EFFECT OF SCREEN READING AND READING FROM PRINTED OUT MATERIAL ON STUDENT SUCCESS AND PERMANENCY IN INTRODUCTION TO COMPUTER LESSON

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ABSTRACT
In this study, the effect of screen reading and reading from printed out material on student success and permanency in Introduction to Computer Lesson is investigated. Study group of the research consists of 78 freshman students registered in Erzincan University Refahiye Vocational School Post Service department. Study groups of research consist of an experiment group and a control group. With a random selection 38 students were assigned as experiment group and 40 students were assigned as control group. In this manner, experiment group with 38 students used screen reading, and control group with 40 students used printed out material for education. Study was designed as control group model with pretest and posttest. Both experiment and control groups were applied pretest and posttest within the research. In process of data analysing, ancova and multiple variance analysis were used. It was found on success tests that there is not a significant difference between posttests corrected according to pretests of control and experiment groups. But, a significant difference between Access and permanency tests in favour of control group was found. Furthermore, dual effect of applied method and gender on posttest success scores and delayed test scores was found to be insignificant. Results of the studies show that reading from printed out material is more efficient than screen reading.

Keywords: Screen Reading, Reading From Printed Out Material, Student Success, Introduction to Computer Lesson

INTRODUCTION
While emphasizing the importance of technology, recent research suggests educating new generations in harmony with technology. This research may be an eligible aspect because technology simplifies many aspects of our lives. It can be said that except for some small tribes, human beings do not find technology strange but are willing to follow it. This tendency to follow technological developments over time made it easy for technology to be used in every aspect of life without being questioned enough.

One of the areas where technology is used without questioning is education. It can be seen that these technologies began to be used as computer and internet technology became more widespread so that students see the internet as the main or first source of information (Tuncer, Yılmaz and Tan, 2011; Tuncer and Kaysi, 2011). As the internet became more widespread, acquisition of knowledge through books or the library became rare (Tuncer and Balcı, 2013). In a major change, learning from cyber media called "screen reading" is more preferred.

Güneş (2009:317) describes screen reading as; reading from screen with pages divided half or quarter the size of printed out materials. These electronic scripts on the computer screen go from pages to other pages as in entering a room in which multiple doors for other rooms exist (Aysever, 2004). This structure is discussed as an aspect of learning in many studies but taking some precautions is suggested for efficient learning. Because as Güneş (2010) and Altun and Çakmak (2008) suggested, comprehension of scripts in order gets harder due to loss of visual on other parts of pages as you read another part, the use of foreign characters making it hard to understand the words, use of reading techniques getting hard and the lack of beginning and ending pages.

Çelik (2006) sees reading as a complex process with physiologic, mental and spiritual aspects like comprehension, analysis and evaluation of feelings and thoughts in the text. According to Günay (2004:23) reading, regardless of its structure, in a text in which words are connected in a meaningful way is looking for connections to explore and express the unity of words or sentences, connecting the words together in order to

find a different meaning than original word meaning and making it meaningful. This expression on reading is the reason why screen reading is a matter of discussion. As texts slip from screen in screen reading, it becomes hard to make a meaningful relationship between the beginning and the end of the text. As screen size is different than page size, it is impossible to see full page and only small parts of page are visible. Maybe this is why some learners prefer reading from printed out materials in earlier studies (More, Guy and Elobaid, 2007; Alshaali and Varshney, 2005; Annand, 2008; Weeks, 2002; Spencer, 2006; Vernon, 2006).Johnson (2000) stated that a successful reader gets bored of simple texts and weak readers give up reading non fluent texts which he/she cannot read. Moreover, Guy and Elobaid (2007) stated that despite the fact that people are spending more time on the computer, they prefer to read texts with more than 3-4 pages on printed out material. Similar findings were stated by Vernon (2006); giventhe opportunity, the primary learning strategy of students is to print online documents. Spencer (2006) also noted that students prefer printed out material. Annand (2008) reports from Mercieca (2004) that screen reading keeps less information in mind for longer time. Weeks (2002) states that people reading from screen are not happy with this and they believe that screen reading would never be popular.

Alshaali and Varshney (2005) stated that reading from a computer screen is 20-30%slower than reading from printed out material and thus text should be 25%shorter. The finding that screen-reading is slower was also obtained by Muter et al., (1982), Gould and Grischkowsky (1984), Belmore (1985), Smith and Savory (1989), Muter and Maurutto (1991). In their study, Dyson and Haselgrove (2001) found that screen-reading reduces reading speed. Rose (2011) notes that opponents of screen reading went so far as to argue that "electronic text ultimately diminishes both personal growth of individuals and the stability of our society (Vandenhoek, 2013). In some other studies, various correlations between reading rate and comprehension were identified. According to Poulton (1958) and Belmore (1985), with the increase of reading rate, individual's level of comprehension decreases. However, for those having natural habit of fast reading, comprehension level of screen-reading is high. Yıldırım et. all (2011) on the other hand, stated that electronic text would be more advantageous than reading from printed out material because of benefits like screen size and screen resolution. Walczyk et al., (1999) found that mild time pressure, encouraging people to read slightly faster than normal from screen, can improve comprehension. Mallett (2010: 143) stated that screen size between A4 and A5 makes it easier to read. Wilson (2003) finds bigger screen size important for reading in order to have a full visual, but states that this also has a negative effect as it brings physical weight along. In some studies (Reinking, Mckenna, Labbo & Kieffer, 1997 and Tuman, 1994; Cit. Maden, 2012), it is emphasized that electronic literacy or reading-writing activities should not be regarded as an alternative to traditional reading-writing, but should be considered as a complementary.

All these research findings cause a cautious attitude towards screen reading. For this reason, screen reading should be investigated in various aspects like planning and effect of it on success. This research was planned with this need in mind. The effect of screen reading and reading from printed out material on learner's success was investigated with experimental study. For this reason, introduction to computer lesson was given as both screen reading and reading from printed out material. According to this, the general purpose of the study could be stated as: the effect of reading from printed out material (Control Group) and screen reading (Experiment Group) on student success and its permanency. Within the context of this general purpose, sub purposes below are investigated.

- Is there a significant difference between posttest score averages corrected according to pretest of both groups
- Is there a significant difference between permanency test score averages corrected according to posttest of both groups
- Is there a significant difference between access scores of both experiment and control groups
- Is dual effect of applied method (reading from printed out material and screen reading) and gender on posttest success score significant?
- Is dual effect of applied method (reading from printed out material and screen reading) and gender on permanency test success score significant?

METHOD
In this research, Pretest-Posttest Control Group Model from experimental research patterns is used. Symbolic expression of the model is shown below (Figure 1); (Karasar, 2009: 97).

G_1	$Q_{1.1}$	X	$Q_{1.2}$	$Q_{1.3}$
G_2	$Q_{2.1}$		$Q_{2.2}$	$Q_{2.3}$
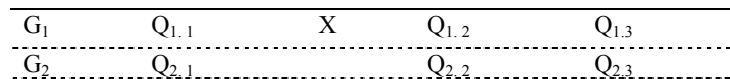
$(G_1$: Experiment Group, G_2: Control Group, X: Independent Variable,
$Q_{1.1}$ and $Q_{2.1}$: Measurement Before Experiment (Pretest),
$Q_{1.2}$ and $Q_{2.2}$: Measurement After Experiment (Posttest) ,
$Q_{1.3}$ and $Q_{2.3}$: Measurement After Experiment (Postponed Test)

Figure 1: Control Group Model with Pretest-Posttest

Karasar (2009:96) describes this pattern as randomly choosing one group as the control group and the other one as the experiment group which have nothing in common at the beginning.

Research was carried out on Erzincan University Refahiye Vocational High School Post Service freshmen students (78 students). Study groups of research consist of an experiment group and a control group. With a random selection (protecting class unity) 38 students were assigned as experiment group (II. Education) and 40 students were assigned as control group (I. Education). In this manner, experiment group with 38 students used screen reading, and control group with 40 students used printed out material for education.

The characteristics of the monitors used in this study are as follow: Screen size: 19 inch, resolution: 1440x900, Visual angle:160/160, Contrast rate: 700:1, Brightness : 300 cd/m2, colour scale:0.72, pixelPitch: 0.285x0.285.

In the study, an achievement test consisting of 50 items was prepared. This test was applied to 2nd class (first and second education) students (69) which are believed to have same qualities (received these classes before, having average academic success, having same physical environment in classes). Item analyses for 50 items were made within test. Item analysis results were compared with reference values given in Taşpınar's (2004:276-279) table 1.

Table 1: The Item Difficulty and Distinctiveness Values and Evaluation of These

P (Item Difficulty)	Evaluation
0,80 and above	Very easy item
Between 0,65-0,79	Easy item
Between 0,35-0,64	Mid-level item
Between 0,20-0,34	Hard item
0,19 and below	Rather hard item
r (Item Distinctiveness)	Evaluation
0,40 and above	Very good item
0,30-0,39	Good item, but may be improved
0,20-0,29	It should generally by corrected
0,00-0,19	It may be removed from the test, but should be corrected
(-) Negative	It should not be included in the test

Comparing these reference values and coverage of the test with values of item difficulty and item distinctiveness, 25 items were excluded. Item difficulty and item distinctiveness about raw success test are given in table 2.

Table 2: Item difficulty and item distinctiveness of Success Test before Experimental Process

Item	P	r	Item	P	r	Item	P	r
1	0,37	0,21	18*	0,39	0,16	35	0,76	0,37
2*	0,92	-0,05	19	0,53	0,74	36*	0,16	-0,11
3	0,42	0,21	20	0,61	0,26	37*	0,71	0,05
4	0,74	0,53	21	0,66	0,37	38	0,53	0,32
5	0,63	0,63	22	0,71	0,26	39*	0,03	0,05
6*	0,97	0,05	23*	0,45	0,05	40*	0,79	0,11
7*	0,68	-0,11	24	0,71	0,47	41	0,37	0,42
8*	0,13	0,16	25	0,79	0,32	42	0,21	0,21
9*	0,03	-0,05	26*	0,42	0,11	43*	0,32	0,11
10	0,71	0,37	27*	0,18	-0,05	44	0,82	0,05
11*	0,45	0,16	28*	0,68	0,21	45	0,82	0,37

12*	0,5	0,05	29	0,39	0,47	46	0,37	0,21
13*	0,68	0	30	0,71	0,37	47*	0,13	0,16
14*	0,92	0,05	31*	0,34	0,16	48	0,29	0,47
15	0,68	0,32	32	0,63	0,53	49*	0,16	-0,11
16*	0,16	0,11	33*	0,08	0,05	50*	0,66	0,16
17	0,47	0,63	34	0,61	0,47			

* The items removed from the test, P=Item difficulty, r =Item distinctiveness

As seen on table 2, items which have distinction lower than ,21 are excluded. With this information, a final success test consisting of 25 items was evaluated in means of typing and meaning.

Both experiment and control groups were applied pretest and posttest within the research. Achievement test is important to determine the efficiency of learning and permanency of learning for both methods (screen reading and reading from printed out material). In process of data analysing, Ancova and multiple variance analysis (Mancova) were used.

FINDINGS
Ancova analysis was used to determine whether there was a significant difference between pretest and posttest averages. In this context, descriptive statistics about posttest are given in table 3.

Table 3: Descriptive Statistics for Posttest Results on Groups

Groups	N	Average	Corrected average
Control	40	55.20	58.18
Experiment	38	58.84	55.69

When the table is examined, it is seen that experiment group posttest average is higher. But when success score averages of groups are checked, it is seen that some differences exist in success scores. Corrected success test average is 58.18 for control group and 55.69 for experiment group. In that respect, it is possible to say that control group success average is higher.

Experiment group pretest scores are higher than control group pretest results. Thus, when comparing posttest results, pretest results should be under control. For this reason, Ancova method was used to compare both groups. Ancova analysis of comparison between posttest results corrected according to pretest is given on table 4.

Table 4: Ancova Results of Posttest Scores Corrected According to Pretest.

Source	Sum of Squares	df	Mean Squares	F	p
Pretest	5312.395	1	5312.395	44.772	.000
Experiment-Control	106.239	1	106.239	.895	.347
Error	8899.058	75	118.654		
Total	14469.949	77			

According to Table 4, a significant difference between corrected average results of posttest compared to pretest was not noticed [F (1,75) =.895, p>.05]. The success of experiments is evaluated by simply Access Scores which are found by subtraction of pretest results from posttest results. Ancova test results of comparison between Access scores of both experiment and control group are given on table 5.

Table 5: Descriptive Statistics for Access Scores on Groups

Groups	N	Average	Corrected average
Control	40	12.50	10.34
Experiment	38	5.57	7.85

When average scores on the table are examined, it is seen that Access score of control group is higher. But it is also seen that success score averages have some differences. Average corrected success score is 10.34 for control group and 7.85 for experiment group. Ancova analysis of comparison between Access scores is given on table 6.

Table 6: Ancova Analysis Results of Access Scores

Source	Sum of Squares	df	Mean Squares	F	p
Experiment-Control	933,455	1	933.455	6.078	.016
Error	11671.263	76	153.569		
Total	12604.718	77			

According to results on table 6, there is a significant difference between average Access scores [F (1,76) =6.078, p<.05]. This difference is in favour of reading from printed out material group. Thus, it is possible that reading from printed out material is more efficient than screen reading.

Other purpose of this study is to compare permanence of information between experiment and control groups. In this manner, permanency of methods (Experiment-Screen Reading, Control-Reading from printed out material) will be revealed. Descriptive statistics of permanency test scores are given on table 7.

Table 7: Descriptive Statistics of Permanency Test Results on Groups

Groups	N	Average	Corrected average
Control	40	54.40	56.13
Experiment	38	55.21	53.59

When the table is examined, it is seen that experiment group posttest permanency average is higher. But when success score averages of groups are checked, it is seen that some differences exist in success scores. Corrected success test average is 56.13 for control group and 53.59 for experiment group. In that respect, it is possible to say that control group success average is higher. Ancova analysis of comparison between permanency test results corrected according to posttest is given on table 8.

Table 8: Ancova results of comparison between permanency test results corrected according to posttest

Source	Sum of Squares	df	Mean Squares	F	p
Posttest	13547.150	1	13547.150	608.509	.000
Experiment-control	122.983	1	122.983	5.524	.021
Error	1669.713	75	22.263		
Total	15237.179	77			

According to Table 8, a significant difference between permanency test averages corrected according to posttest was noticed [F (1,75) =5.524, p<.05]. LSD test applied on corrected posttest scores show that this significant difference is in favour of control group. Calculated effect size is η^2=.069.

Two factor Ancova analysis for irrelevant samples is used to investigate whether gender of students affected student success on applied method. Descriptive statistics of posttest scores according to teaching method and gender is seen on table 9.

Table 9: Descriptive statistics of posttest scores according to teaching method and gender

	Gender	N	$\bar{X}$	Std. Deviation
Control	Female	24	54,66	13,27
	Male	16	56,00	13,77
	Total	40	55,20	13,31
Experiment	Female	9	60,00	13,26
	Male	29	58,48	14,47
	Total	38	58,84	14,03
Total	Female	33	56,12	13,28
	Male	45	57,60	14,12
	Total	78	56,97	13,70

Posttest average of reading from printed out material group is X=55.20. Posttest average of screen reading group is X=58.84. Dual variance analysis was used to determine whether this difference between groups (Experiment-control) is significant and to determine whether the gender effect on posttest results is significant. Results about these 2 situations are given on table 10.

Table 10: ANOVA analysis Results of Teaching Method and Success Scores According to Gender

Source	Sum of Squares	df	Mean Squares	F	p
Experiment-Control	244,599	1	244,599	1,277	,262
Gender	,135	1	,135	,001	,979
ExpCont x Gender	32,534	1	32,534	,170	,681
Error	14178,575	74	191,602		
Total	14469,969	77			

According to the table, a significant difference between average posttest results of experiment and control group was not noticed (F (1,74) =1.277, p>.05). Furthermore, the mutual effect of applied method and gender is not significant [F (1.74) =.170, p>.05]. Line graph based on Method and Gender for this analysis is given on figure 2.
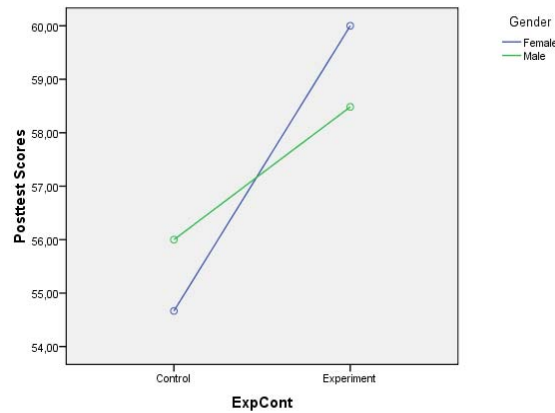

Figure 2: Method and Gender Based Line Graph

It is seen on figure 2 that female success average is 54.66 and male success average is 56.00 on control group. However female success average is 60.00 and male success average is 58.48 on experiment group. Apart from this, results on table 11 shows permanency test score averages.

Table 11: Descriptive Statistics of Teaching Method and Gender Based Delayed Test Scores

	Gender	N	$\bar{X}$	Std. Deviation
Control	Female	24	54,33	12,58
	Male	16	54,50	14,37
	Total	40	54,40	13,15
Experiment	Female	9	55,55	13,33
	Male	29	55,37	15,86
	Total	38	55,42	15,13
Total	Female	33	54,66	12,59
	Male	45	55,06	15,19
	Total	78	54,89	14,06

As seen on table 12, permanency test average of reading from printed out material group (control group) is X=54.40. Delayed test of screen group is X=55.42. Dual variance analysis is applied to determine whether this permanency test average difference between 2 groups is significant and whether the mutual effect of applied method and gender is significant. Results for these 2 situations are shown on table 12.

Table 12: ANOVA Analysis Results of Teaching Method and Gender Based Delayed Test

Source	Sum of Squares	df	Mean Squares	F	p
Experiment-Control	17,683	1	17,683	,086	,770
Gender	,000	1	,000	,000	,999
ExpCont x Gender	,471	1	,471	,002	,962
Error	15216,383	74	205,627		
Total	15237,179	77			

A significant difference between these two groups' delayed test average scores was not noticed (F (1,74) =.086, p>.05). Another finding on Table12 is that mutual effect of method (Experiment-Control) and gender on delayed test success scores is insignificant [F (1,74) =.002, p>.05].

RESULT, DISCUSSION AND SUGGESTIONS

Screen reading, as a result of technological advancements, is a situation which teachers and students will continue to encounter frequently. Since screen reading is becoming more widespread, it is of common interest whether screen reading or reading from printed out material gives better results on learning. Furthermore, clarification is needed for such an important question on learner success in which model would be higher. With this purpose in mind, a significant difference between pretest and posttest, corrected according to pretest, of both experiment and control groups researched. A significant difference between Access score averages which could be taken as a predictor was found. It is also noted that there is a significant difference between permanency test scores corrected according to posttests of experiment and control groups. According to LSD test, this difference is in favour of control group. Furthermore, dual effect of applied method and gender posttest success scores and delayed test success scores is found insignificant.

Results of the studies show that reading from printed out material is more efficient than screen reading. Similar results were found by Tuncer (2012) and reading from printed out material was found to be more efficient than reading from projected screen. As Gunes has stated before, this result may be caused by skipped reading from screen, reflections on screen, vertical movements of screen while reading and eye strain. Another finding supporting this position was noticed by O'Hara and Sellen (1997).They found that reading from printed out material is fast, comfortable and not tiring while screen reading is slow, lacking comfort and hard. Nielsen (1995) found that screen reading is 25% slower than reading from printed out material. Dyson (2004) stated that this deficiency of screen reading process is because of physical order of scripts read from screen. The finds of this study show a parallelism with those of Muter et al., (1982), Gould and Grischkowsky (1984), Belmore (1985), Smith and Savory (1989), Muter and Maurutto (1991), Dyson and Haselgrove (2001) in general terms. Kurniawan and Zaphiris (2001), in opposition to these results, state that there is no difference in speed between screen reading and reading from printed out material. Annand (2008) and Çetin (2007) also found results supporting this and stated that there is no significant difference between screen reading and reading from printed out material.

These research results show that reading from printed out material increases success. Conversely, it is thought that with better planning for both students and teachers, technology becoming more widespread and its contribution to education variability could be better. Screen readers should arrange surrounding environment's physical factors like light and colour in a way which would affect the reading process positively. It is thought that the benefits of changing paper size, font type and size would help the reading process. Especially students in elementary education level should be directed to read from printed out material as it is known that they are not suitable for screen reading (Ulusoy, 2011). Students with this level should not be left alone with a computer. Different specifications of electronic scripts and the way they are becoming more widespread should be considered and in education programmes screen reading should be included. It is thought that enriched presentations with the use of animation and figures instead of plain text could be efficient for visual memory and reduce the limitations of screen reading.

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