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Interactive e-content development for vocational and technical education

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Abstract

The aim of this study is to investigate interactive and web based simulation contents on education for students' achievement in Vocational and Technical Education. Research carried on 10th class students in Department of Information Technology at Technical High School. The study was created by utilizing pre-test and post-test model. Sample set consist of 12 test and 12 control subjects, in total 24, 10th class students. Students who enrolled "Foundations of Information Technology" course are provided to make virtual experiments on laboratory application in simulation environment with web based education. Same course is given in traditional teaching and laboratory work style to the control group students. Achievement tests that developed to measure success was used as pre-test and post-test. Interactive and web-based content of simulation education may be a solution to shortage of professional tools and space and shortage of teaching staff.
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Keywords: Vocational education; vocational technical education(VTE); interactive education; virtual laboratory; learning styles.

1. Introduction

Vocational Technical Education (VTE) is essential for educating people to bring them a profession that needed in all areas of life. If we take attention to the significant development of technology, education given by VTE must be compatible with countries' requirements. Developed technology and increasing knowledge brings also content and approaches of rendering skills in VTE (Bülbül, 1998). Nowadays, importance of VTE is increasing. This importance is understood well when we examine the dimensions of technology development in the world. Especially advancements in informatics and electronics indicate more importance should be given to these areas (Jimoyiannis, 2004). Problems in education could not solve only with traditional education techniques, but it can be solved with help of technology. Distance education is the one of the most useful advancement method in educational technologies. But distance education needs interactive and deep contents. Developed educational contents must be more comprehensive when it will be given with web based for VTE. Because students can learn everything with visual way, from this viewpoint visualization and interaction is so important. Visual expression should be used while

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teaching technical issues. The use of images and animations will be needed more in VTE. Therefore in web based VTE, it is essential to use multimedia tools. In VTE, we should not forget workshops and laboratories. In order to provide this we can use simulation and animation.

Simulator is a device which has dynamic behaviour of a real system. Simulator used training produces illusion of the real system and provides responses to the students in education.

According to a definition, simulator is "A machine mimicking environment for educational or research purposes" (Hyperdictionary).

Educational computer software is correct students' misunderstood and so, students become more active in education (Issa,, et al., 1999). In addition, computer-aided environments are helps students to increase their problem solving ability, imagination and learning (Williamson, 1996). Laboratory experiments make dangerous and so expensive (Steed, 1992), such as nuclear energy experiments or process occurring takes long-time, such as degradation of radioactive elements, are made is very easy with web-based environment (Hofstein, 2003). Such applications in science increases students' achievement and efforts about science research (Sinclair, 2004).

Nowadays trained manpower is very important with technological development. Education is becoming important and it causes large expenditures. To minimize expenditures, material saving and for security reasons, simulator applications can be used in all these fields. When we look at aspects of organisation, personal training, people who just started a business, workers and group which consists for doing their jobs more effective in company, all of educational activities and actions that increase their manners such their professional experience, thought, rationale decision, behaviour.

Web based education becomes an important educational environment with computer and Internet technology. Educational institutions and companies develop their own Web based educational models. Rapidly increasing world population needs and gets education by using web based education on Internet (Horton, 2000).

Interactive pages in Web Based Educational models make easier to training course and by this way increase quality of education (Hall, 1997). For web based education, interaction can be provided with animations, simulations, audios, videos and films. An event can be animated to the course content and how it happens with animation, dangerous or expensive experiments tools that require laboratory practices can be performed with simulation. The purpose of this research is comparing web based education with content of interactive and simulation and traditional education in VTE by taking into account learning styles of the students.

2. Materials and Methods

In research, it is try to find the effects of web based distance education with interactive contents on VTE. For this purpose, it is designed and applied 2 X 2 pre-test and post-test according to complex pattern with control group (Büyüköztürk, 2001).

Purpose of research is to explain role of giving course and laboratory application with interactive and simulation content to VTE to 10th grade class students. Therefore, it was tried to find answers for following questions:

1) Is there any significant difference between pre-test and post-test achievements of control group that was applied traditional educational method?
2) Is there any significant difference between pre-test and post-test points of control group that was applied web based education?
3) Is there any significant difference between pre-test and post-test point of control group that was applied web based education and control group that was applied traditional education?

2.1. Method

Study universe of research selected from Istanbul Barbaros Harettin Paşa High School, IT 10th class students at 2008-2009 education year. 24 students were chosen as sample. As a matter of course, Basic Information technology, Motherboards and Chassis, Processors (CPU), Memory Unit, Disk Drives, Hardware Cards, Ports modules were selected and processed. 12 students of 24 random selected students were taken for laboratory practices and lessons for traditional way. Other 12 students took course with application over Internet as web based education by simulations and interactive pages. Number of students who selected for sample is shown in Table 1.

Table 1. Sample of Universe

Groups	Students of Information Technology Field		
	Female	Male	Total
Experimental	4	8	12
Control	3	9	12
Total	7	17	24

2.1.1. Achievement Test

In application, for identifying success of students who take course have following topics; Basic Information technology, Motherboards and Chassis, Processors (CPU), Memory Unit, Disk Drives, Hardware Cards, Ports modules. Vocational Education and Teaching System Development Project was prepared and applied from question and course teaching modules.

2.1.2. Training Materials

Training material has following modules; Motherboards and Chassis, Processors (CPU), Memory Unit, Disk Drives, Hardware Cards, Ports. This syllabus is followed in IT basic course at Vocational High School, 10th class. In VTE, visual learning has priority. For this reason, visual contents have not only interactions, but also have some sounds and music at the background of the each scene. Course syllabus was created by using course modules in MEGEP internet site. Training material was designed according to the six modules in Basic Information Technology course content. Animation is used in expression of module. Adobe Flash has been used as Laboratory application ("IT Basic Virtual Desktop"). This programme provides students, to assemble a desktop computer, to examine computer equipment and to test their knowledge. During the application, a short knowledge about usage of web-site was given to the students. Students were asked to complete the application.
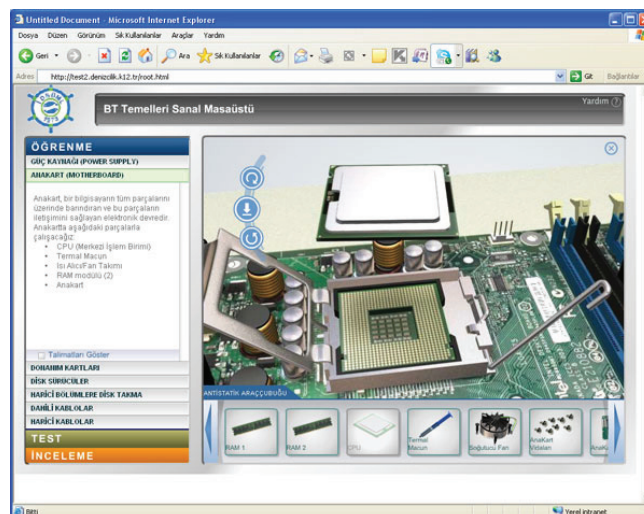

Figure 1. Simulator Laboratory Application (Installing the CPU)

Figure 2. Simulator Laboratory Application (Installing the motherboard PATA Cable)

3. Findings

In this study, experimental design was used. The experimental group trained in computer-assisted instruction environment and control group is educated with traditional teaching methods.

3.1. Comparison of Achievement of Pre-test Average Scores

First of all, both groups were examined by pre-test. Pre-test exam is applied to experimental and control groups. Scores of achievement are investigated by independent t-test (Table 2).

Table 2. Independent t-test implementation for pre-test scores

Groups		**N**	**Average**	**Std.Deviation**	**Std.Error**
Pretest	Experiment	12	33.08	12.595	3.636
	Control	12	40.42	10.501	3.031

Independent Groups Test

PreTest	Variances Equality Test of Levene		T test for equality of average						
	F	Sig	T	Df	Sif(duplex)	Mean Diff.	Std Error Diff	% 95 Confidence interval of difference	
								Bottom	Top
Equal variance hypothesis	0.059	0.811	-1.549	22	0.136	-7.333	4.734	-17.150	2.484
Unequal variance			-1.549	21.311	0.136	-7.333	4.734	-17.169	2.502

Mean scores of pre-test can be seen at table 2, is 33.08 for experiment group and 40.42 for control group. An examination of the t-test table; t value is -1.549, % 95 confidence interval, bottom (-17.150) and top (2.484). There

is no significant difference between experimental and control group, in pre-test on mean scores. This shows prior knowledge about the subjects of both groups indicates in almost equivalent knowledge level.

3.2. Comparison of Average Post-test Achievements

The other comparison about achievement test has been done, to see if experimental group is more successful than control group in academically. These findings can be shown in the Table 3.

Table 3. Independent t-test implementation for post-test scores

Groups		N	Average	Std.Deviation	Std.Error
Post-test	Experiment	12	61.42	15.120	4.365
	Control	12	73.17	14.128	4.078

		Independent Groups Test							
PostTest	Variances Equality Test of Levene	T test for equality of average							
	F	Sig	T	Df	Sif(duplex)	Mean Diff.	Std Error Diff	% 95 Confidence interval of difference	
								Bottom	Top
Equal variance hypothesis	0.019	0.892	-1.967	22	0.062	-11.750	5.974	-24.139	0.639
Unequal variance			-1.967	21.899	0.062	-11.750	5.974	-24.142	0.642

Average scores for post-test can be seen at table 3. It is 61.42 for experiment group and 73.17 for control group. An examination of the t-test table; t value is -1.967, % 95 confidence interval, bottom (-24.139) and top (0.639). There is no significant difference between experimental and control groups in post-test on mean scores.

3.3. Pre-Test and Post-Test Score Averages Comparison of Control Groups

Findings which were taken from independent t test results between pre test and post test score average difference on experiment group can be seen in Table 4.

Table 4. Pre-test and post-test score averages of t-test results

Control Groups		N	Mean	Std. Deviation	Std Error Mean	
Pre Test		12	40.42	10.501	3.031	
Post Test		12	73.17	14.128	4.078	
Control Group		Test value=0				
	T	Df	Sif(duplex)	Mean Diff.	Std Error Diff	% 95 Confidence interval of difference
						Bottom / Top
PreTest	13.333	11	.000	40.417	33.74	47.09 / 13.333
PostTest	17.940	11	.000	73.167	64.19	82.14 / 17.940

As listed in Table 4, because of p<0.05, it can be said that control group statistically significant and there is an increase in success at the end of the experiment. At the end of the control group; test scores are increased as 32.75 points.

3.4. Pre-Test and Post-Test Score Averages Comparison of Experiment Groups

Findings which were taken from independent t-test results between pre test and post test score average difference on experiment group were seen at Table 5.

Table 5. The experiment groups' pre test and post test score averages of t-test results

Control Groups	N	Mean	Std. Deviation	Std Error Mean
Pre Test	12	33.08	12.595	3.636
Post Test	12	61.42	15.120	4.365

Control Group			Test value=0				
	T	Df	Sif(duplex)	Mean Diff.	Std Error Diff	% 95 Confidence interval of difference	
						Bottom	Top
PreTest	9.099	11	.000	33.083	25.08	41.09	9.099
PostTest	14.071	11	.000	61.417	51.81	71.02	14.071

As seen at Table 5; because of p<0.05, it can be said that control group statistically significant increase in success at the end of the experiment. At the end of the control group; test scores are increased as 28.334 points.

3.5. Means of Post Test Scores versus the Learning Styles

In order to understand students learning styles Index of Learning Styles instrument by Felder (1994) was employed. Felder (1994) states that active learners retain and understand information best by doing something active with it discussing or applying it or explaining it to others. *Reflective learners* prefer to think about it quietly first; sensing learners like learning facts; intuitive learners often prefer discovering possibilities and relationships; *visual learners* remember best what they see—pictures, diagrams, flow charts, time lines, films, and demonstrations and *sequential learners* tend to gain understanding in linear steps, with each step following logically from the previous one. *Global learners* tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly. As Felder (1990) claims that in most of the college classes, very little visual information is presented and most of the students do not get nearly as much as they would if more visual presentation was used in class.

According to the Felder; to determine students' learning model "Felder-Soloman Learning Model Determining Test" was developed. This test was examined in terms of reliability and validity. Test on social science's that accepted the reliability of the test limit value is %70. The results of applications in various universities in USA and Canada, test has %65-70 reliable results.

Table 6. Anova test results

		Sum of Squares	df	Mean Square	F	Sig
Pre Test	Between Groups	712.125	5	142.425	.998	.447
	Within Groups	2568.375	18	142.688		
	Total	3280.500	23			
Post Test	Between Groups	2482.863	5	496.573	2.925	.042
	Within Groups	3056.095	18	169.783		
	Total	5538.958	23			

As listed in Table 6, learning model can be used to distinguish students according to the Felder's Index of learning styles. Anova table's in the relevance column value is 0.042 when applying students Felder test. We can say that statistically significant at the $P<0.05$ level.

It was understood that the difference between different learning styles are not statistically significant on Turkey test table. According to these findings with web based education content including interactive and simulation content and because of meeting, all the teaching techniques are not used together with learning model; it was responding to the needs of students with different learning styles. According to the results obtained from the research; Motherboards and PC Cases, Processors (CPU), memory units, Disk Drives, Hardware Cards are used on experimental procedure and Fundamentals of Information Technology Course from the curriculum.

Students from being used interactive electronic content with educational software education are more successful than traditional vocational technical education. Both of the two learning styles students' average of achievement has significant difference on pre test and post test. This finding shows that, both of the learning styles provide significant success. In addition, in traditional vocational technical education system, students have learned more knowledge according to the findings. But, students' knowledge was increasing who were taken education by prepared for electronic content with using the interactive training software education.

There is no significant difference between electronic content with using the interactive training software education and traditional vocational technical education. Because both teaching activities have equal affect on different levels of cognitive space.

Table 7. Learning styles of students

Dependent Variable	(I) Personal	(J) Personal	Mean Difference (I-J)	Std. Error	**Sig.**	95% Confidence Interval	
						Lower Bound	Upper Bound
Post Test	Act	Ref	6.000	10.301	.991	-26.74	38.74
		Sns	-15.000	10.301	.694	-47.74	17.74
		Int	11.000	10.301	.888	-21.74	43.74
		Vis	-4.714	6.744	.980	-26.15	16.72
		Seq	23.333	8.821	.137	-4.70	51.37
	Ref	Act	-6.000	10.301	.991	-38.74	26.74
		Sns	-21.000	13.030	.602	-62.41	20.41
		Int	5.000	13.030	.999	-36.41	46.41
		Vis	-10.714	10.447	.903	-43.92	22.49
		Seq	17.333	11.895	.694	-20.47	55.14
	Sns	Act	15.000	10.301	.694	-17.74	47.74
		Ref	21.000	13.030	.602	-20.41	62.41
		Int	26.000	13.030	.382	-15.41	67.41
		Vis	10.286	10.447	.917	-22.92	43.49
		Seq	38.333(*)	11.895	.046	.53	76.14
	Int	Act	-11.000	10.301	.888	-43.74	21.74
		Ref	-5.000	13.030	.999	-46.41	36.41
		Sns	-26.000	13.030	.382	-67.41	15.41
		Vis	-15.714	10.447	.666	-48.92	17.49
		Seq	12.333	11.895	.899	-25.47	50.14
	Vis	Act	4.714	6.744	.980	-16.72	26.15
		Ref	10.714	10.447	.903	-22.49	43.92
		Sns	-10.286	10.447	.917	-43.49	22.92
		Int	15.714	10.447	.666	-17.49	48.92
		Seq	28.048	8.992	.056	-.53	56.62
	Seq	Act	-23.333	8.821	.137	-51.37	4.70
		Ref	-17.333	11.895	.694	-55.14	20.47
		Sns	-38.333(*)	11.895	.046	-76.14	-.53
		Int	-12.333	11.895	.899	-50.14	25.47
		Vis	-28.048	8.992	.056	-56.62	.53

* The mean difference is significant at the .05 level.

4. Results

Achievement test results for the whole study is taken into consideration, both of electronic content with using the interactive training software education and traditional vocational technical education has a positive effect on students' success. Moreover, there is no significant difference between electronic content with using the interactive training software education and traditional vocational technical education on students achievement. This result show electronic content with using the interactive training software is effective as traditional vocational technical education. Both of electronic content with using the interactive training software education and traditional vocational technical education are responding to the needs of students with different learning styles. Electronic content with using the interactive training software education at Vocational High School in the field of information technology related with "Motherboards and PC Cases, Processors (CPU), Memory Unit, Disk Drives, Hardware Cards, Ports" so this shows that students who are taken electronic content with using the interactive training software education are more successful than traditional vocational technical education students.

In conclusion, electronic content with using the interactive training software education at traditional vocational technical schools is a solution for shortage of teaching staff and material failure.

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