1. Online quizzes, you will be able to have a quiz online on the e-learning within time limit

Least little moderate much very much

2. Encourage active participation through feedback & comments on various activities and class topics with appropriate monitoring

Least little moderate much very much

3. Collaboration among students and staff through discussion forums to share ideas that would improve research and communication skills collectively

Least little moderate much very much

4. Provide video streamed lectures and labs to your students

Least little moderate much very much

5. share interesting bookmarks of various academic resources and important web sites

Least little moderate much very much

6. Provide interactive chat rooms for students and staff to communicate with each others

Least little moderate much very much

7. Enable voting where students can vote on several topics, activities and ideas through a social network

Least little moderate much very much

8. File sharing system for posting research paper and various research contributions

Least little moderate much very much

9. A hot question activity, where the students could vote on others' question, so the hottest question will be popped up. Teachers will make oral comments on question in classroom

Least little moderate much very much

10. Adding voice narration to PowerPoint slides, where you will be able to read and hear the contents online, in other words the students will be able to hear the instructors' explanation while reading the slides online.

Least little moderate much very much

Next section gives the details of the collected data. Finally, technology advances will never take the role of a facilitator. That role is done by the teacher. Machine will never take the place of the teacher, his role was and will stay the most crucial element at any teaching activity (Harmer, 2000) (Soong, 2012).

3. Results

The following Figures and explanation show the result of paper-based evaluation completed by 85 students at BUE during the spring semester of the academic year 2011-2012.

Figure 4, indicates that 35% of students are from Faculty of Business Administration, Economics and Political Sciences (BAEPS), 46% of students are student from Faculty of Informatics and Computer Sciences (ICS), and 16% of students are from Faculty of Engineering have participated.

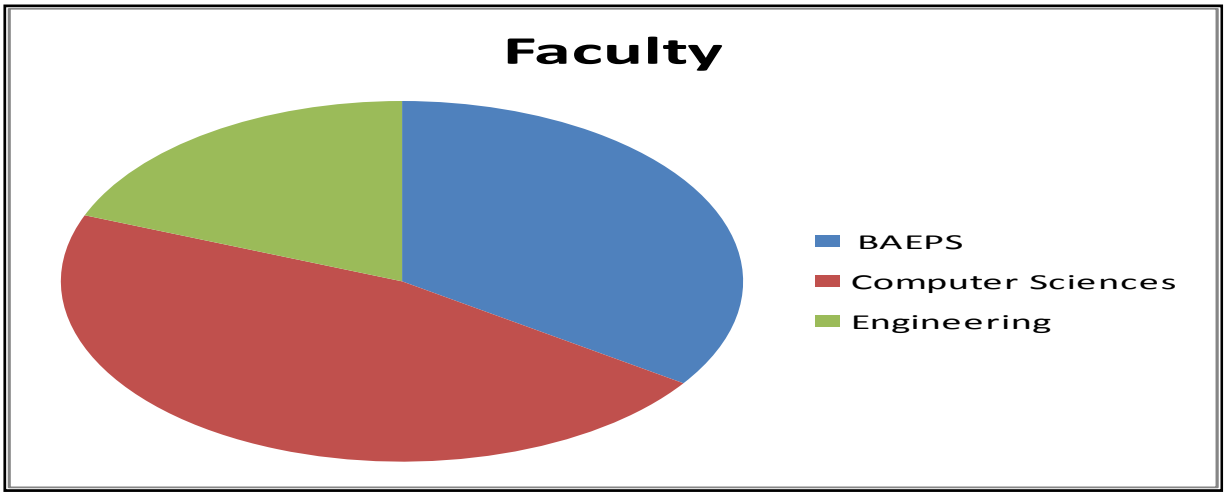

Figure 4. Fculty participation

Figure 5, indicates that 36% of students are in year 1, 34% of students are in year 2, 15 % of students are in year 3, and 15% of students are in year 4.

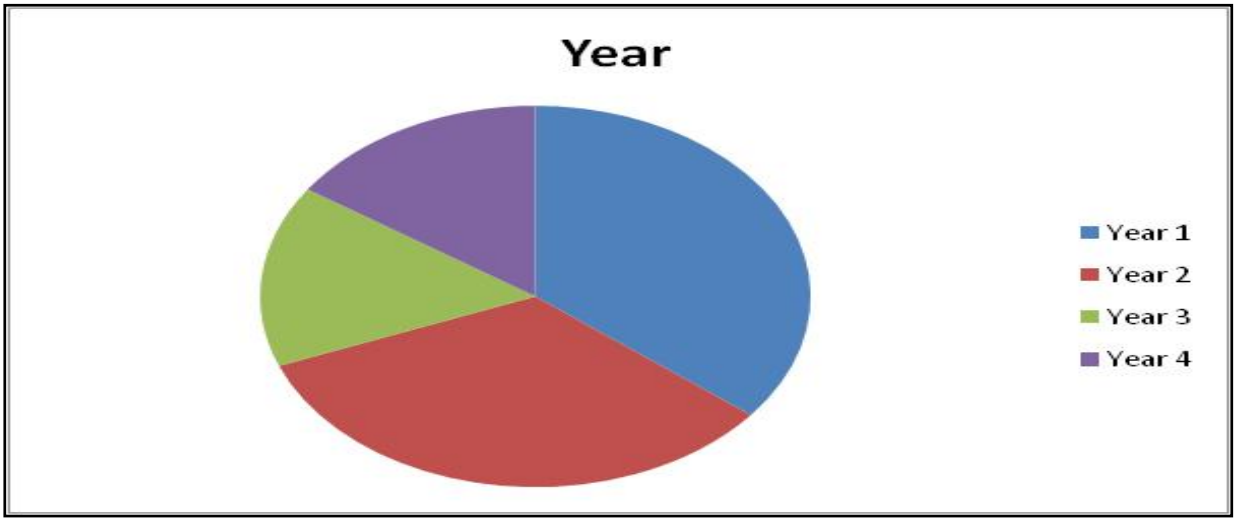

Figure 5. Academic year of participation

Figure 6 and Figure 7, indicate that the Majorty of the students access e-learning, however not spending more than 15 minutes per day.

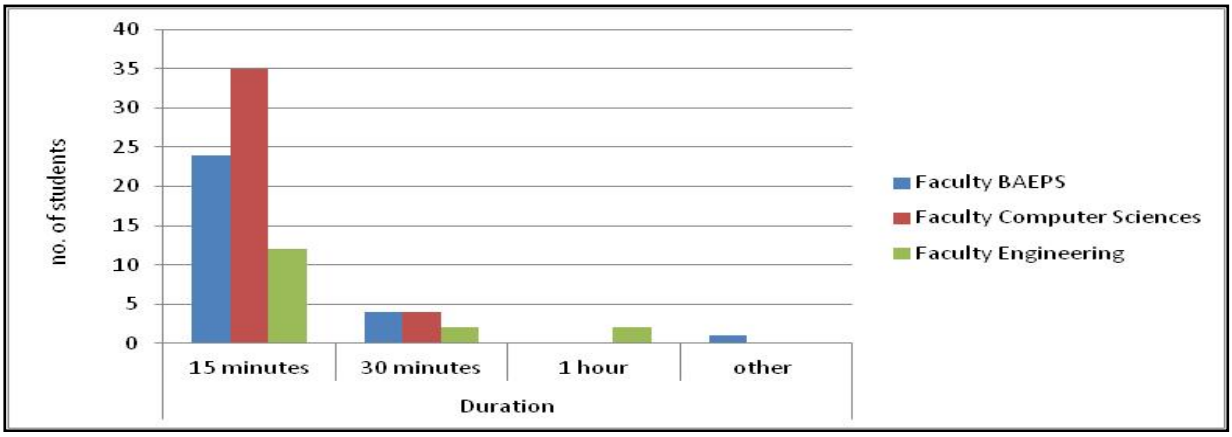

Figure 6. Time spent in accessing the e-learning per faculty

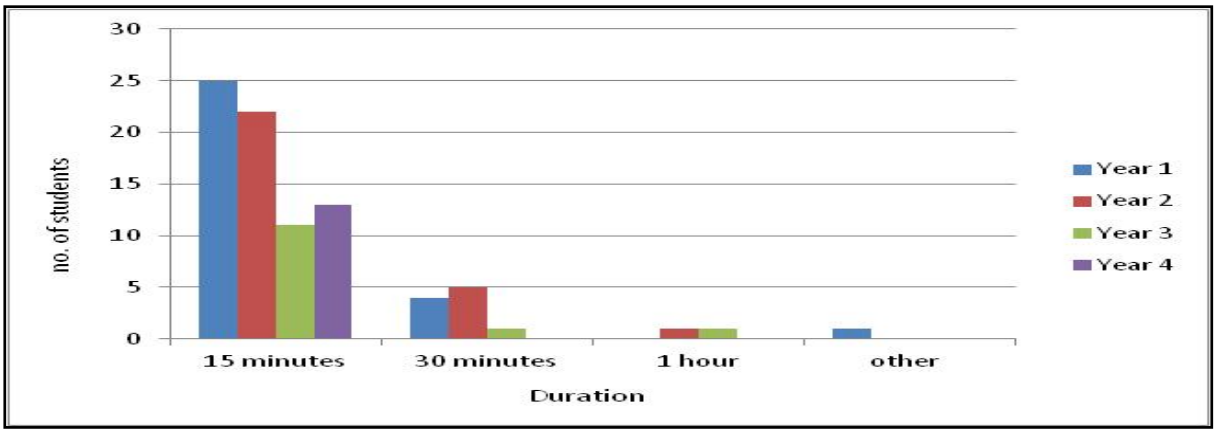

Figure 7. Time spent in accessing the e-learning per academic year

Figure 8, indicates that 72% of the students think that it is easy to access the system.

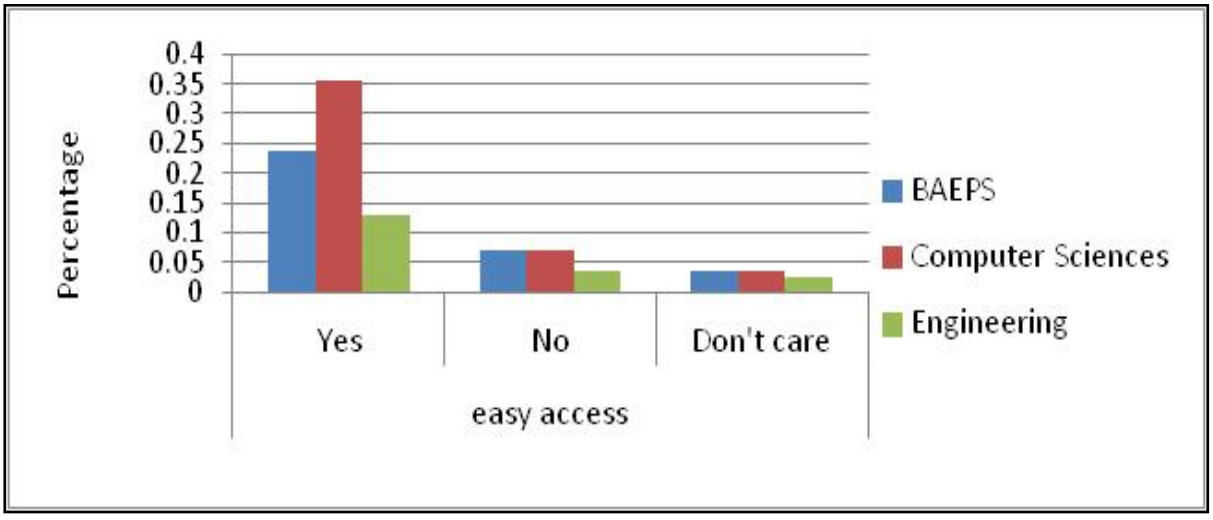

Figure 8. Percentage of accessing the system

Figure 9, indicates that 68% of the students think that this system does not provide a mean of interaction among students. It also indicates that 53% of the students think that this system does not provide a mean of interaction between students and teacher.

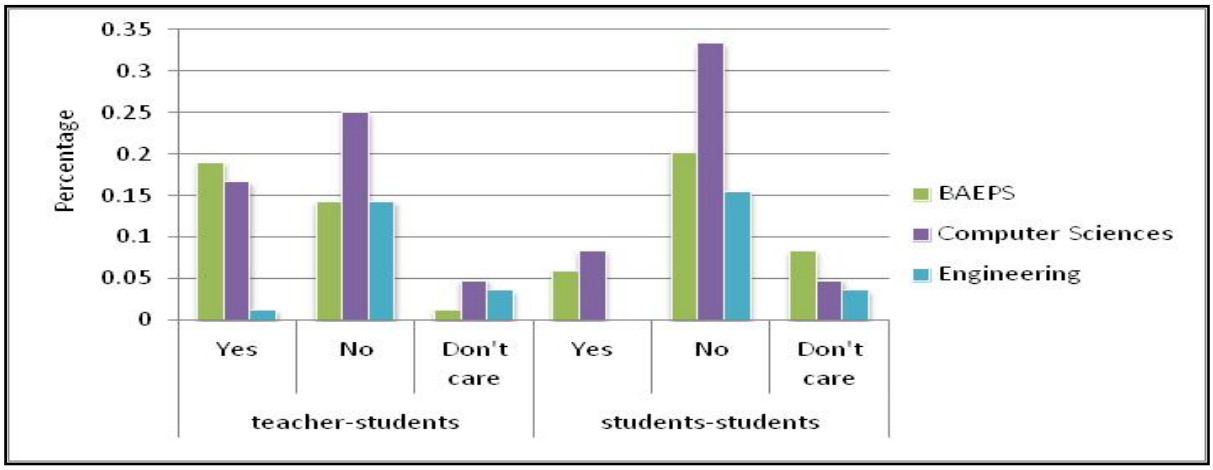

Figure 9. Percentage of system interaction

Figure 10 shows the mean of every e-learning system's activity. Figures from 11 to 20 show the details of the responses of the students from each faculty for each activity.

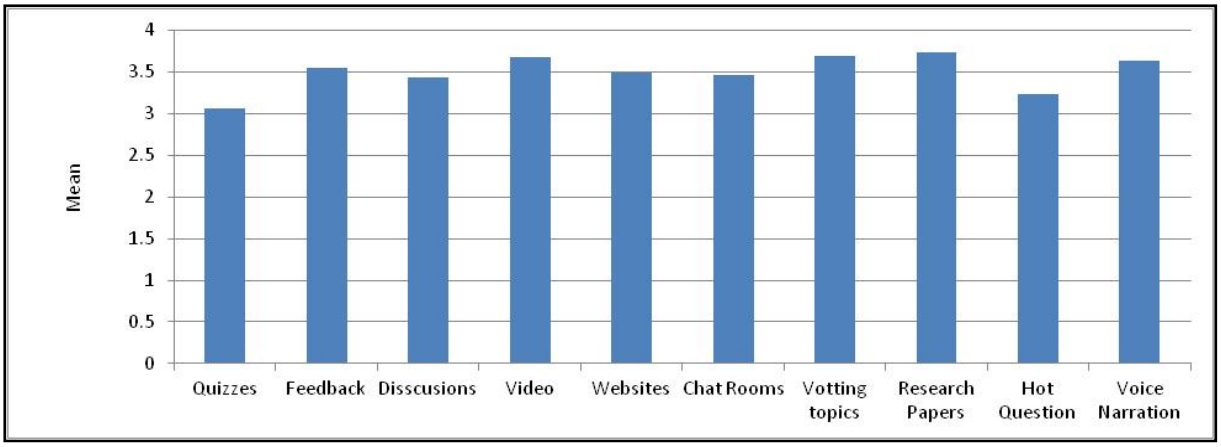

Figure 10. The mean of all ten e-learning system's activities (see e-learning questionnaire)

Figure 11 shows the response of the students on the question if online quiz using e-learning within time limit is possible (question 1). The number of students from each faculty is shown along vertical axis. The ranking is shown along the horizontal axis.

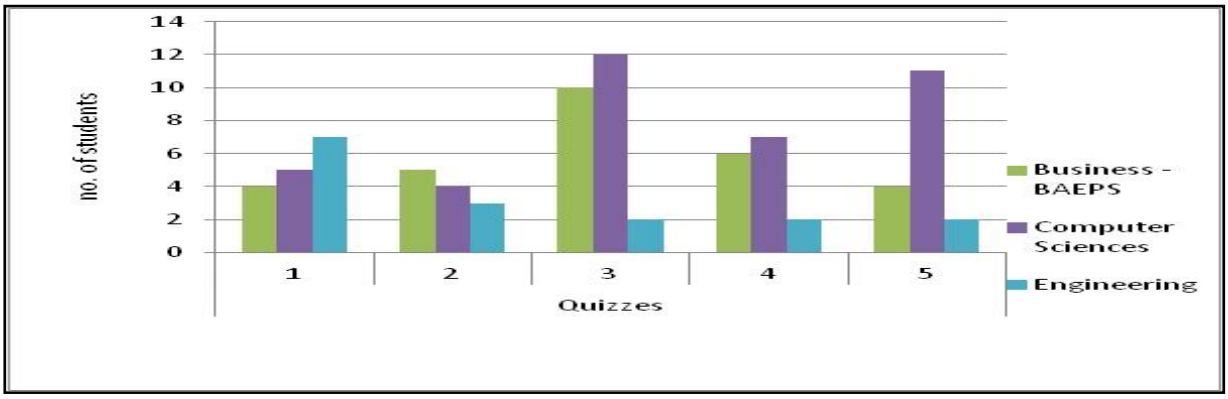

Figure 11. Quizzes via e-learning system (question 1)

Figure 12 shows the response of the students on the question if e-learning is encouraging active participation through feedback and comments on various activities and class topics with appropriate monitoring (question 2). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

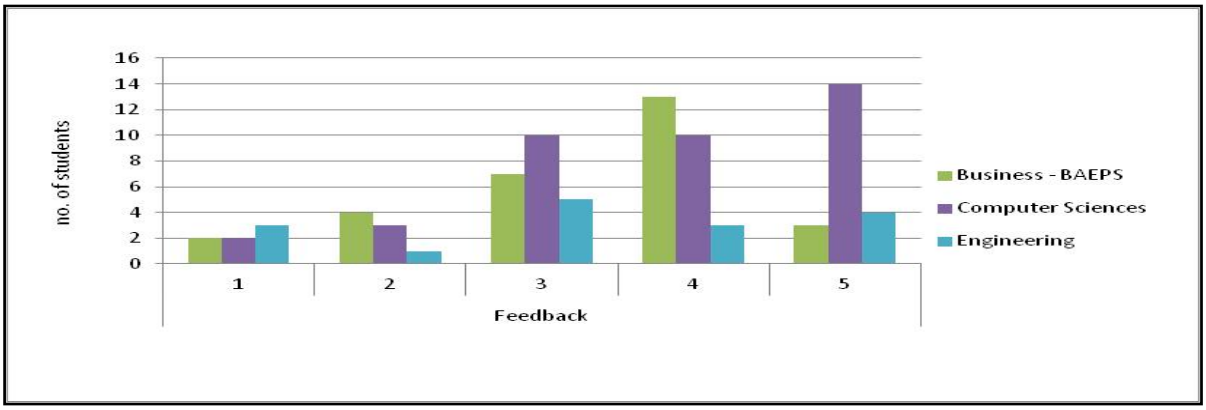

Figure 12. Encouraging active participation (question 2)

Figure 13 shows the response of the students on the question if using e-learning for collaboration among students and staff through discussions forums to share ideas would improve research and communication skills collectively (question 3). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

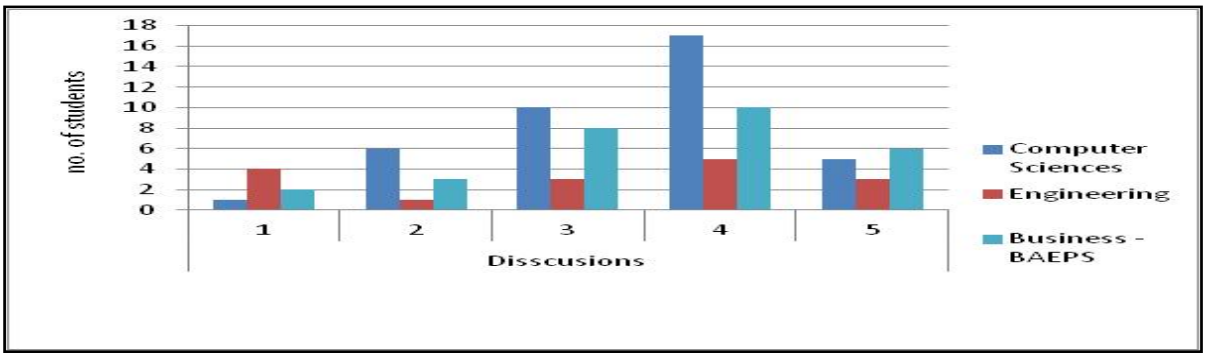

Figure 13. Collaboration among students and staff (question 3)

Figure 14 shows the response of the students on the question if using e-learning for providing video streamed lectures and labs to the students is preferable (question 4). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

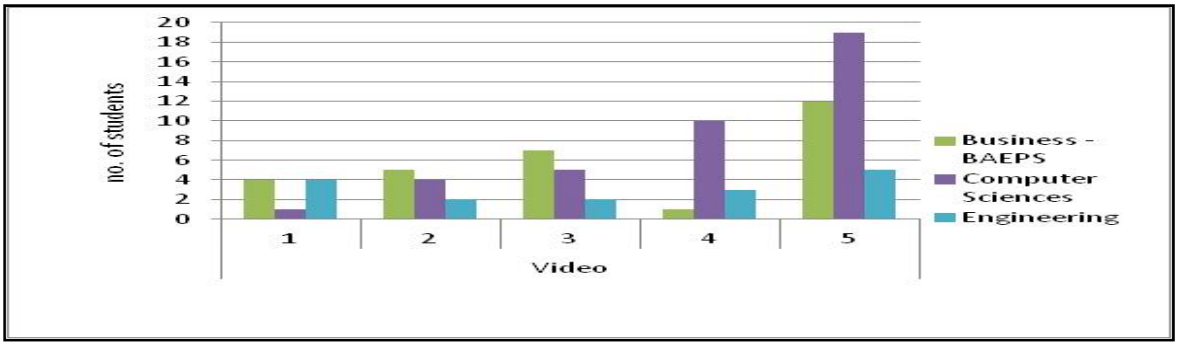

Figure 14. Providing video streamed lectures (question 4)

Figure 15 shows the response of the students on the question if using e-learning for sharing interesting bookmarks of various academic resources and important websites is preferable (question 5). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

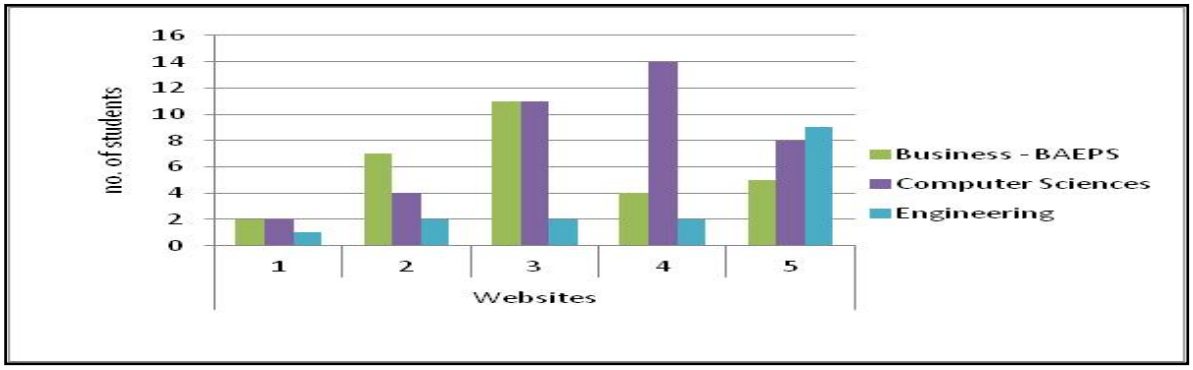

Figure 15. Sharing interesting bookmarks of various academic resources (question 5)

Figure 16 shows the response of the students on the question if using e-learning for providing interactive chat rooms for students and staff to communicate is preferable (question 6). The number of students from each faculty is shown along the vertical axis. The ranking is shown at the horizontal axis.

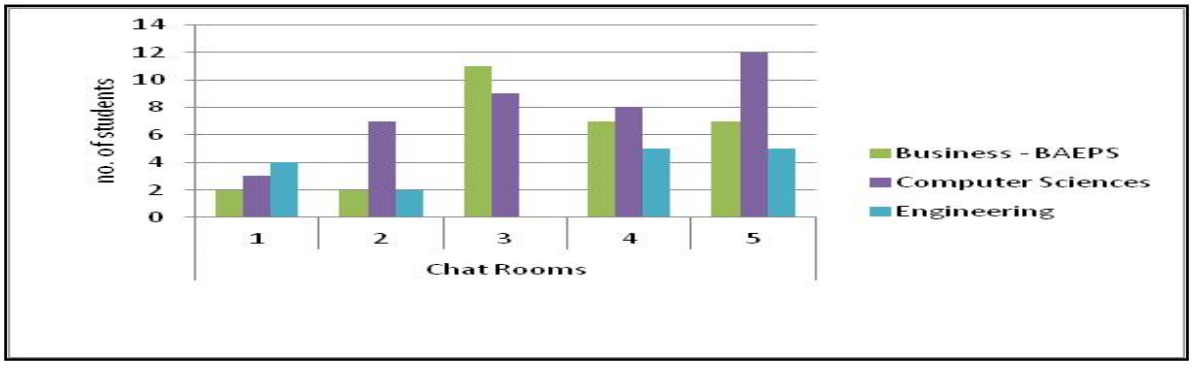

Figure 16. Providing interactive chat rooms (question 6)

Figure 17 shows the response of the students on the question if using e-learning for enabling voting where students can vote on several topics, activities and ideas through a social network is preferable (question 7). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

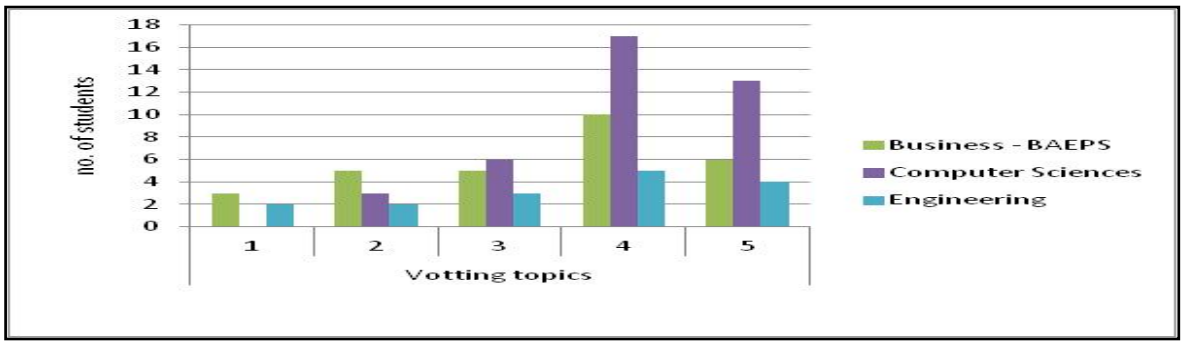

Figure 17. Enabling voting where students can vote (question 7)

Figure 18 shows the response of the students on the question if using e-learning for file sharing system, posting research paper and various research contributions is preferable (question 8). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

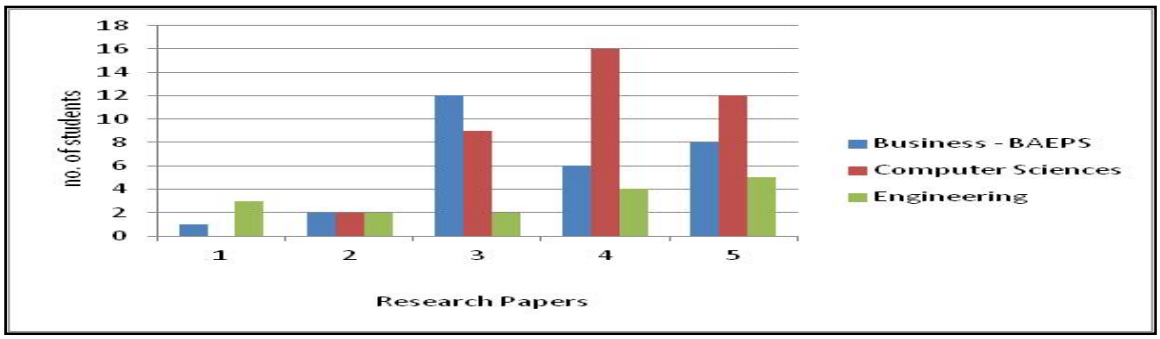

Figure 18. File sharing system for posting research paper (question 8)

Figure 19 shows the response of the students on the question if using e-learning for introducing a hot question activity, where the students vote on others' question, so the hottest question will be popped up and teachers will make oral comments on question in classroom is preferable (question 9). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

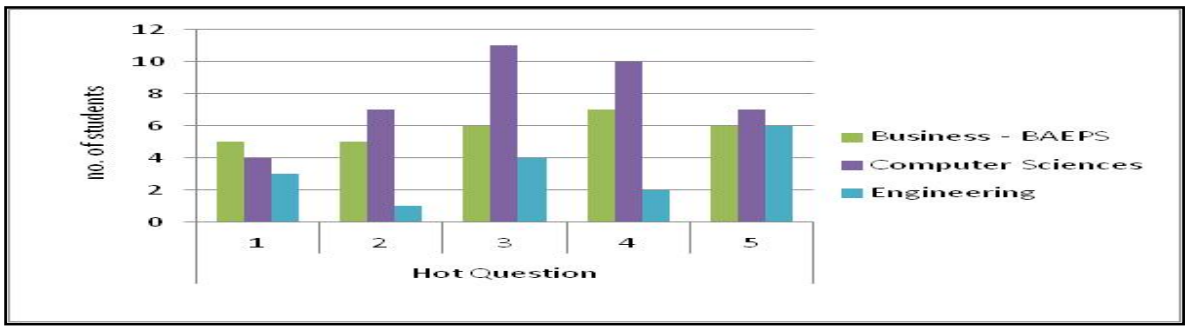

Figure 19. Introducing a hot question activity (question 9)

Figure 20 shows the response of the students on the question if using e-learning for adding voice narration to PowerPoint slides, where reading and hearing instructors' explanation online is preferable (question 10). The number of students from each faculty is shown along the vertical axis. The ranking is shown along the horizontal axis.

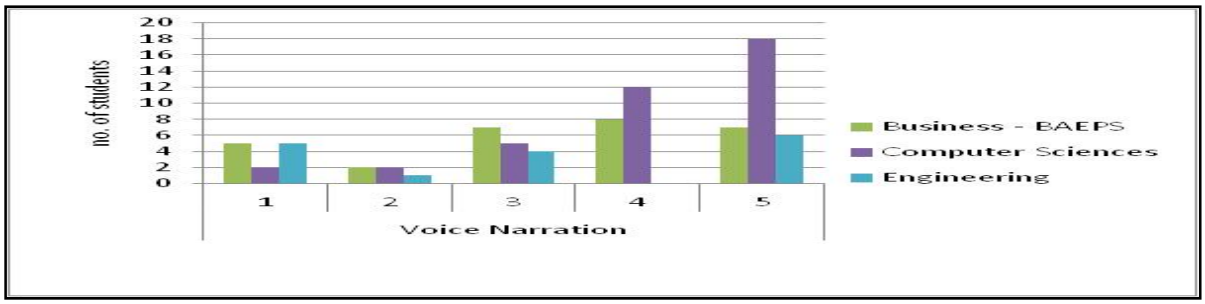

Figure 20. Adding voice narration to PowerPoint slides (question 10)

4. Discussion

The gap between what is taught and what is learned exists in both traditional and web-based learning (Mirabella, Kimani & Tiziana, 2004**)**. The assessment process in an educational system is an important and primordial part of its success to assure the correct way of knowledge transmission and to ensure that students are working correctly and succeed to acquire the needed knowledge. Almost all educational institutes, especially in the Middle East region are seeking to implement the web-based evaluation system for their programs, courses, and student, depending on the requirements of the accreditation of Quality for their academic programs (El-Sofany & El-Seoud, 2011).

Faculty can empower themselves by using technologies to facilitate a proven educational process of receiving and acting on feedback from learners. When the students cooperating seriously in the assessment a reinforcement of their grasp of course content and strengthen of their own skills at self-assessment will occur. Furthermore, student motivation is increased when realizing that faculty are interested in their success as learners. We designed paper-based questionnaire to collect students' feedback about the courses taught at the British University in Egypt. It shows that:

- Almost all students think that the e-learning system lack effective means of interactions between students-students and students-teachers (see figure 9).
- Almost all students are very keen to have e-learning system with effective means of allowing feedback on their work (see figure 12), video streaming for lectures & labs (see figure 14), links to websites of various academic resources (see figure 15), voting on topics and activities (see figure 17), sharing e-learning systems for posting research paper (see figure 18), and voice narration to PowerPoint slides (see figure 20).
- Student's preferences are different based on faculty. For example Engineering students are less keen of having e-learning with effective means of allowing feedback on their work (see figure 12), video streaming for lectures & labs (see figure 14), and voice narration to PowerPoint slides (see figure 20)

Since English language studies are required for all students from all majors, a comprehensive group of students could be participated into a more thorough survey studies that measure how e-learning motivate the learning process. The participants of the study could be divided into two groups. The students of the first group have to do all their assignments via e-learning. The students of the second group have to deal with hard copies only to submit their assignments. In order to control the variables between the two groups, the assignments of each group are balanced in terms of the grades assigned for each, as well as in terms of difficulty. Also, the participants of the two groups are selected from the same grade year. The teacher is another extraneous variable that will be dealt with through creating a third group. This group will receive a pack of online assignments via e-learning and a pack of offline assignments. Assignments from each pack will be given to the students alternatively. The packs are designed so that each one has the same number of assignments. Also, the weight of the grades assigned for each pack is equal (El-Seoud et al., 2013) (El-Seoud, Seddiek, Taj-Eddin, Ghenghesh & El-Khouly, 2013).

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