



Using artificial Intelligence Techniques to Explore the Relationship between Virtual Learning and Educational Performance of the Students

Hossein Fathi¹, Reza Samizadeh^{2*}

MA in MIT, Science & Research Branch, Islamic Azad University¹, Assistant Professor,
Department of IT, Science & Research Branch, Islamic Azad University²
Email: Hossein.fathiii@gmail.com¹, Rezasamizadeh@yahoo.com²

Abstract: Increasing development of information and communication technology (ICT) intentionally or unintentionally has influenced all aspects of our lives, we are getting more and more affected by this phenomenon and every day witness great speed and power of the technology and capacity to receive, process, and transmit information [1]. Teaching and learning is also influenced by this technology, so that many paradigms of higher education are changing. The potential of this technology, capacities created by it, the quality of higher education's dealing with this emerging phenomenon underpin the foundation of the future of higher education. Using neural network techniques, this research examines the impact of various factors (such as human factors, management, organization, culture) on the educational performance of students in Iran while using virtual learning to learn various sciences.

Keywords: Artificial Intelligence, Virtual Learning, Educational Performance



1. Introduction

Increasing development of information and communication technology (ICT) intentionally or unintentionally has influenced all aspects of our lives, we are getting more and more affected by this phenomenon and every day witness great speed and power of the technology and capacity to receive, process, and transmit information [1].

Teaching and learning is also influenced by this technology, so that many teaching methods are changing, so that it is expected that the potential of this technology, capacities created by it, the quality of higher education's dealing with this emerging phenomenon underpin the foundation of the future of higher education. In Iran, due to the ever increasing demand for higher education, creating variety in training courses, especially virtual training have directed the students and teachers to efficient use of potential created by information technology in virtual education [2].

Virtual learning is a new way of distance learning that by using the new communication tools and technologies creates the possibility to the learners to have access to the course material

needed any time of day from anywhere in the world and in case of any problems or questions contact their professor and express their problems or questions. This system is a virtual online environment where students and teachers are connected with each other. This environment simulates the typical class by facilities such as video conferencing and multimedia systems [3].

Of the most important features of virtual learning or e-learning, one can mention items such as flexibility, student-centeredness, access to it at any time and in any place, saving college cost, the possibility of registering a large number of students in a course, high interaction scalability and availability of information resources via the Internet. Given that e-learning has a great impact on the traditional model of education and on the one hand has a distinct philosophy, its implementation calls for and culture and provision of social and value infrastructure, and the optimal use of electronic technologies needs tools and standards of information and communications. In this study, by using artificial

intelligence techniques, we will examine the role of various factors on the performance of virtual learning students [4].

This paper is designed in five sections: Section two describes the key concepts related to this research. In the third part, works related to this research will be expressed. Data collection and analysis will be explained in the fourth part. Experimental results obtained from the analysis of the data collected and presented approach to identify factors associated with the performance of students will be explained in detail in the fifth section. Finally, section six will include survey results.

2. Basic Concepts

In this section, some explanation is given briefly about the mentioned concepts in this research.

2.2.1. Distance Learning

Distance learning is the use of new information and communication technologies such as the Internet and multimedia systems as tools to improve the quality of education, through the

provision of educational services and facilities to provide easy access to resources and mechanisms for distance cooperation [5].

Distance learning institutions have been established in each country according to its specific training requirements; for example, in Australia the extent of territory and population density are the most important factors in the emergence and popularity of distance education. In China and India, the main factor of tendency towards the system of distance learning is due to population density and lack of adequate capacity in institutions of higher education and budget constraints. In America, England, France, Germany and Japan, teaching students continuation of their education, introduction to science and new skills are of the important factors causing the establishment of distance institutions. In African countries, economic constraints have caused distance learning, as a low-cost system, to replace traditional education system, largely [6].

In Iran, most applicants of higher education, expert professors' concentration in the capital, the necessity to train the teaching staff of the university and providing continuing education opportunities for employees have had a key role in the establishment and operation of institutions of distance education [7].

2.2.2. Virtual Class

Virtual classroom is a new way of teaching in distance learning that by using modern communication and information tools provides the opportunity for all learners to have access to course material any time, from anywhere in the world. Moreover, if there are any problems or questions, contact their teachers and share their problem, opinion or question. In other words, this system in an online virtual environment where students and teachers are connected with each other. This environment simulates the typical class by facilities such as video conferencing and multimedia systems. Some of the features available in virtual classes are public and private chat, students request to write on the board or talk in class, possibility of Voice Chat, Voice Conference, and the possibility of sharing files in virtual classrooms. Various forms of virtual training systems are computer-assisted instruction, computer-based training, computer-based learning, web-based training, and video conferencing [8].

2.2.3. Learning Management System LMS

Learning Management System is software that records and tracks training activities of the learner. In other words, this system automatically manages the process of learning and teaching. In other words, the e-learning system is a space

where educational programs are offered. Using LMS, students choose their course, receive curriculum materials, complete the coursework and exam, and communicate with the professor and other students [9].

One of the objectives of LMS is simplifying the curriculum and learning of employees, so that managers and academics plan to assess and track the progress of their student learning, and help communicate and collaborate with their peers. Most LMS do not have the ability to create content, and that is why most LMS vendors offer complete solutions by providing the tools to create additional content, or cooperation with content providers. Common tools to create content such as Macromedia Dreamweaver can be used create custom content for higher education [10].

3. Related Works

Numerous studies have been conducted on the use of virtual education in universities, each of which mention the role of specific factors in this context, and in this section we refer to some of them.

Davis (2007) refers to social, economic and cultural limits in effectiveness of technology in the future of universities [11]. Assareh and his colleagues (2011) sees the performance capabilities of the virtual training dependent on teachers' ability in using various tools of

technologies and processes supporting the teaching / learning processes [12].

Iahad and his colleagues (2012) examined the impact of the online e-learning in campus on the performance of students [13]. They used Cronbach's alpha to analyze the reliability. In their study, they compared the performance of students in person and virtual training system. To do this, they used statistical analysis and T-test. The variables used to evaluate the performance of students include final and midterm scores, projects, and class discussions. In fact, based on these factors, they evaluated student performance.

Chris Ninness and colleagues examined the merits of neural networks in usual statistical methods such as regression analysis, and referred to issues such as independence of this method from the kind of distribution, detection of complex non-linear relationships, ability to learn and its high ability to explain the variance in the dependent variables [14].

Wang (2012) examined the attitude and thinking of freshmen accounting students towards virtual training. In this article, he states that to examine the impact of virtual learning on students' performance, their point of view and look to this issue should be identified. In this study, the students are evaluated based on their scores [15].

[16] investigated the impact of learning on the students' performance. These variables included

the quality of training, personality traits, mental and spiritual well-being, and their educational outcomes. In this study, correlation analysis is used to determine the impact of each of the factors listed on the academic performance of students in virtual learning system. Manisha Domun and colleagues (2014) studied the impact of education on the performance of students. In this study, students with different abilities were assessed so that the performance of the education system is well analyzed [17]. They divided the students' knowledge of the system into 5 groups, and according to the division, they designed two statistical hypothesis tests for the impact of this educational system. They used statistical analysis to conduct the study. Martin Daniel (2014) examined the factors influencing the interaction of the students in using technology. Their studies results have shown that teachers who use technology to teach have more interaction with the students than their colleagues do [18].

4. Research Methodology

4.1. Data Collection and Analysis Procedures

The instrument used in this study is a questionnaire (Appendix 1) that is one of the common tools of research and a direct way to obtain research data. The reason to choose questionnaire is that, it requires less time and cost and more information can be collected from

more people. It also provides the possibility of quantitative analysis data [19]. The first phase of data collection in the survey is questionnaire. After library studies, based on the theoretical basis a questionnaire is designed.

The study population consisted of all faculty, graduate, and PhD students, whose number is 1,000 people. Because of extensiveness of research community on the one hand and on the other hand the limited number of the population studied, to determine the minimum required sample size Cochran formula was used:

$$n = \frac{(1000)(1/96)^2(0/5)(1-0/5)}{(1000-1)(0/05)^2 + (1/96)^2(0/5)(1-0/5)} \approx 277$$

Where:

n = is minimum required sample size

N = is size of population

p = is the ratio of the distribution of property in the population

$Z_{\frac{\alpha}{2}}$ = is the value obtained from the standard normal distribution table (in this study and by considering 0.05 amount of error, the value derived from the standard normal distribution is 1.96).

d = error accepted by the researcher or a tolerable range of parameter estimates (usually in the social sciences, it is considered as 0.05.) (Rafipour, 1999).

4.2. Validity of the Questionnaire

Validity of the questionnaire determines that the how much the developed tools measures the particular intended concept. Validity tells us

whether we measure the true meaning of what is intended. Validity is important because wrong and inadequate measures can make the scientific research worthless [20]. The researcher has also used the guidance of professors and doctoral students in the research questionnaire to design due to factors related to the pathology of the performance of students in virtual training.

4.3. Reliability

The purpose of reliability is that if this research is conducted by another person or by the same researchers in different times and places similar results are achieved. To calculate the reliability coefficient of measuring tools various ways are used including: Running again, parallel method, Cronbach's alpha coefficient (for questions or multi-scale components) and Kuder-Richardson formula (for bi-dimension questions) [21]. In this study, to estimate the reliability of research tools Cronbach's alpha method is used.

To investigate the reliability, the questionnaires were given to 30 people of the population and after their analysis using Cronbach's alpha and SPSS software, reliability value was obtained as Table 1.

4.4. Analysis of Data

Analysis of data obtained from this study consists of two parts as follows:

4.4.1. Descriptive Statistics

In order to describe the data, tables and frequency diagrams are used. In addition, in

order to better describe central tendency indices such as mean, median and dispersion indices such as standard deviation and variance are used.

Table 1: Table of the Reliability of the Questionnaire

Row	Components	The number of questions	Cronbach's alpha
1	Organizational	10	0.850
2	Culture	2	0.882
3	Education	4	0.867
4	Partnership Management	5	0.850
5	Human Resource	1	0.861
6	Performance	1	0.875
Total		23	0.884

4.4.2. Inferential Statistics

Inferential statistical methods used in this research are:

A: one-sample t-test.

B: ANOVA and Tukey tests

First, Kolmogrov-Smirnov test was used to determine normal and abnormal data and then using one-sample t-test, teachers' and students opinions about the barriers to academic performance of electronic students of Islamic Azad University have been addressed.

Also for pathological evaluation of virtual learning in the Islamic Azad University of electronics department MSE and gradient method in MATLAB are used.

5. Research Findings

Using the artificial neural network, we have offered a model to study pathology and factors affecting the performance of students in virtual education system. For this purpose, an inventory with 23 questions was designed in which the factors affecting virtual learning were evaluated. Moreover, by using a statement, students' virtual performance in the virtual system is examined. Then the data was divided into two parts: training set and testing set. Moreover, we analyzed them in different dimensions and then using test data, we assessed their performance.

5.1. Descriptive Analysis of Data

To provide an overview of the data and to summarize them descriptive statistics can

also be used. In this study, information on the demographic characteristics of the sample is as follows:

- Frequency of gender: of the total number of 211 subjects, 106 (52.2%) are women and 105 (49.8%) are men.
- Frequency of the age of the total sample, 15 (7.1%) 25-30 years, 159 (75.4%) people between 31 and 36 years, and 37 people (17.5%) are over 36.
- Frequency of educational level of the participants: of the total number of subjects, 183 (86.7%) have MA, 18 people (8.5%) have PhD and 10 (4.7%) are professors.
- Marital status of the subjects: of the total number of subjects, 134 (63.5%) were single, and 77 (36.5%) married.

- Descriptive statistics of variables: statistical characteristics of the variables are presented in Table 2.

Table 2 figures show that the highest and lowest mean are related to human resources and cultural variables (3.30) and organizational (3.08), respectively. It should be noted that all indices are above the average theoretical value (3) in the questionnaire, also values' being close to each other also the point of focus.

Table 2. Statistical Characteristics of Research Variables

Variables	The number of questions	Average	The standard deviation	Minimum	Maximum
Organizational	10	3.08	1.06	1	5
Culture	2	3.28	1.04	1	5
Education	4	3.15	0.917	1	5
Partnership Management	5	3.25	0.939	1	5
Human Resource	1	3.30	0.989	1	5
Total	22	3.23	0.908	1	5

- Kolmogorov-Smirnov test: before using t-tests, normal distribution of variables must

be ensured. For assessing the normality of components, Kolmogorov-Smirnov test is used, which is a nonparametric test.

Calculating this test is possible by using SPSS software. If the value provided by this test statistic is greater than 5%, the statistical null hypothesis of normal distribution of

variables is accepted by 95%. The results of the normality of variables are shown in Table 3.

Table 3: Results of Kolmogorov - Smirnov

Variable	Value of statistic calculated	Significant level (Sig)
Organizational	1.626	0.062
Culture	1.627	0.059
Education	1.360	0.213
Partnership Management	1.69	0.362
Human Resource	1.964	0.512

The results of Kolmogorov - Smirnov test show that, as the level of significance for all variables is greater than $\alpha=0.05$, it is located in H_0 area, and assumption of normal distribution of data is approved.

5. Conclusion

In examining the factors influencing academic performance among respondents with regard to their education level, since all these variables have a significance level (sig) greater than 0.05, it can statistically be concluded that there is no significant difference in the values of all the variables affecting the academic performance of students (including MA, PhD and professors). Tukey test was used to verify the test results, the results of which also showed no difference among respondents

about the variables assessed. In addition, independent variables (organization, culture, participation, training and human force) have an impact on the academic performance of virtual university student.

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Appendix 1:

Row	Items	very good	Good	Average	Weak	Very weak
1	What is the level of the use of virtual education solutions (Virtual Education) and the use of ICT tools in the electronics department of Azad University?					
2	What is the level of developing virtual courses like software programming and web-based electronic bulletin boards in the electronics department of Azad University?					
3	What is the level of facilities and infrastructure of virtual learning in the electronics department of Azad University?					
4	What is the level of time limit in virtual learning and teaching materials in the educational system frequencies in the electronics department of Azad University?					
5	What is the level of the use of different methods of learning such as Online (such as Internet communication and online bilateral interaction with the instructor), Offline (not online and without the need for permanent presence of professor such as tools and electronic books) and Blended (mixed and flexible with a combination of previous methods) in the electronics department of Azad University?					
6	What is the level of using a variety of methods and different ways of learning, such as web-based and computer-based training or education via telecommunications platform or network, or even via mobile phone in the electronics department of Azad University?					
7	What is the level of different methods of learning with the ability to record professor's talk or distribution of educational pamphlets and educational CDs in the electronics department of Azad University?					
8	What is the level of consistent use of virtual teaching methods, such as seminars, conferences and live classes in the electronics department of Azad University?					
9	What is the level of submitting assignments and exercises in person instead of using information technology tools such as electronic mail (E-Mail) in the electronics department of Azad University?					
10	What is the level of computer dialogue and debate through Internet and video conferencing (Video Conference, Web Conference) between teacher and student instead of question and answer and solving problems in the electronics department of Azad University?					
11	What is the level of referencing to written sources available for research, instead of using the Internet and e-mail content (E-Book, E-Content) in the electronics department of Azad University?					
12	What is the level of using PowerPoint slides or film presentations in the electronics department of Azad University?					
13	What is the level of Internet use in surveys and questionnaire implementation and exchanging views with the use of Internet such as virtual discussion room and online survey (FAQs, E-Polling, Forums) in the electronics department of Azad University?					
14	What is the level of providing electronic content through hypertext network media efferent (Hyper Text, Hyper Media, Web Casting) and managing by automatic virtual content management systems (LMS, LCMS) in the electronics department of Azad University?					
15	What is the level of holding group exams by using information technology tools such as Tele-Communications in the electronics department of Azad University?					
16	What is the level of students' self-evaluation and using information technology tools in the process of evaluation by the students in the electronics department of					



	Azad University?					
17	What is the level of the most important infrastructure needed to implement and operate the virtual teaching methods in the teaching process including preparation of software, hardware, cultural and funding infrastructure in the electronics department of Azad University?					
18	In your idea, is the budget of virtual education system unit in Azad University allocated well to improve education and research?					
19	What is the level of virtual education system compared to the traditional education system in the electronics department of Azad University?					
20	In terms of culture, how much is virtual learning known to students and our community?					
21	What is the level of controlling and monitoring system of virtual learning in the electronics department of Azad University?					
22	What is the level of virtual learning system and Human Resource, professors and experts required for virtual training system in connection with this matter in the electronics department of Azad University?					
23	What is the level of performance (Academic performance) of virtual students in the electronics department of Azad University?					