A Knowledge-Based Educational Module for Object-Oriented Programming & The Efficacy of Web Based e-Learning

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Abstract—**The purpose of this research was to explore the effectiveness of using computer-aided learning methods in teaching compared to traditional instructions. Moreover, the research proposed an intelligent-based educational module for teaching object oriented languages. The results provide teachers positive outcomes of using computers technology in teaching. Sample of more than one hundred undergraduate students from two universities located in the Middle East participated in this empirical study. The findings of this study indicated that students using e-learning style perform more efficient in terms of understandability than traditional face-to-face learning approach. The research also indicated that female students' performance is equally likely to male students.**

Keywords_ Computer-Aided Learning (CAL); Educational module; e-Learning; Knowledge-Base; Object-Oriented Programming (OOP); Student performance; Traditional Learning.

I. Introduction

Students learn through many different mechanisms that provide the best long-term retention rates including lectures, books, demonstrations, and experimentation. Reference [1] explained variety of learning styles that include:

- Verbal style: learning materials from word-based interfaces such as books and lectures.
- Visual style: learning materials from visually oriented stimuli such as pictures, graphs, and movies.
- Sequential style: learning materials in discrete steps reaping partial understanding from incomplete instructions.
- Global Style: learning materials throughout top-down design by understanding facts of a topic before understanding its component's structures.

The use of intelligent tools and multimedia modules in education is a rapidly growing trend. Students can access their university's computer rooms and retrieve information in a more entertaining and easily remembered format than purchasing packs of extra readings, sample problems, and old exams. The writer have recently developed a knowledge-based module that incorporate intelligence in browsing materials, displaying items of information, self-correcting faults, and measuring learner progresses. But before explaining the structure of the module, let's address the available learning styles.

Many researchers have studied traditional learning style effectiveness, and they have concluded that only a small portion of student population matches the optimal learning styles. The majority of students are then left with teaching mechanisms that are not suitable for their optimal learning mode [2-4]. Currently, most universities around the world offer Internet/Intranet-based education. One of the most obvious infrastructure attributes of e-learning depends upon technology for its implementation. This includes browser technology, platform-independent transmission protocols, and media-capable features, e.g., Java-enabled client/server interactivity [5].

The aim of this research is to compare traditional learning and e-learning techniques, and the impact they have on student's performance and to gain a better understanding to factors that influence student performance. A knowledge-based educational module is developed, and students' performance is compared with traditional teaching. The research was carried through a survey of a sample of 110 respondents who are taking both tradition and online courses. A standard questionnaire was distributed via face to face interviews to secure high response rate. The collected data was analyzed and tested using SPSS and Excel programs.

The proposed educational module is a visual environment that appeals to both visual and traditional learning styles. It has many features that meet the needs of those students who are not well served by traditional learning styles; the module is designed for teaching Object Oriented Programming (OOP) concepts. The principles that characterize OOP are abstraction, encapsulation, inheritance, and polymorphism. There are many Languages that support object-oriented mechanism, include Ada95, C++, C#, Visual Basic.net, Java, and Small talk [6-7].

II. Research Questions

The aim of the research is to study the viability of using computer-aided learning methods in teaching.

This study sought to answer the following questions:

1. What models may be used in developing computer-aided learning courseware.
2. How acceptable is the online course compared to traditional learning and whether the learning outcome differs by gender.

The structure of this paper is as follows: In the next section, readers are furnished with the background materials related to computer-aided learning. The third section introduces the knowledge-base model. In the fourth section, a number of experiments have been performed to demonstrate the viability of the model. Conclusions and future works are presented within the last section.

III. Theoretical Perspective

Advancements in technology and changes in dynamics in the world have been the twin drivers of the shift from classroom based traditional learning to e-learning. Reference [8] indicated that many years ago, the development of computer software and hardware were directed towards education. During this period, higher education has witnessed fundamental changes from courses delivered in the traditional face-to-face method to those delivered via video cassette and television, to a proliferation of courses and course content delivered via computer technologies. The use of Internet resources in course and curriculum development has made a significant impact on teaching and learning. The application of the Internet has evolved from the display of static and lifeless information to a rich multimedia environment that is interactive, dynamic, and user friendly [9]. In fact, the Internet has become an important component in the teaching and learning process, and according to [10], Web 2.0 technologies have the potential to shape both the way instructors teach and the way students learn. As a result, the use of the Internet in higher education settings has become more accepted and widely used tool in academia [11-13].

Moreover, the development and refinement of university commercial developed Course Management Systems (CMS) like Blackboard and WebCT have resulted in the proliferation of web utilization in higher education [13-14]. CMS have shown significant increase of students' involvement in multiple aspects of courses [15], and while these tools were initially developed for use in distance education pedagogies, their use in on-campus classroom settings to compliment traditional courses is now considered a viable and often preferred option. In short, these technologies have made it possible to easily and efficiently distribute course information and materials to students via the Internet/Intranet, and allow for greater online communication and interaction [15-16].

Numerous studies have been conducted on computer-aided learning. Many of these studies focused on technical topics [17-18], case studies [19], and the use of educational packages [20]. Nowadays, many computer-aided learning packages were implemented in most of higher education institutions around the world [21-22], and learning from a distance continues to gain popularity. Reference [23] detailed the success of a computer-mediated asynchronous learning (CMAL) program of graduate studies in Educational Leadership and Higher Education that was offered through the University of Nebraska – Lincoln. The study explained the evolution of the concept focusing on an integrated sequence of high-quality learning to: (a) enhance student learning experiences; (b) provide greater accessibility by removing barriers of time and space; (c) deliver learning opportunities to participants around the world on a conventional university semester schedule; (d) develop learning cohorts representing many cultures and nationalities; (e) foster active and substantial participation in the learning process; (f) provide multiple pathways to learning; and (g) facilitate the development of a world-wide community of learners. The Program allowed for asynchronous interactions, and enabled students to access to the contributions of all other participants. Additionally, there were opportunities for real-time technology-based collaboration between and among participants.

The U.S. Department of Education [24] reviewed empirical studies of online learning literature from 1996 through July 2008, the key findings include:

- Blended and purely online learning conditions generally result in similar student learning outcomes.
- Elements such as video or online quizzes do not appear to influence the amount that students learn in online classes.
- Online learning can be enhanced by giving learners control of their interactions with media and prompting learner reflection.
- When groups of students are learning together online, support mechanisms such as guiding questions generally influence the way students interact, but not the amount they learn.

IV. Effect Of Learning Method On Student Performance

Although job markets worldwide are not accepting e-learning degrees, the literature continues to claim that e-learning (Web, wireless, etc.) knowledge delivery methods can be as effective as traditional (face-to-face traditional ones). References [25-28], showed no significant difference in achievement between online and face-to-face traditional delivery modes. Several other studies have shown that e-learning can improve learning and achievement for students and employees [29-31] among other. Reference [32] noted that at the University of Phoenix, standardized test scores of its online graduates were 5 to 10 percent higher than graduates' on-campus programs at three Arizona public universities. Another study at California State, Northridge looked at two groups of statistics courses and found that online students consistently scored better than their traditional counterparts by an average of 20 percent [33].

Some studies have found poorer learning outcomes associated with e-learning. One study [34] found that higher course failure rates in a Web section compared with a classroom section of an introductory psychology course. Reference [35] found poorer course grades and standardized achievement test scores following Web-based rather than classroom-based instruction in a more advanced psychology course. Similarly, other researchers found lower final exam scores for students in the instructor's Web-based Psychology Research Methods course compared with the classroom section [36]. Reference [37] summarized the failure of e-learning educational software platforms that did not perform well for users because this type of software is not based on sound educational principles.

Reference [38] investigated the issue of time through the use of a detailed comparison of the time required to prepare and teach a traditional course and the same course presented in an online format. He found that teaching in an online format can be more time-consuming than teaching in a traditional in-class format. The additional time required by the online format is found to result largely from increased student contact and individualized instruction and not from the use of technology per se.

Therefore, it is difficult to conclude that e-learning is more, less, or equally effective at the learning level than traditional classroom-based education/training. It is not surprising that results differ so widely as the studies themselves differ in many ways from each other (e.g., the content, duration, and goals of the training; the quality of the research design used).

Since student performance is a major concern of many parties including students, educational institutions, government, and parents. With the emergence of a new mean for learning, i.e., e-learning, there are many factors that can be used to decide the best learning methodology that influence the student performance. After reviewing and studying the literature I come up with seven important dimensions, including:

- Teaching materials [39],
- tutorial supporting [40-41],
- learning Environment [42-43],
- assessment techniques [44],
- collaboration with peers or groups [45-47],
- mutual communication [48], and
- teaching styles [49-51].

These dimensions are presented in (figure 1) below. An empirical test had been performed on a sample of students in a university to validate these variables. The results of testing confirmed the positive impact of these variables on the learning process. Detailed discussions of these factors are outside the scope of this research. References provided can be used as a guide for more explanation.

V. The Proposed Educational Model

Object oriented programming (OOP) has become the dominant programming style in both the software industry and education over last two decades or so. It is now widely accepted that the object oriented style offers better tools for teaching and software development because they facilitate the creation of complex software products [52].

A lot of research is being conducted with regards to the effective instructional methods for the Object Oriented design and programming. Many related studies have shown that students face various learning difficulties with this paradigm [53-54]. Such studies propose the utilization of educational tools for helping students overcome learning difficulties.

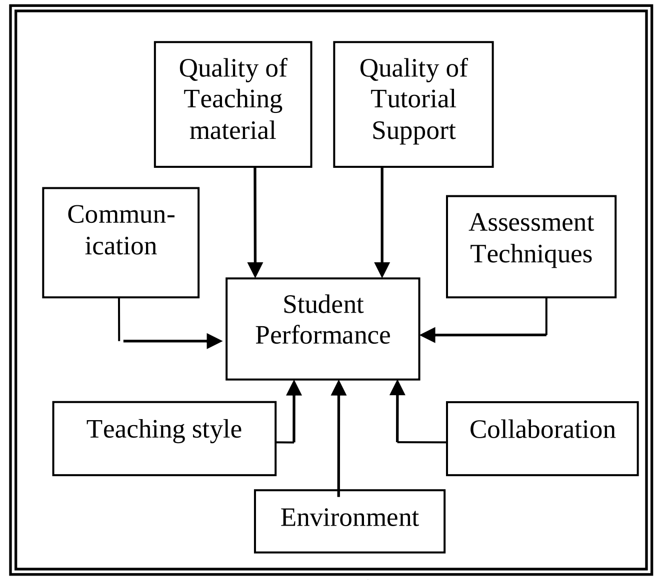

Figure 1. Student Performance Model

As mentioned above, the proposed knowledge-based module is a visual system that can be used for on-line/off-line multi-functional activities to present and consult educational knowledge. Using the computers for that type of knowledge will provide:

- Easy learner's access to many forms of educational knowledge (for on-line/off-line activities)
- Easy achievements of teachers' training objectives with separate tasks of educational knowledge
- Opportunities of electronic educational material for authors to design a proper educational environment
- An opportunity to use tools or develop new ones
- Enhancement of problem solving skills

A. *The Methodology*

The design strategy of this study is based on the top down planning process, where the highest level is the strategic planning of the problem solving mechanisms. This highest level provides learners with an overall language top-down constructs. At the next level, learners construct more detailed plans for parts of the problem.

In this level, the language specifics are not yet tied up together. The next levels require from the learners to fill the gap by the chosen implementation language (See Figure 2).

The first and second levels introduced learners to the concepts of object oriented programming principles, as more lines of code need to be organized, managed, and maintained to enhance the functionality of computing systems. This requirement coined the need for object oriented programming that will provide better paradigms and tools for:

- Modeling the real world as close to user's perspective as possible

- Easily interacting with computational environments using familiar metaphors.
- Constructing reusable software components and easily extensible libraries of software modules.
- Easily modifying and extending implementations of components without having to record every item from scratch [55-56].

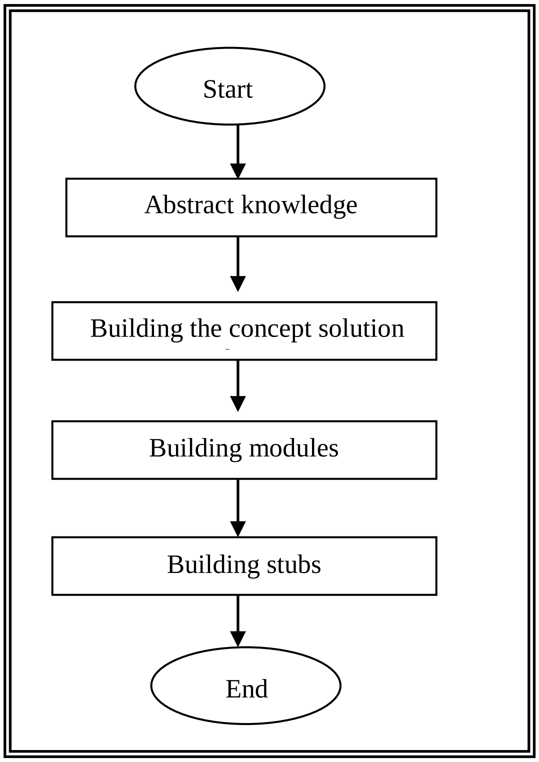

Figure 2. Abstraction Levels of Learning

The idea behind OOP was to break a program down into small and independent components. Each component could be developed independently of any other component, and then it could be combined with other component in order to form a larger application.

In OOP there are a number of basic constructs and concepts that are used in order to develop an object-oriented program [57]:

a) *Class:* A small independent program that can be combined with other similar programs in order to provide a larger application. A class is made up of attributes and methods (encapsulation);

b) Attribute: Usually a simple data element that is part of a class. It is usually a variable or a constant;

c) *Method:* Small independent part of a class's code. Similar to the notion of a function or a procedure in linear programming;

d) *Object:* A class acts only as a template and consequently in order to be used in a program an instance of this class has to be created. This instance is called an object. Any number of objects can be instantiated by a single class.

e) *Inheritance:* Ability to create a new class (subclass) from an existing class (superclass). The subclass will inherit all of the characteristics of the superclass (attributes and methods). The subclass can extend the superclass by defining its own attributes and methods.

f) *Aggregation:* The ability to join a number of instances of one class in order to create a new class (e.g. if square is a class, then joining 64 instances of this class will give a new class called chess board).

The syntax for objects in OOP can be defined as:

< Object oriented >::= <object> <classes>
<Classes>::= <Abstract Data Type> <inheritance>
<polymorphism><overloading>

Where objects communicate or invoke with one another through sending messages to each other. Collections of objects that respond to the same message are implemented through classes where a class describes and implements all the methods that capture the behavior of its instances.

Classes contribute greatly to the modeling of the real world, software extensibility, and software reusability. A class is similar to a module. Modules, in object oriented concepts, can be used in different applications that can extend or specialize a class. This can be accomplished through the use of inheritance.

The low levels of learning introduce the building block of a language implementation. It starts by demonstrating the basic constructs such as classes. The proposed system displays the grammar rule as follows:

Class < <Class-name>
{
    Private:
        <Private-member-declarations>
    Public:
        <public-member-declarations>
    }

The construct <Class-name> identifies the name of the new class definition.

The following syntax can be used to determine a newly derived class definition that inherits constructs from several basic classes:

Class <new-derived-class>:
    [virtual] [public| private] <base-class-1>
        { , [virtual] [public| private] <base-class-2 . . . > }
    {
    . . .
    }

where < base-class-1>, <base-class-2>, and so on, are existing class definitions.

First, the system introduces the basic concepts and asks students to write his/her own construct implementation. This implementation is evaluated according to its syntax structures. When students' writes constructs have not complied with the syntax, a message is issued to students and language. Syntax is displayed and the rest that does not comply is identified and a message is issued to explain to students the next steps that need to be followed.

The new model helps students by offering a wealth of information that goes to students rather than trudge to repositories of information like classrooms and libraries.

The proposed system automates testing and instructions whose purpose is to increase the level of individualization in educational process and presents more precise record-keeping on the abilities of students.

B. Test evaluation

Although performance evaluations are unique, techniques used for one problem generally cannot be used for the next problem. Nevertheless, there are common steps to all testing evaluation including:

- The definition of the system under investigation,
- selection of evaluation criteria,
- determining factors required to be analyzed,
- selection of evaluation techniques,
- designing experiments,
- analyzing and interpreting data, and
- Presenting findings.

C. Investigation of the New Model Enhancement

In order to estimate the optimal learning mode, a number of experiments have been performed to demonstrate the model viability. Table 1 presents the results of experimentation.

D. Evaluation of Learners' Performance

The teaching module must contain model of the learner performance. This can be achieved by using a specialized model called "Student Model". The student model is a file containing a learner's history and his/her present performance. The model is considered important because it measures the student understandability of taught materials, and ability to learn. The student-modeling module consists of three parts.

o Compute the learning rate and learner's skill level by:

Where S is the score domain and S(i) is the score of task number i . The t is the time domain, and t(i) is the time spent on task i. The skill level indicates the level at which students grasp concepts. This is divided into four levels giving scores from 1 to 4.

These scores are translated into qualitative term as follows:

o Update the items of information in the students' record.

o Analyze the information that was collected during the teaching process.

E. Experiment

The project proceeds as follows: A sample of 110 students was selected with 66 females' students and 44 males. From equation (1), the collected data is presented in table 1.

From Table 1, sufficient items of information cannot be drawn concerning the significance of analysis. There were needs to some statistical techniques to guide through analysis. A comparative test was used to sample means (see Table 2).

To have a better visualization, the means for the two samples were drawn (see figure 3).

Figure 3 show that the knowledge-based module has better performance on student than the traditional teaching approach. Also it looks that female may achieve better performance than male using the new approach. This visualization may sometimes be misleading. So more thorough analysis need to be done using advanced descriptive and parametric statistical techniques.

F. Analysis of Results

Researchers need to make a decision about the truth or falsity of statistical hypothesis. A statistical hypothesis is presumed to be either true or false. Using such methods would enable a decision to be made within a certain margin of errors as whether the statistical hypothesis is enabled or must be rejected as false.

$$Learning\ Rate = \frac{\sum_{i \in S} s(i)}{\sum_{i \in T} t(i)} \qquad (1)$$

Table I. STUDENT LEARNING MEASUREMENTS

Gender	measurement	Performance	Understandability	Consistency	Moral	Learning mode
female	**Un**	4	2	1	0	1
	Us	8	12	10	8	10
	Li	15	12	19	18	23
	Ve	39	40	26	40	30
male	**Un**	2	2	3	2	5
	Us	5	9	7	6	9
	Li	10	10	6	9	8
	Ve	27	23	28	27	22

Key: Un: Unlikely Us: Usually Li: Likely Ve: Very likely

Table II. COMPARATIVE TEST

Qualitative measurement	Avg-Male	Avg-Female
Un	2.8	1.6
Us	7.2	9.6
Li	8.6	17.4
Ve	25.4	35

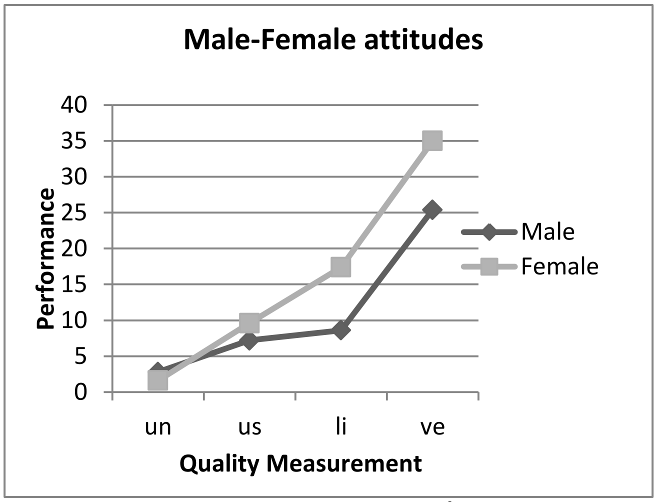

Figure 3. Comparative test of means

Four steps are required for testing of any statistical hypothesis:

- State the statistical hypothesis H0
- Specify the degree of risks.
- Assuming H0 to be correct, determine the probability (p) of obtaining a sample mean that differs from the population mean by an amount larger or equal the observed mean.
- Make a decision regarding H0 – reject it or not reject (accept it).

The hypothesis was tested to see if there is no difference between the means of male and female learning. A z-test was used to determine whether the two means of the two samples are equal. Examining the output (see Table 3), the mean data for males was 2.8 whereas the mean for female was 1.6. We have to answer the question is this difference in the mean statistically significant? Because we had no hypothesis before the study that male would learn better than female, it is appropriate to use a “two-tail” test [58].

From table below we see that the critical value of z for a two-tail test with these number (6) degrees of freedom is 1.959961. The value of z calculated for these tests is 0.56391, which is less than 1.959961. Thus the difference between the two sets of data is not significant at the 5% level.

This means that there is no difference in perception of programming by female- students from that of male students.

Table III. TEST- TWO SAMPLE FOR MEANS

	male	*female*
Mean	11	15.9
Known Variance	98.26667	203.7467
Observations	4	4
Hypothesized Mean Difference	0	
Z	-0.56391	
P(Z<=z) one-tail	0.286406	
z Critical one-tail	1.644853	
P(Z<=z) two-tail	0.572812	
z Critical two-tail	1.959961	

To get a better understanding of the difference between group means, the concepts of confidence intervals (CI) was used. The CI for the difference between □□ and □2 is outlined as follows. The two samples, male and female, were treated as one sample of n pairs.

For each pair, the difference in average performance was computed and CI was constructed (See Table 4).

Table IV. DESCRIPTIVE STATISTICS

Mean	-4.9
Standard Error	2.594224
Median	-5.6
Standard Deviation	5.188449
Sample Variance	26.92
Kurtosis	-3.64305
Skewness	0.379286
Range	10.8
Minimum	-9.6
Maximum	1.2
Sum	-19.6
Count	4
Confidence Level(95.0%)	8.255987

The 100(1- α)% confidence interval is given by:

$$(\bar{x} - t_{[1-\alpha/2;\, n-1]}\ s/\sqrt{n} ,\ \bar{x} + t_{[1-\alpha/2;\, n-1]}\ s/\sqrt{n})$$

The $t_{[1-\alpha/2;\, n-1]}$ is the (1- α/2-quantile of a t-variate with n-1 degrees of freedom. In this case, from table IV, the CI is 8.255987 and the 95% confidence interval is:

-4.9 ± 8.255987 = (-13.155987, 3. 355987)

The confidence interval includes zero. Therefore, the two samples are not different.

In empirical research the hypotheses of greatest interest usually pertain to means, proportions, and /or correlation coefficients. At times, however, there are interests in questions regarding variances such as:

Are the individual differences in learning among male greater than among female? Assuming that the two sample variances are equal, a t-test can be used and result presented in table 5.

From table 5, one can see that there is no much evidence to reject the assumption. Furthermore, there are no much differences between the two-sample variances, i.e. inter-variance for gender is not significantly different.

Table V. t-TEST - TWO-SAMPLE ASSUMING EQUAL VARIANCES

Measures	*male*	*female*
Mean	11	15.9
Variance	98.26667	203.7467
Observations	4	4
Pooled Variance	151.0067	
Hypothesized Mean Difference	0	
Df	6	
t Stat	-0.56391	
P(T<=t) one-tail	0.296624	
t Critical one-tail	1.943181	
P(T<=t) two-tail	0.593248	
t Critical two-tail	2.446914	

VI. CONCLUSIONS

This study shows that computer-aided learning (CAL) is offering a viable educational alternative to traditional education, while at the same time there is an increasing pressure on educational institutions to move towards this type of education. The effectiveness and the efficiency of the educational technology tools are becoming overwhelming in the learning process. The use of the Information Technology educational tools such as WebCT, Blackboard, the Internet and other software tools has become more accepted and widely used tools in higher education due to the development of the interactive features of Web 2.0.

The benefits achieved include the quality of skills earned by the learner, the reduction in the cost of the learning process, and the globe reach of the education. The technology have also made it possible to easily and efficiently deliver and manage course material (and other related aspects such as fees and online exams) to student via the Internet, and many academic departments are now struggling to support face-to-face courses by creating course websites to post lecture notes, syllabi, assignments and other course-work.

The research in this paper is based on teaching object oriented programming to university students.

This type of learning was approached because OOP seems to have less complexity in the development of large applications (consequently faster, easier and cost effective development), easier in detecting errors, easier in updating of application, ability to extend software applications, the efficiency in creating new classes from existing ones (inheritance), and the ability to store and reuse classes whenever they are needed (reusability). In this research, a model course was designed for learning based on object oriented programming.

The proposed course was implemented on two groups of male and female students at a Persian Gulf State university. The results were achieved by statistical analysis and testing using SPSS, and have showed better response for the new proposed course in comparison to traditional teaching. In addition, male and female students reacted equally to the new discipline of teaching.

The main limitation in this study is that the number of students surveyed does not express concrete opinion. Thus survey more students in more number of universities is needed.

REFERENCES

[1] J. T. Bell, and H. S. Fogler, “Vicher: a virtual reality based educational module for chemical reaction engineering”, Computer Applications in Engineering Education, vol. 4, No. 4, pp. 285-296. 1996.

[2] A. Dovgiallo, V. Gritsenko, V. Bykov, V. Kolos, S. Kudrjavtseava, Y. Tsybenko and N. Vlasenko “Intelligence in educational technologies for traditional and distance case: trends and the need for cooperation”, Proceedings of UNESCO Second International Congress, 1996.

[3] E. Chrysler, “Measuring the effect of redesigning an introductory MIS course”, Journal of Computer Information Systems, vol. 36, number 2, pp. 30-36, Winter 1995-1996.

[4] L. A. Harris, and B. A. Weaver, “A comparison of information systems ethics and attitudes among college students, Journal of Computer Information Systems, Winter (1994-1995).

[5] A. L. Ellis, E.D. Wagner, and W.R. Longmire, Managing Web-based Training, ASTD, 1999

[6] J. Farrell, Microsoft visual C#, Course Technology, Cengage Learning, 4th edition, 2010

[7] S. Khosh, and R. Abnous, “Object Oriented: concepts, languages, databases, and user”, Proceeding of The International Conference on Intelligent Information Systems, S. Mani, R. Shankle, M. Dick, M. Pazzani Eds., Two-stage Machine learning model for guideline development artificial intelligence in medicine, 1999, pp.16, 51-80,

[8] C. F. Harrington, S. A. Gordon, and J. S. Timothy, “Course management system utilization and implications for practice: a national survey of department chairpersons”, Online Journal of Distance Learning Administration, volume VII, number IV, Winter 2004, retrieved from http://www.westga.edu/~distance/ojdla/winter74/harrington74.

[9] P. Powel, and C. Gill, “Web content management systems in higher education”, Educause Quarterly,2003, 2:43-50.

[10] P. Daniels, “Course management systems and implications for practice”, International Journal of Emerging Technologies & Society, vol. 7, no. 2, 2009, pp: 97–108, retrieved from http://www.swinburne.edu.au/hosting/ijets/journal/V7N2/pdf/Article3-Daniels.pdf.

[11] R. Glahn, and R. Glen, “Progenies in education: the evolution of internet teaching”, Community College Journal of Research and Practice. 26: 777-785, 2002.

[12] R. Katz, “Balancing technology and tradition: the example of course management systems”, Educause Quarterly, July-August, 2003.

[13] J. Angelo, “New lessons in course management”, University Business, 2004, retrieved from

http://www.universitybusiness.com/page.cfm?p=616.

[14] G. Morgan, "Course management system use in the University of Wisconsin system", Educause Center for Applied Research (ECAR), May, 2003.

[15] B. Stith, "Web-Enhanced Lecture Course Scores Big with Student and Faculty, Syllabus", T.H.E. Journal, 2000, 27 (8), pp. 20-28, retrieved from www.editlib.org/d/14856/proceeding_14856.pdf.

[16] S. Gray, "Collaboration tools". Syllabus,1999, vol. 12, No. 5

[17] Z. Al-Khanjari, F. Masoud, S. Kutti, and M.Hatam,"Plugging software tools in the existing e-learning portals", in the International Arab Conference on Information Technology (ACIT), 2002.

[18] H. Alfawareh, "Rebuilding object oriented software architecture tool for understanding purposes", in the proceedings of the International Arab Conference on Information Technology (ACIT), 2002.

[19] H. Chorfi, and M. Jemni,, "e-learning at Esstt, a case study and perspectives", in the proceedings of the International Arab Conference on Information Technology (ACIT), 2002.

[20] S. Mani, R. Shankle, M. Dick, and M. Pazzani, Two-stage machine learning model, 1999.

[21] C. P. Chrysostomou, and G. Papadopoulos, "An evaluation of e-learning technologies: establishing an object-oriented approach to learning object design and development", the proceeding of the first International Conference on E-business and e-Learning, Amman- Jordan, 2005.

[22] [22] M. Biggs, "Comparison of student perceptions of classroom instruction: traditional, hybrid, and distance education", Turkish Online Journal of Distance Education, 7(2), 2006, pp. 46-51.

[23] S. L. Stick, and N.V. Ivankova, "A decade of innovation and success in virtual learning: a world-wide asynchronous graduate program in educational leadership and higher education", Online Journal of Distance Learning Administration, volume VII, number IV, Winter 2004.

[24] B. Means, Y. Toyama, R. Murphy, M. Bakia, and K. Jones, "Evaluation of evidence-based practices in online learning", A meta-analysis and review of online-learning studies, 2009, Washington, D.C.: U.S. Department of Education, retrieved from http://ctl.sri.com/people/displayPerson.jsp?Nick=bmeans.

[25] S. Sawa, "Asynchronous streaming video from the classroom to the remote student's desktop: preliminary results of a distance education project", in T. Reeves & S. Yamashita (Eds.), Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, 2006, pp. 898-903, Chesapeake, VA: AACE, retrieved from http://www.editlib.org/p/23813.

[26] K. Machtmes, J. W. Asher, "A meta-analysis of the effectiveness of tele-courses in distance education", The American Journal of Distance Education, 2000, 14(1), 27 – 46.

[27] T. L. Russell, "The no significant difference phenomenon: a comparative research annotated bibliography on technology for distance education", Raleigh: Office of Instructional Telecommunication, North Carolina State University, 1999.

[28] J. T. Socks, and P. P. Freddolino,"Evaluation of a world wide Web-based graduate social work research methods course", Computers in Human Services, 1998, pp. 15: 51-69.

[29] M. Brown, "Handhelds in the classroom", Education World, May, 2001

[30] D. L. Whetzel, D. B. Felker, and K. M. Williams, "A real world comparison of the effectiveness of satellite training and classroom training", Educational Technology Research and Development, 1996, 44: 5-18.

[31] M. Allen, E. Mabry, M. Mattrey, J. Bourhis, S. Titsworth, and N. Burrell, "Evaluating the effectiveness of distance learning: a comparison using meta-analysis", Journal of Communication, 2004, pp. 54: 402-420.

[32] L. Gubernick, and A. Ebeling, "I got my degree through e-mail", Forbes, 159, pp. 84-92, 1999.

[33] K. McCollum, "A professor divides his class in two to test value of online instruction", Chronicle of Higher Education, 1997, 43, p. 23.

[34] S. B. Waschull, "The online delivery of psychology courses: attrition, performance, and evaluation", Teaching of Psychology, 2001 28: 143-146.

[35] K. E. Mottarella, B. A. Fritzsche, and T. J. Parrish, "Who learns more? Achievement scores following Web-based versus classroom instruction in psychology courses", Psychology of Learning and Teaching, 2004, 4: 50-53.

[36] M. Newlin, A. Wang, and M. Kosarzycki, "Who succeeds in Web-courses", in the International Conference on Intelligent Information Systems1998, EDUCOM, Orlando, FL.

[37] [37] D. Bunis, Commentary, College and University, Fall, v.78, n.2, 2003.

[38] J. Cavanaugh, "Teaching online - a time comparison", Online Journal of Distance Learning Administration, volume VIII, Number I, Spring, 2005.

[39] A. Rogers, Teaching Adults, Open University Press, 2002, third edition. Berkshire, UK.

[40] F. Heidari, and K. Galvin, "Action learning groups: can they help students develop their knowledge and skill?", Nurse Education in Practice, 2003, 3, pp. 49-55 retrieved fromhttp://www.educause.edu/Resources/EvaluationofEvidenceBasedPract/174235.

[41] H. Ashton, and C. Shuldham, " An exploratory study of student's perceptions of the benefits of regular small group tutorials in a two year data release course", Journal of Advanced Nursing, 1994, pp. 20, 925–934.

[42] N. Zhou, and D. Agosto, "The collaborative information behavior of middle school students in online learning environments", presented at the Panel of Behaviors and Preferences of Digital Natives: Informing a Research Agenda at the annual conference of American Society of Information Science and Technology (ASIST) 2007, Milwaukee, WI, USA.

[43] N. Zhou, "Interactions of education and culture for economic and human development: an Asian perspective", in Delors et al., "Learning: the treasure within", Paris: UNESCO Press, 1996.

[44] R. Stiggins, J. Arter, J. Chappuis, and S. Chappuis, Classroom Assessment for Student Learning: Doing it Right-Using it Well, Allyn & Bacon; 1st edition, 2009.

[45] B. Barros, and M. F. Verdejo, "An approach to analyze collaboration when shared structured workspaces are used for carrying out group learning processes", AIED'99, Lemans, July, 1999.

[46] C. Crook, "Computers and the collaborative experience of learning", routledge, Newyork,1996, p.79.

[47] G. Stahl, T. Koschmann, and D. D. Suthers, Computer-supported collaborative learning: An historical perspective, Cambridge handbook of the learning sciences, 2006.

[48] R. Fenton, N. O'Leary, "Improving student achievement through enhancing the instructional communication competence of teachers", paper presented at: Annual meeting of the communication and instruction division of the western states communication association", February 1990.

[49] F. C Worrell, L. D. Kuterbach, "The use of student ratings of teacher behaviors with academically talented high school students", The Journal of Secondary Gifted Education, 2001, pp. 14, 236-247.

[50] N. A. Buang, A. Abd Samd, "Is there a relationship between business studies teachers' teaching styles and students' motivation to learn?", the soc. Sci., 6(5): pp. 357-360, 2011 (Medwell Journal).

[51] M.S. Hass, "The influence of teaching methods on student achievement on Virginia's end of course standards of learning test for Algebra I", unpublished Ph.D. Dissertation submitted to Faculty of Virginia Polytechnic Institute and State University, Sep., 2002.

[52] M. C. Okur, "Teaching object oriented programming at the introductory level", Journal of Yasar University, 1(2), 2006, pp. 149-157, http://joy.yasar.edu.tr/makale/no2_nol1/05_m_cudi_okur.pdf.

[53] S. Georagantaki, and S. Retails, "Using educational tools for teaching object oriented design and programming", journal of Information Technology Impact, Vol. 7, No., 2, 2007, pp. 111-130.

[54] E. Lahtinen, K. Ala-Mutka, and H. M. Jarvinen, "A study of the difficulties of novice programmer", in the proceeding of the 10th annual SIGCST conference on innovation and technology in computer science education, 14-18 June, 2005, pp. 27-29.

[55] John Vinsonhaler, Jean Vinsonhaler, and C. Wagner, “PERIS: a knowledge based system for academic productivity”, Journal of Computer Information Systems, spring, 1996.

[56] V. Shankaraman, and B. S. Lee, ”Knowledge - based safety training system - a prototype implementation”, Computer in Industry, 25, 1994, PP. 145-157.

[57] J. Farrell, An Object-Oriented Approach to Programming Logic and Design, 3rd ed., Course Technology, Cingage Learning, 2010.

[58] Gips, James (1997). Mastering Excel, A problem Solving Approach. John Wiley & Sons.

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