

# Blended Learning Using Virtual Reality Environments

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**Abstract**— *Immersive virtual reality isn't just for gaming. It's poised to have a big impact on education as well, giving students an opportunity to interact with content in three-dimensional learning environments.*

*Blended learning, according to the Inn sight Institute is "a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student' control over time, place, path and/or pace". On the other hand, there are many disadvantage found in blended learning such as the learners with low motivation or bad study habits may fall behind, and many others. So, there is an essential need to improve and develop the theory of the blended learning by using virtual reality environments and get rid of these disadvantages to develop the face-to-face learning to add a lot of features such as excitement and make it more efficient. As well as affirms clarity of the scientific content of the lecture that the student may be miss them by absent or even mentally, so student can live atmosphere the lecture again and overcome the difficulties resulting from the using blended learning or traditional learning. Firstly, this approach is applied by building a specialized website application that allow using virtual reality feature in order to measure the effectiveness of this study on students, and then a questionnaires was designed and the information result of these questionnaires impact was gathered. It is found that, the most of students were excited, active and they understand the lecture in an easy way with a high Likert Scale (4.74), but they found difficulties in using VR tools which has a low Likert scale (2.66).*

**Index Terms**— blended learning, virtual reality, VR, E-Learning, Statistical questionnaire.

## 1. INTRODUCTION

In recent decades, the world has seen significant progress in the development of knowledge and technology, which had a significant impact in advancing the educational institutions to introduce radical changes in its anti-crime policy and schemes of education, experts have realized that education was not in any era of the ages free from successive changes which lead societies and education to play a major role in the development of civilization as it affected and influenced by contributes of education in building intellectual capital through West latest educational methods used in educational institutions.

### A. Traditional Teaching

Previously, the traditional teaching method was used in education. It is allow for the teachers to give and explain the lesson only in the class. This method has several disadvantages. One of this, is the case of student absent which prevent the student from the opportunity of understanding the lesson due to the lack of any tool that can be used to represent the lesson again. Today, students have to ask themselves about

their positions in the midst of the scientific and industrial revolutions. Arab world were still depend on the traditional teaching methods which is not compatible with the modern life; The traditional education at the present time does not confer new educational content for generations because it alone cannot keep up with the modern thought and technologies, and that the Arab world needs to a change in the quantity and the type of students twenty-first century, where the level of education is very low compared to the world countries

### B. E-Learning

E-Learning is a modern revolution in teaching and techniques methods, which utilizes the latest technology from

the hardware and software in the education process [1]; starting from the use of electronic display to take lessons in traditional classrooms and the use of multimedia in the quarterly education and self-education operations, and ending with the construction of smart schools and virtual

classrooms that allow students to attend and interact with lessons and seminars are held in other countries through the Internet and interactive television technologies. The concept of E-Learning during his appearance and evolution has passed in three generations since the 1980s [2], to the current form: first generation was emerged in the early of 1980s, where the electronic content on CD, and it was the interaction of which individually between the student and the teacher with a focus on the role of student. Second generation came with the beginning of the Internet, the process of interaction and communication evolved from being the individual to being a collective, to involve students with specific teachers. Third generation begin with the concept of e-commerce and cyber security in the late 1990s, coinciding with the rapid development of multimedia technologies and virtual reality technology and satellite communication technology, allowing for the development of the third generation of E-Learning to the current concept, which depends on the use of electronic media in communicating and receiving information and acquiring skills and interaction between the student and the school and between the school and the teacher.

And still even now there is controversy about selecting the most comprehensive of the concept of E-Learning term, and predominantly on the most of the jurisprudence; in this area

focus of each team on the corner of specialization and attention, and then the researchers differed on the definition of E-Learning according to different viewpoints.

The E-Learning method was defined in [3] as a way for teaching using modern communication mechanisms of computer networks and multimedia from the voice and image, graphics, and mechanisms of search, electronic libraries, as well as web portals, whether remotely or in the classroom "and that the style and techniques of education based on the Internet to connect and share lessons and topics of research between the learner and the teacher, and the E-Learning concept contains a lot of techniques and styles.

The adoption of E-learning in education, especially for higher educational institutions has several advantages; it is able to provide opportunities for relations between learners by the use of discussion forums. Through this, e-learning helps eliminate barriers that have the potential of hindering participation including the fear of talking to other learners. E-learning motivates students to interact with other, as well as exchange and respect different point of views. E-learning eases communication and also improves the relationships that sustain learning. [4] Note that e-Learning makes available extra prospects for interactivity between students and teachers during content delivery

However, it should be noted that there are many disadvantages of E-Learning method; hence the use of blended learning is an attempt to overcome a lot of them, and these defects as follow:

- The sense of isolation and lack of emotion, lack of sense of community and interaction with peers and face-to-face; The asynchronous communication may have some limitations that reduce the quality, as the absence of feelings and physical expressions "body language" may affect

learning, and the interaction of the student, in addition to that the researches indicate that the students who have a sense of shame to participate prefer the E-Learning environment, and vice versa students who have a fluent literary and rhetorical eloquence may avoid writing or to participate in electronic asynchronous discussions [5].

- Problems related to the time with the overload of information: One study refers that the lack of time needed to adequately prepare the teaching duties as well as the E-Learning teaching takes longer time than the traditional teaching [5].

- Problems related to the credibility: fraud has become a common phenomenon in the educational process, where there are disturbing statistics on this phenomenon show that about 70% of the teachers, Teachers in graduate, allowed for their students to cheat- at least - in one exam, and 95% of those cheating students were not caught [5].

- Waste problem: which is defined as "the number of students who were registered with a course, but they have not completed all the requirements of decision or did not complete the schedule or failed in passing," One study refers that the increase in these rates which ranged from 30% and 50%, were due to the confusion and anxiety, feeling of isolation, and technological frustration.

- The misuse of technology: misuse of technology, which may be due to technical reasons such as lack of training on the use of devices, or ethical or health such as eye strain [5].

- Technical problems: Some studies refer that student of E-Learning feeling frustration and anxiety as a result of poor communications, flow technical problems, mainly depending on the technology and external support systems as well as the weakness of the skill level of the students when dealing with telecommunications and information technology [5].

It should be noted that an important technology applied and developed can never substitute the traditional methods of teaching and learning, such as the E-book did not substitute the traditional book, e-trade did not substitute the traditional trade also e-mail did not substitute the postal mail; therefore the E-Learning will not be a substitute for traditional learning and human teacher classroom at the campus. The president of one Canadian university, which refused the full transformation from traditional University to the electronic university, remarked that "I will never change the teaching staff with computers" [6].

### C. *Blended Learning*

According to the above sections, the concept of Blended Learning or built learning as a natural evolution of E-Learning, this type of learning that combines E-Learning and traditional classroom learning normal, it does not eliminate the E-Learning and the traditional learning, but it is a combination of both, as well as blended learning appears as an attempt to overcome the disadvantages of E-Learning, ' a study results indicated that students in blended learning and who were given the opportunity to communicate face-to-face work could do more coherent discussions and relationships than their peers who They were on E-Learning [7]. Although, the circumstances of the current era show that the

traditional learning will accommodate the E-Learning and considered it as a complement due to its cons, on the other hands some viewer see the reverse in the near future, where it is expected that the E-Learning will accommodate the traditional learning.

## 2. RELATED WORK

For more than a decade the growth in applications and effectiveness of virtual reality provides a much more intuitive link between the computer and human participate and has been applied successfully to thousands of scenarios in diverse areas including anxiety therapy, multiplayer, online gaming and medical procedure; As well as the studies have been conducted on the applications and effectiveness in education and training since 1980s. The aim of this research is to use the virtual reality in blended learning. There are a several studies of using the blended learning; these studies can be stated as follows:

**Khalaf Allah and Muhammed(2010) [8]**, present a study on the blended learning; this study aimed to reveal the effectiveness of using E-Learning and blending learning in Skills development of the production of educational models among students in technology education Division, Faculty of education, University of Al-Azhar, and the researcher chose a random sample of students 1st Division for educational technology Faculty of education numbered 70 students were divided into two groups, each group having (35) students, the researcher has applied the test collection and note card sets to learn the skills of producing educational models before applying the two programs, the researcher apply the two prepared programs where the first one was the E-Learning and the second one was the blended learning on the individual study sample, the results showed the effectiveness of e-education lectures in cognitive achievement increase associated with the skills of the students also showed the effectiveness in developing performance skills in practice. Also the results showed that the effectiveness of blended learning method in increasing the collection of knowledge related to the skills among students, as well as its effectiveness in skills performance development on a practical level, and the study also showed superiority of blended learning groups on a range of E-Learning in achievement-related skills, as well as its superiority over the E-Learning group in the performance skills production models.

**Kinsara and Hassan Mohamed (2009) [9]**, present a study that investigates the impact of computer-based education strategy to direct collection and deferred decision students learning techniques compared with individual and traditional way, through applied to a sample consisted of 90 teachers college students in the Umm Al-Qura University and have distributed as three study groups by type of treatment. In order to achieve the objectives of the study the researcher used a number of tools with a computerized tutorial, test prerequisites which was built to gauge fundamental experiences of students in the decision and also to classify students into three levels: low, medium, and high, and then development of an achievement test was used

before and after treatment, and the results showed a lack of statistically significant differences in the direct collection of students rapporteur learning techniques to enhance teaching method or the level of student achievement or the interaction between them.

**Manolizadeh , H.; Biemant .H. & Mulder .M (2008)[10]**, present a study that aimed to identify factors that can be interpreted in the light of the use of E-Learning environments for lecturer in higher education. The sample consisted of 178 teachers in different departments at the University of Wageningen in the Netherlands, researchers preparing a questionnaire to identify factors renewed use of eLearning. The results of the study indicated that the attitudes and views of faculty members play a crucial role in E-Learning environments used by universities representing 43% of the variation in a variable using the E-Learning environments. The results confirmed that views faculty members about activities implemented through the network of information and computer-assisted learning. The study also showed the importance of recognizing faculty members value the benefit of E-Learning environments in the achievement of the objectives of the educational process.

## 3. PROPOSED METHOD

This research foxes on the ability of using virtual reality environment in blended learning that gives the students an opportunity to interact with content in three-dimensional learning environments, this approach consider a modern way to solve the complicated scientific problems that faced student. By create a web application to interact with lectures between lecturers and students with virtual reality features, and then a statistical questionnaire consisting of ten fields (paragraphs) was designed and distributed to a random sample of undergraduate students more than one hundred students; they were first and second class from university of information technology and communication and the fourth class from university of Baghdad. The proposal method can be adopted in the universities as the basis for the undergraduate students to develop their future skills and achieve ambitions. It consists of two parts: theoretical side and Implementation side each of one will be explained in details in the next sections.

Previous studies of proposal method like Kavita Choudhary and Anuradha in their study [11] were proposing a model of virtual reality incorporated smart classes, also they proposed e-learning to be of digital text books and virtual reality. That was not enough to add exciting to VR approach.

### A. Theoretical Side

In the theoretical side, some of statistical measurements are used to analyze and process the data of the statistical questionnaire, and these scales are explained as follows:

#### 1. Likert Scale

A Likert Scale is a psychometric scale commonly involved in research that employs with respect to the statistical methods used in data analysis, depends on the quality of the questions or hypotheses, according to the research methodology used, which is generally divided into two parts:

statistical descriptive methods and statistical evidentiary methods; Therefore, the focus will be on the most important descriptive methods: the arithmetic mean and standard deviation [12]. The arithmetic mean of the responses both on one item or all items are considered as the most important of Central Tendency Measurements, and is calculated using (Weighted Mean), in the case of fifth Likert Scale with values: 5, 4, 3, 2 and 1, the arithmetic mean of the responses calculated as follows:

The arithmetic mean of the responses to item =  $(5 * \text{Number of individuals who chose this option}) + (4 * \text{contrast repetition}) + (3 * \text{repetition contrast}) + (2 * \text{contrast repetition}) + (1 * \text{contrast repetition}) / (5 + 4 + 3 + 2 + 1)$ . Arithmetic mean could be interpreted after was calculated based on the number of options and categories in scale, as illustrate below: in case of using fifth Likert Scalet:

- We calculate the range as equals  $5-1 = 4$
- We calculate the length category by dividing the range by the number of categories (choices), then  $4/5 = 0.80$
- The first category of the arithmetic mean values are: 1 to  $0.80 + 1$ , and so for the others, table (1) shows the method of interpreting arithmetic means values:

TABLE 1: METHOD OF INTERPRETING ARITHMETIC MEANS VALUES:

arithmetic means values	Interpreted
1 to 1.80	non
1.81 to 2.60	non
2.61 to 3.40	non
3.41 to 4.20	non
4.21 to 5.00	non

On the other hand, with respect to the proportion of the standard deviation, it is the most important measures of dispersion, which means the extent of the data spacing (responses) from each other and arithmetic mean, calculated by the following law:

The square root of the sum of the values of the deviations of the arithmetic average of squares divided by (the total number of individuals - 1), From this point the values of Interpretation of the standard deviation, whenever its value closer to zero, the dispersion will be decreases and homogeneity of individuals about their response and their agreement to arithmetic mean value will be increased, the general rule, which is used in the interpretation of the standard deviation value, depends on the confidence intervals for the average arithmetic and the Chebyshev Theory can be summarized as shown in table (2) :

TABLE 2: SUMMARIZED OF THE CHEBYSHEV THEORY

CONFIDENCE INTERVAL	INTERPRETED
(ARITHMETIC MEAN (+, -) ONE STANDARD DEVIATION)	68% OF RESPONSES WITHIN THIS PERIOD
(ARITHMETIC MEAN (+, -) TWO STANDARD DEVIATIONS OF TWO)	95% OF THE RESPONSES WITHIN THIS PERIOD
(THE ARITHMETIC MEAN (+, -) 3 STANDARD DEVIATIONS)	99% OF RESPONSES WITHIN THIS PERIOD

We must use all of the arithmetic mean and standard deviation in the descriptive interpretation of the responses of scale. Some conditions that should be taken into consideration when design Likert Scale as shown below:

- a. Likert Scale should have equilibrium between positive and negative item, also there distribution should be randomly.
- b. When writing the Likert Items the following criteria should be taken into consideration:
  - Short so that no more than twenty words.
  - Do not expressive the past.
  - Short so that no more than twenty words.
  - Do not be expressive the past.
  - Contain one simple idea.
  - Written in an easy language and clear meaning.

Analysis of the scale item for appropriate statistical way, especially with validity and reliability.

### 2. Standard Deviation

Standard deviation: is a common Metrology used to measure the level of deviation or product variation from previous predefined specification and measures the dispersion of data on the arithmetic mean [13]. It is the square root of variance and it is represented by (S) character according to the samples in (1):

$$S = \sqrt{\frac{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}{n-1}} \tag{1}$$

Where  $x_i$  are display values, n: sample size. If the value of S indicates the displays scattered around the arithmetic mean and vice versa. Otherwise, if the value is equal to zero this means that the displays values equals and equal to the arithmetic mean, table (4) shows one-sample Statistics. Also T test was used for testing the proposal which claims that there is no relationship statistically significant at the level of 0.05 according to (2) and (3), the result of one sample test shown in table (5).

$$T = \frac{\bar{x} - \mu}{S_{\bar{x}}} \tag{2}$$

$$S_{\bar{x}} = \frac{s}{\sqrt{n}} \tag{3}$$

### 3. Chi- square Test

This test is used in compatibility tables to test the goodness of fit as well as test the independent and homogeneity. This test has one parameter is the degree of freedom, this value was always positive. The Chi-square test in (4) was used:

$$\chi^2 = \sum \frac{(O-E)^2}{E} \tag{4}$$

Where O is the display values and E is the predict values [14].

### 4. Kruskal Wallis Test

kruskal wallis test is a test of the non-parametric tests which calculates the levels in addition to the values[13]. This test is a substitute for one way ANOVA and the choosing of

samples supposed to be randomly, independent, for size five and more, and It does not require that the groups are equal number; therefore, this test can be used regardless the number of members Sampler, (5) was used as the test equation:

$$K = \left( \frac{12}{N(n+1)} * \sum_{i=1}^h \frac{R_i^2}{n_i} \right) - 3*(N+1) \quad (5)$$

### B. Application Side

Application aspect includes analysis for the data that obtained questionnaire which was distributed to 116 students from specialists. Data were unloaded in special tables and the metrics that mentioned previously in the body of this research were used. SPSS program was used to obtain and analyze the results. The Paragraph questionnaire with their answers ratio was shown in table (3):

From table (3) it is found that. The value of the Likert scale is more than three for all the paragraphs which means positive direction, and the best one was the first paragraph which was the using of virtual reality in the blended learning is excited; this supports the ability of using virtual reality in the blended learning field. The tenth paragraph was negative which means

**TABLE 3: QUESTIONNAIRE PARAGRAPH AND THE RESULTS**

No.	Paragraph	Strongly agree	agree	I don't know	disagree	Strongly disagree	LIKERT SCALE	STD. DEVIATION	T
1	Do you think the using of virtual reality in the blended learning fully excited?	78	31	5	2	0	4.74	33.10	1.567
2	Do you prefer the using of virtual lab. instead of traditional lab.?	47	40	8	17	4	3.94	19.27	2.691
3	Do you think the using of virtual reality properties in the blended learning lead to easily understand the educational content?	62	39	12	2	1	4.37	26.56	1.953
4	Does the using of virtual reality in blended learning help the students to perform their educational tasks?	55	41	11	6	3	4.20	23.34	2.222
5	Do you think the using of virtual reality leads to the occurrence of health problems and the sense of a headache?	14	30	49	17	6	3.25	16.81	3.085
6	Does the virtually in the blended learning leads to Improve the quality of learners and develop the performance of vocational education?	47	53	11	2	3	4.20	24.80	2.092
7	Does the virtual reality in the blended learning leads to achieve the educational communication between the students with each other?	32	38	30	14	2	3.72	14.81	3.504
8	Are there obvious advantages in the blended learning that enable the teacher to benefit the students?	49	46	16	5	0	4.20	22.95	2.260
9	Do you think the learning through the using of virtual reality in the blended learning is more flexible and enjoyment than the E-Learning?	63	33	14	3	3	4.29	25.40	2.042
10	Have you found a difficult in the using of tools that are used to display the scientific material in the virtual reality like the classes?	4	15	48	35	14	2.66	17.85	2.906
	General Average						3.95	22.48	2.43

that the students found difficulties in the using of tools that used for displaying the scientific material in the virtual reality because the using of these tools was bounded in the entertainment fields. Knowing that, the general average of all paragraphs was positive.

It is known the success of using virtual reality in many fields such as training, games and may other fields also was positive. So these results indicate that the ability of developing the blended learning through the using of virtual reality environment to improve the education and to achieve its expected objectives.

**TABLE 4: ONE-SAMPLE STATISTICS**

	N	MEAN	STD. DEVIATION	STD. ERROR MEAN
VAR00001	5	23.200	33.10136	14.80338
VAR00002	5	23.200	19.27952	8.62206
VAR00003	5	23.200	26.56501	11.88024
VAR00004	5	23.200	23.34952	10.44222
VAR00005	5	23.200	16.81368	7.51931
VAR00006	5	23.200	24.80323	11.09234
VAR00007	5	23.200	14.80540	6.62118
VAR00008	5	23.200	22.94995	10.26353
VAR00009	5	23.200	25.40079	11.35958
VAR000010	5	23.200	17.85217	7.98373

The value of t was morale for all the paragraphs as well as for the general average and it was the higher than the table value amounting to (1.47) and this was support the hypothesis that endorses the virtually in the blended learning improve the quality of learners for the paragraphs ten. And the results of SPSS program were as follow:

**TABLE 5: ONE-SAMPLE TEST**

	VAR00001
CHI-SQUARE	29.383
DF	4
ASYMP. SIG.	0.000

Cronbach Alfa scale which acts the Reliability and validity of the questionnaire amounted to (0.917) and the results according to the SPSS program were as shown in table (6):

**TABLE 6: CRONBACH ALPHA**

CRONBACH'S ALPHA	N OF ITEMS
0.917	10

	TEST VALUE=0					
	T	DF	SIG. (2-TAILED)	MEAN DIFFERENCE	95% CONFIDENCE INTERVAL OF THE DIFFERENCE	
					LOWER	UPPER
VAR00001	1.567	4	0.192	23.200	-17.9008	64.3008
VAR00002	2.691	4	0.055	23.200	-0.7387	47.1387
VAR00003	1.953	4	0.123	23.200	-9.7848	56.1848
VAR00004	2.222	4	0.090	23.200	-5.7923	52.1923
VAR00005	3.085	4	0.037	23.200	-2.3231	44.0769
VAR00006	2.092	4	0.105	23.200	-7.5973	53.9973
VAR00007	3.504	4	0.025	23.200	4.8167	41.5833
VAR00008	2.260	4	0.087	23.200	-5.2961	51.6961
VAR00009	2.042	4	0.111	23.200	-8.3392	54.7392
VAR000010	2.906	4	0.044	23.200	1.0336	45.3664

The calculated values of Chi-square and kruskal wallis test were morale when compared with the tabular value for degree of freedom (30), morale level (5%) mounted to 18.5; and this

Support the hypothesis that endorses the virtually in the blended learning improve the quality of learners. And the results of the two tests according to the SPSS program as showed in table (7) and table (8):

**TABLE 7: TEST STATISTICS**

	VAR00001	VAR00002
CHI-SQUARE	26.560	0.000 <sup>B</sup>
DF		4
ASYMP. SIG.	0.984	1.000

**TABLE 8: TEST STATISTICS<sup>A,B</sup>**

	VAR00001
CHI-SQUARE	29.383
DF	4
ASYMP. SIG.	0.000

#### 4. PROGRAM IMPLEMENTATION

With the ubiquity of Web browsers and Web document formats across a range of platforms and devices, many developers are using the Web as a platform-independent application environment. Examples of Web applications include reservation systems, online shopping or auction sites, multimedia applications, and data entry/display systems, etc. Over the past several years a number of different technologies have targeted application development on the Web. However, much of the work in this research focuses on building web application to using it as a virtual reality platform. In implementation part a 3-tier Web-based databases application is design and configure using Apache Web server, PHP server-side scripting language, and MySQL relational database server. firstly, a relational database schema diagram (i.e., physical data model) is presented, as well as the SQL DDL and DML scripts, Then, the required application that contains all programs is created as shown in the site map in figure (1).

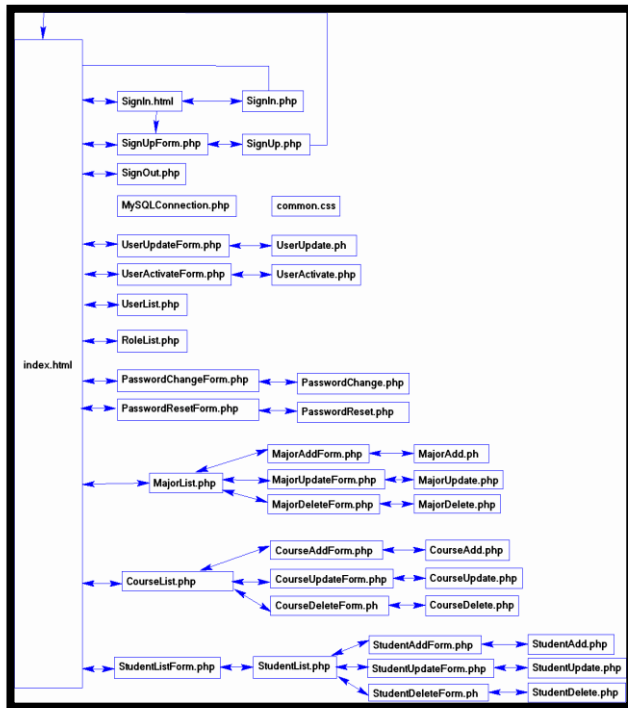


Fig.1. Site Map

All programs are written in XHTML, CSS, JavaScript, and PHP. It does actually constitute the client-side and the server-side parts of the Web site illustrated in this research. This virtual reality platform allows lecturers and students to make registration and create their accounts as well as many other utilities.

After the lecturer complete the physical lecture and record it as a 3-D video, the lecturers can easily sign in to the web application university to upload the recorded lecture. By using mobile device, students can sign in by using their accounts and watch the recorded lecture by using 3D Board as shown in figure (2).

Through the using of questionnaire which are prepared

and distributed on the students, its observed that the most students are

Get bored after 10 minutes of starting lecture which was also shown in many scientific researches [15]. Therefore, the adding of thrill elements through the using of virtual reality will enable the students to accept the scientific content of the lecture in easy and affordable way.

In case of a student's absence or misunderstanding of scientific content of the lecture, she/he can access proposed web and watch the lecture again with a virtual reality feature. Figure 3 and 4 show some webpage that interact with users.



Fig.2. 3D Board

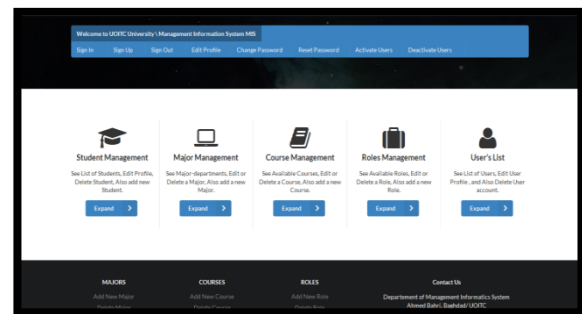


Fig.3. homepage web application

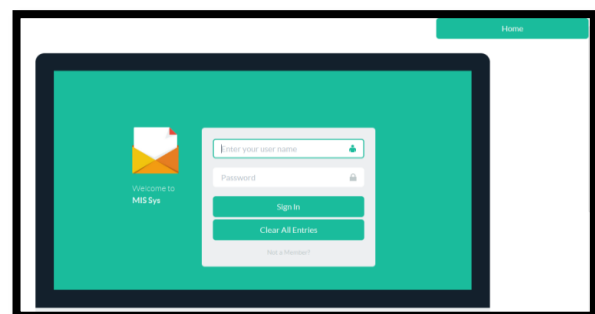


Fig.4. Sign In page

#### 5. CONCLUSION

In this proposal case study has taken which involved a category of students which was more than one hundred students from University of Information Technology and Communications and University of Baghdad to measure the effect of using virtual reality for the enhancement of the educational level, and the results of the proposal manifested

in the questionnaire paragraph and shown in table (3) were very good. It's found that most of the students were excited, active, and comprehended the lecture easily especially in result of paragraph (1) which has a high Likert scale (4.47),

but they faced difficulties in using VR tools in paragraph (10) which has a low Likert scale (2.66).

We, therefore; conclude that using virtual reality in educational field is vitally important and should be soon applied to transfer the scientific content realistically.

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