WHAT TECHNOLOGY, SCIENCE AND SOCIETY MEANS FOR INSTRUCTIONAL TECHNOLOGISTS: EXPLORING THE RELATIONSHIP AMONG TECHNOLOGY, SCIENCE, AND SOCIETY

İlker YAKIN, Evren SUMUER, Soner YILDIRIM
Middle East Technical University

ABSTRACT: This study aims to explore the relationship among science, technology and society concepts of 1st, 2nd, 3rd and, 4th year university students of the "Computer Education and Instructional Technology Department (CEIT)" at Middle East Technical University, in Turkey. To serve this purpose, a questionnaire included 25 items was administered to 168 teacher candidates. Major findings were explored and analyzed based on the factors were identified as follows: *"Optimism", "Contextualism", "Pessimism", and "Social responsibility"*. Under the light of the study results, recommendations are offered for both implication and further studies.

Keywords: Technology, Science, Society, Instructional Technology

1. INTRODUCTION

Nowadays, technology plays a more significant role in people's daily routines including how they live, work, communicate, entertain, and learn. Despite of this fact, technology as a word has caused both confusion and different understandings because of its meaning. In many inquires, technology has been associated increasingly with machinery, objects, technical skills and scientific knowledge. Therefore, it is common that technology has been perceived as a part of applied science that transforms the understanding and discoveries of science into applications for society (Krone, 2005). Indeed, technology is created, developed and modified, so evolved, using specific knowledge and skills relating with science. However, the whole meaning of technology cannot be described with a lens of any single philosophical system or tradition (Kateb, 1997). Questioning technology in current works and describing and illuminating the central features of the technology as a phenomenon have given rise to improve the understanding of the social perspectives of the its meaning. In other words, our ideas, values, politics, history, environment, actions and cultures have impact on the meaning and also the definition of technology. As a result, exploring different perspectives for the relationship among science, society and technology is an important research inquiry.

The role of beliefs about technology and relationship between science, society and technology in Instructional Technology (IT) profession is also crucial because technology is one of the roots of the field (Ely, 1999). The definition and meanings of technology has also caused confusion in the IT field. As Romiszowski (1981) pointed out it is possible to define technology as both a product or as a process. He further advocated that considering technology only as a product led technology to be perceived as a monster which threatens all values of society. In the light of these different positions, understanding of the relationship among society, culture, gender, science and technology provides a framework for the field of IT.

2. METHODOLOGY

This study aims to explore the relationship among science, technology and society concepts among 1st, 2nd, 3rd and, 4th year university students of the "Computer Education and Instructional Technology Department (CEIT)" at Middle East Technical University, in Turkey.

3.1. Purpose of the Study and Participants

This study explored students of the CEIT department because those teacher candidates are the ones who will shape students' understanding of technology, science and society concepts. Additionally, these students are the ones who completed necessary courses, on information

technology in education, programming languages, instructional technology and material developments, instructional design, and design, development and evaluation of educational software, classroom management, distance education, development and learning and so on. These courses provide a theoretical framework for becoming both a teacher and a media specialist. The study included 168 teacher candidates; demographics of participants are depicted in table 1.

Table 1: Demographics of Participants

		Grade			
		1st grade	2nd grade	3 grade	4th grade
Gender	Male	35	24	22	33
	Female	12	14	15	13
Years of Computer Use	1-5 years	17	6	4	4
	5-8 years	22	12	13	15
	More than 8 years	8	20	20	27
GPA	Low	26	13	8	8
	Middle	9	13	14	20
	High	12	12	15	18

3.2. Instrumentation

A questionnaire which was translated and adopted from the study of Moore (2005) was used to collect data. The final version of the questionnaire included 25 items on a five-point scale; from strongly disagree to strongly agree. Statistical analysis was conducted among factors, as identified in a large scale of the research and literature by Moore (2005). The factors were identified as follows: *"Optimism", "Contextualism", "Pessimism", and "Social responsibility"*. These factors were defined in table 2 as stated by Moore (2005).

"The optimism factor derived from the belief that technology is neutral. In other words, the belief that technology represents progress and helps society and achieves goals faster or technology benefits society are the main concerns of the factor. As for Contextualism, the main characteristic of this factor is that technology can influence society, but society can also influence society. In other words, there is an interaction between technology and context. The Pessimism factor derived from the idea that "technology is designed with values implicit in the design and that technology has the ability to fundamentally change our essence. Last factor, Social Responsibility was derived the idea that humans can exert influence over the use and design of the technology" (Moore, 2005, p.136).

Table 2: Definitions of the Factors

Factors	Identification	Definition
Factor 1	Optimism	"This factor measured whether a person an optimistic view of technology and its impact on society"
Factor 2	Contextualism	"This factor measured whether persons thought there was a relationship between a technology and the context in which it is used"
Factor 3	Pessimism	"This factor measured whether a person was generally pessimistic about technology and its impact on society"
Factor 4	Social Responsibility	"This factor measured whether participants believed technology was means to end, rather than an end in itself"

A reliability analysis was conducted for the entire scale and for the subscales as well. The Cronbach alpha coefficient of a scale was .59, pointed out a low level of internal consistency of items. In Moore's study, the initial reliability for entire scale was .76, after excluding items with low coefficient values; coefficient value scaled up to .80. In our study, subscale reliability scores are reported in Table 3.

Table 3: Subscale Reliabilities

Subscale	Reliability	Number of Items
Factor 1: Optimism	.501	6
Factor 2: Contextualism	.492	11
Factor 3: Pessimism	.443	5
Factor 4: Social Responsibility	.586	3

3.3. Overall Design and Procedure

Descriptive research design was employed in this study to explore the relationship among science, technology and society concepts among teacher candidates. The survey included four independent variables (gender, the years of computer experience, GPA, and grades) and one dependent variable (Factors). The questionnaire was administered to the CEIT students of four different grades and data were obtained from different class sections on voluntarily basis. The data has been examined with respect to assumptions of parametric test. The assumption of normality was not violated because of the large enough sample size (N=168). The equity of group variances was determined with the Levene statistics. For the analyses, t-test for independent groups and one-way analyses of variance with Tukey's HSD post hoc test if the data provide assumptions of normality and homogeneity of variances has been computed.

4. RESULTS

Firstly, independent samples t-test was applied to determine whether there was a significant difference between male and female in relation to the factors. Analyses demonstrated that there were no significant differences among factors in associated to genders (Table 4).

Table 4: Differences between genders in relation to factors

Factor	Gender	N	M	SD	*t*	*p*
1. Optimism	Male	114	3.73	0.45	-0.33	0.743
	Female	54	3.75	0.39		
2. Contextualism	Male	114	3.58	0.37	-0.18	0.858
	Female	54	3.60	0.43		
3. Pessimism	Male	114	3.52	0.51	-0.48	0.634
	Female	54	3.56	0.52		
4. Social Responsibility	Male	114	2.58	0.68	-1.06	0.290
	Female	54	2.69	0.66		

Secondly, the differences in perspectives between the years of computer experience in relation to four factors were statistically analyzed by one-way analysis of variances (ANOVA) test for each factor. According to the values in Table 5, there was not a statistically significant difference at the $p<.05$ level in factors for the computer experiences of students.

Table 5: Differences between the years of computer use

Variable	1-5 years		5-8 years		More than 8 years		ANOVA	
	M	SD	M	SD	M	SD	F	p
1. Optimism	3.67	0.24	3.69	0.38	3.81	0.52	1.78	.172
2. Contextualism	3.45	0.31	3.59	0.37	3.63	0.42	2.57	.080
3. Pessimism	3.40	0.49	3.52	0.50	3.61	0.52	1.86	.159
4. Social Responsibility	2.43	0.72	2.63	0.63	2.68	0.69	1.56	.210

Thirdly, the differences in perspectives between students' GPA (Grade Point Average) scores in relation the factors were statistically analyzed by one-way analysis of variances (ANOVA) test. Table 6 below indicates that there was not a significant difference between GPA scores for the factors.

Table 6: Differences between GPAs'

Variable	Low		Middle		High		ANOVA	
	M	SD	M	SD	M	SD	F	p
1. Optimism	3.72	0.44	3.76	0.41	3.73	0.45	0.19	.827
2. Contextualism	3.58	0.38	3.53	0.39	3.65	0.38	1.48	.231
3. Pessimism	3.47	0.56	3.64	0.46	3.49	0.49	1.79	.171
4. Social Responsibility	2.65	0.72	2.67	0.65	2.54	0.67	0.59	.552

Lastly, in order to determine there was a significant difference between 1st, 2nd, 3rd, and 4th grade students in relation to factors, one-way analysis of variances (ANOVA) test was run, and the groups were compared. As presented in Table 7, there was a significant difference among grades in factor 2 (Contextualism). [$F(3, 164) = 2.68$, $p = .049$]. The effect size calculated using eta squared, was .04, which in Cohen's (1988, as cited in Pallant, 2001) terms, can be considered as small effect size.

Table 7: Differences between grades

Variable	1st Grade		2nd Grade		3rd Grade		4th Grade		ANOVA	
	M	SD	M	SD	M	SD	M	SD	F	p
1. Optimism	3.70	0.33	3.67	0.43	3.71	0.49	3.85	0.47	1.57	.198
2. Contextualism	3.58	0.38	3.46	0.35	3.70	0.41	3.61	0.38	2.68	.049
3. Pessimism	3.43	0.56	3.49	0.52	3.64	0.49	3.59	0.44	1.48	.222
4. Social Responsibility	2.58	0.76	2.69	0.72	2.73	0.64	2.50	0.57	1.01	.392

Follow-up tests were performed to find out which level(s) differs significantly among the group. Because homogeneity of variances assumption was not violated (significance value = .888), we assumed equal variances among groups and used Tukey's HSD post hoc test as a follow-up test. Post-hoc comparisons using the Tukey HSD test indicated that the mean score of 3rd grade students (M=3.70, SD=0.41) was significantly different from 2nd grade students (M=3.45, SD=0.34).

5. CONCLUSION

This study investigated the relationship among science, technology and society concepts among 1st, 2nd, 3rd and, 4th year teacher candidates. The results indicated that there were no significant differences among factors based on genders, computer experiences and GPA scores.

Moreover, the result pointed that the grade of the teachers' candidates had no significant effect on the mean scores of three factors; namely, optimism, pessimism and social responsibility. However, only one significant difference was found between the mean score of 2nd grade and 3rd grade students in the contextualism factor.

Although there was a difference between 3rd grade students and 2nd grade students on mean score of the factor, contextualism, the effect of grade of the teacher candidates on the factor was small. (Significance value was .049; very close to significance level of .05). Therefore this significant result might be misleading when interpreting the finding. The findings pointed out the fact that 2nd and 3rd grade teacher candidates' belief, which was based on the idea that technology can influence society, and vice versa, differs for some reasons. Because of the small effect size, and significance value we concluded that some other factors may lead that result.

Teacher candidates from the CEIT departments should gain the understanding of different philosophical perspectives about technology throughout their education. These different perspectives or beliefs about technology and the relationship between technology, society and science are vital not only for their professional development but also for requirements of their educational life.

Although this study is limited to a small number of participants from CEIT department, more investigations and in-depth researches should be conducted to understand teacher candidates' perspectives. Additional studies should be performed to understand teacher candidates' theoretical and philosophical perspectives on technology, society and science.

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