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DEVELOPING PRE-SERVICE SCIENCE TEACHERS' COGNITIVE STRUCTURES ABOUT TECHNOLOGY: WORD ASSOCIATION TEST (WAT)

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Abstract
The purpose of this study was to examine the development of senior pre-service science teachers' cognitive structures about technology. Cognitive structures about technology were investigated by using a Word Association Test (WAT). In order to construct the WAT, eight words were selected. WAT was used as a pre- post test to thirty senior pre-service science teachers. The study constructed in spring semester 2010. Pre-service teachers designed technology supported instruction and presented to their peers who acted as pupils. In the analyze procedure, meaningful responses were accepted and counted for each key word than frequency table was prepared. Concept map was drawn by using the frequency table. To draw concept maps, the cut-off point was determined to be 25-up. Also t-test pair wise comparisons were calculated. When the pre-concept maps were examined, it was found that pre-service science teachers' cognitive structures about technology were generally at the novice level. For example, they associate educational technology with computers. Furthermore, when the post- concept maps were examined pre-service science teachers' responses were improved in general. As a consequence there was increasement in association rate and also the number of associated words.
Keywords: Word Association Test, Cognitive Structure, Pre-Service Science Teachers, Technology Supported Teaching.

INTRODUCTION

Word Association Test (WAT) is one of the most common and oldest methods for investigating cognitive structures and has been used by several researchers (Cachapuz & Maskill, 1987; Gussarsky & Gorodetsky, 1988; Bahar, Johnstone & Sutcliffe, 1999; Taşar, 2001; Bahar & Öztatlı, 2003; Aydın & Taşar, 2010, Ercan, Taşdere & Ercan, 2010; Ören, Ormancı, Babacan, Koparan, & Çiçek 2011). "Understanding how students acquire knowledge is always an important issue for science education researchers." (Tsai & Huang, 2001). Participants' cognitive structure about technology was investigated by WAT.

METHOD

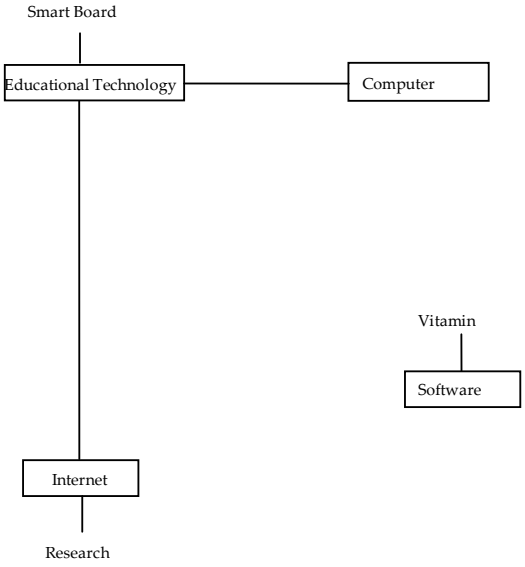
This study aims to examine how senior pre-service science teachers' cognitive structures about technology changes during a technology and design course that involves technology supported teaching. The research question is that "What is the effect of using technology supported teaching to enhance pre-service science teachers' cognitive structures about technology?" For this purpose

WAT was used. In order to construct the WAT, eight words were selected. The selected words were; computer, educational technology, Internet, ICT, educational software, animation, simulation, and technological pedagogical content knowledge (TPCK). Each key word was written at the top of the page in WAT. Pre-service science teachers' were required to write maximum ten responses for each key word that they recalled associated with that key word. We gave 10 seconds for each word. WAT was used as a pre- post test to thirty senior pre-service science teachers participated in the study in spring semester 2010. The senior pre-service science teachers were taking a technology and project design course which was being taught by the researcher during the period of the study. Pre-service teachers designed technology supported instruction and presented to their peers who acted as pupils. In the analyze procedure, meaningful responses were accepted and counted for each key word than frequency table was prepared. Concept map was drawn by using the frequency table. To draw concept maps, the cut-off point was determined (Bahar, Nartgün, Durmuş & Bıçak, 2006) to be 25-up. Next, this cut-off point was lowered three times and following concept maps were drawn for each cut-off point. Also t-test pair wise comparisons were calculated.

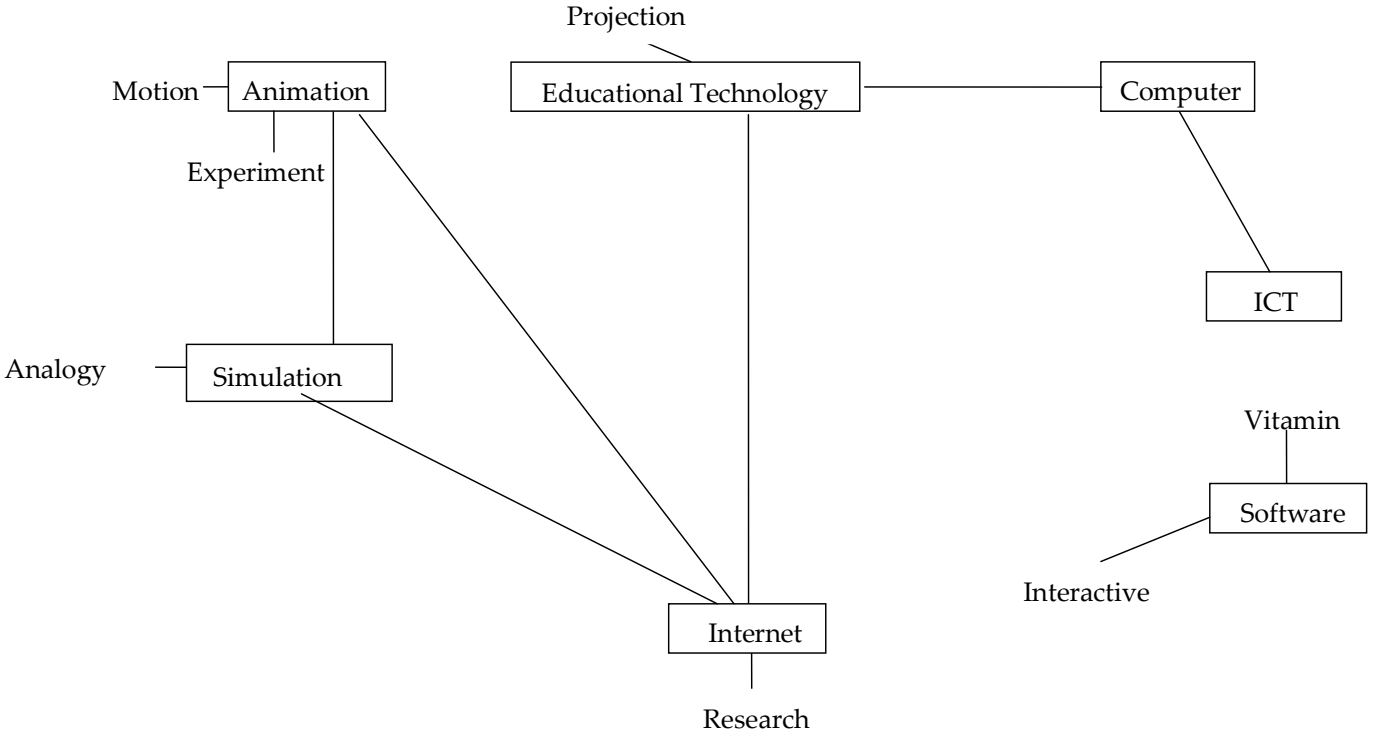
FINDINGS

For each key word than frequency table was prepared. Concept map was drawn by using the frequency table. To draw concept maps, the cut-off point was determined to be 25-up. Next, this cut-off point was lowered three times and following concept maps were drawn for each cut-off point. A sample concept map is shown below:

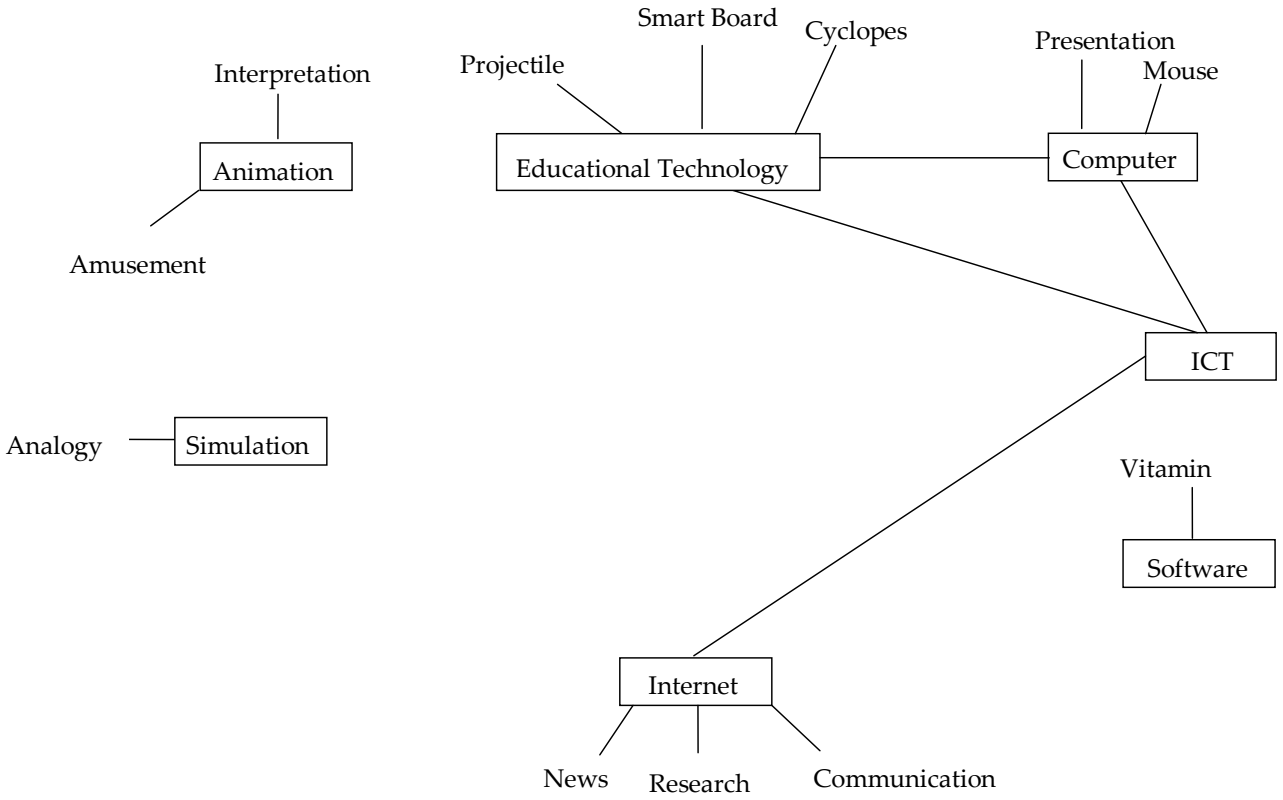
Pre-test concept map: **Cut-off point 15-19**



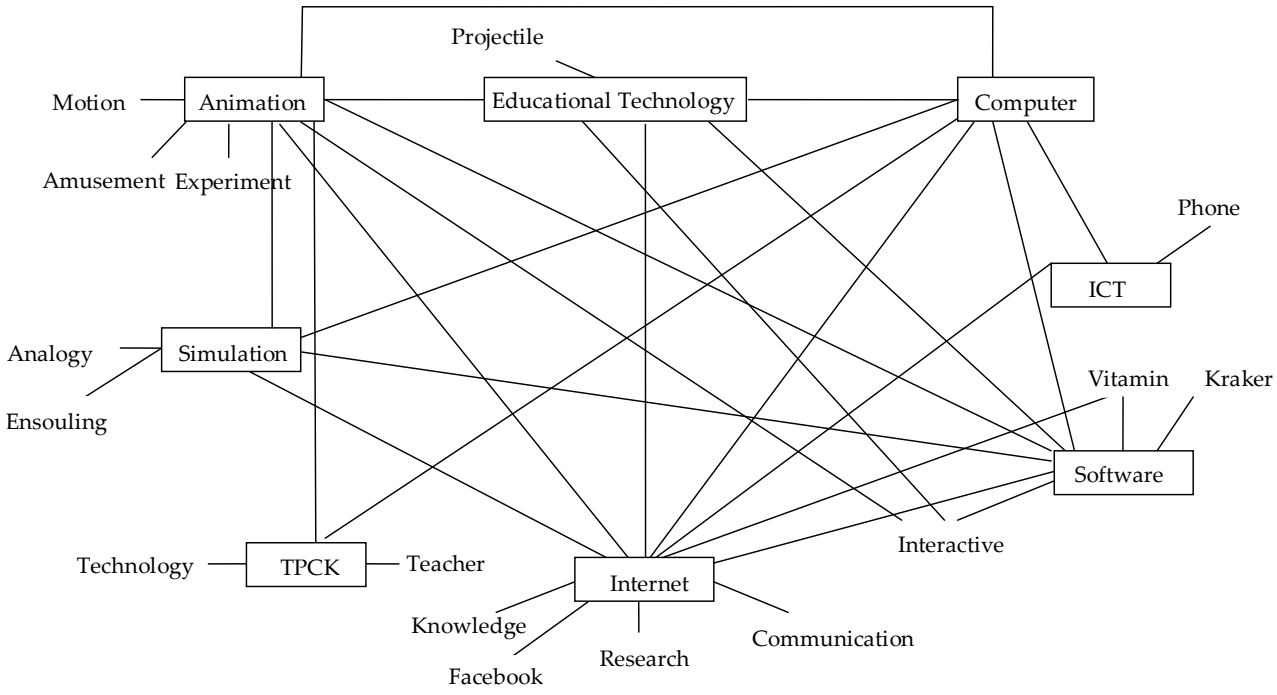
Post-test concept map: **Cut-off point 15-19**



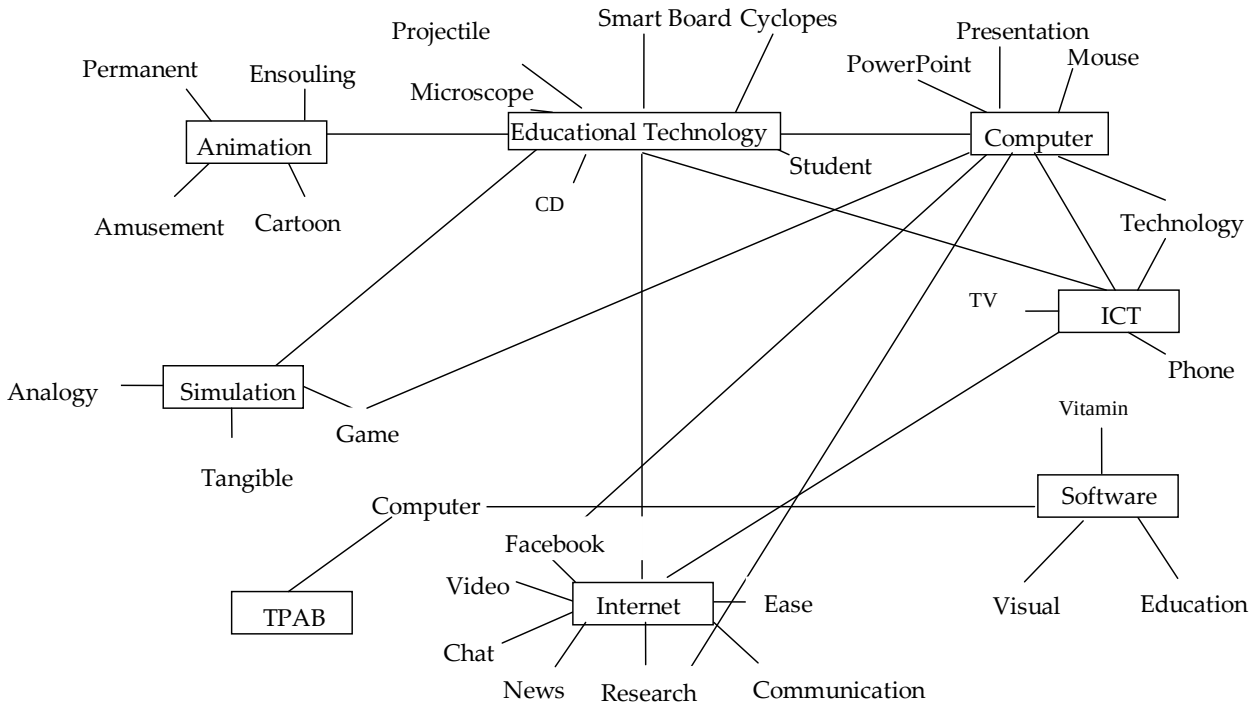
Pre-test concept map: **Cut-off point 10-14**



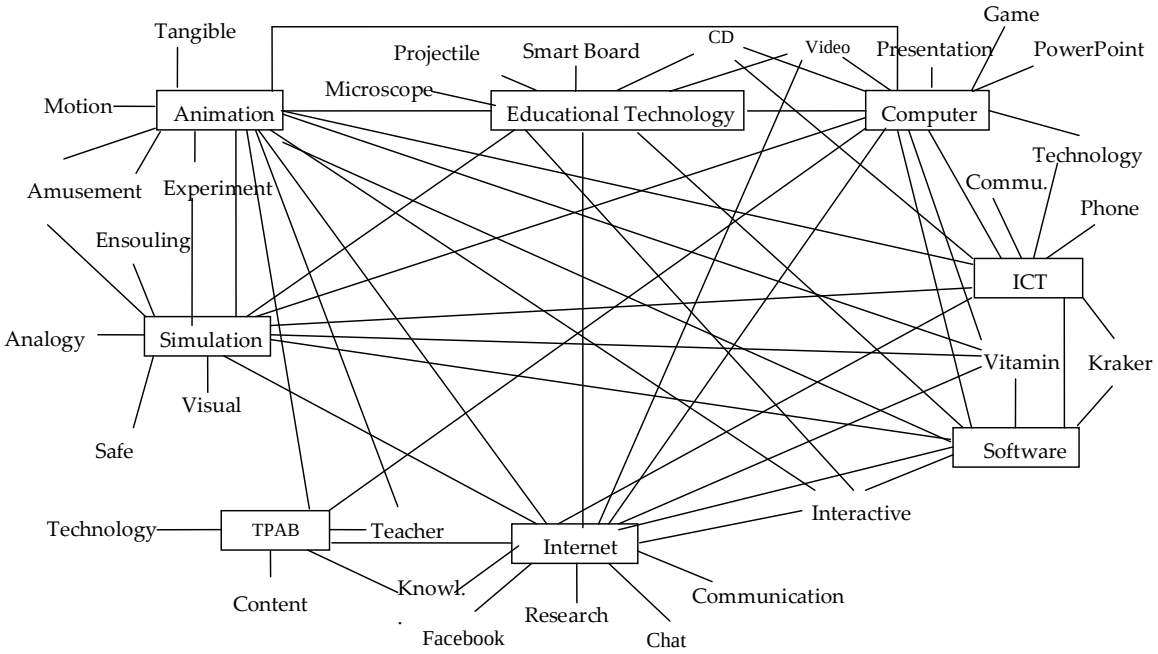
Post-test concept map: **Cut-off point 10-14**



Pre-test concept map: **Cut-off point 5-9**



Post-test concept map: **Cut-off point 5-9**



When the pre-concept maps were examined, it was found that pre-service science teachers' cognitive structures about technology were generally at the novice level. For example, they associate educational technology with computers. Furthermore, when the post- concept maps were examined pre-service science teachers' responses were improved in general. As a consequence there was an increasement in association rate and also the number of associated words (Table 2). In addition, this increasement is remarkable in that the concepts presented in the test (Table 1).

Table 1. Results of Paired-Sample t-Tests for Total Reponses

	N	M	Sd	Min	Max	Df	t	p
Pre test	30	26.56	9.47	12	45	29	-10.65	.000*
Post Test	30	43.13	8.10	30	58			

*Significant at the. 05 level.

Pre and post-test means were calculated for the meaningful responses of pre-service teacher. There were significant improvements between pre and post scores on meaningful responses to each key word. For the paired sample t-test, results indicate significant increase for all constructs. This means pre-service science teachers' responses to each keyword were improved as compared to the pre test (Table 2).

Table 2. Responses for each key word

Key word	Number of word	
	Pre test	Post test
Animation	83	175
Simulation	91	176
TPCK	55	103
Computer	122	169
ICT	64	126
Educational technology	136	187
Internet	129	204
Educational software	86	130
Total	769	1270

DISCUSSION and CONCLUSION

This study indicates that pre-service science teachers' cognitive structures about technology improve during a technology and design course that involves technology supported teaching. When the pre-concept maps were examined, it was found that pre-service science teachers' cognitive structures about technology were generally at the novice level. For example, they associate educational technology with computers. Furthermore, when the post- concept maps were examined pre-service science teachers' responses were improved in general. As a consequence there was increasement in association rate and also the number of associated words. In addition, this increase is remarkable in that the concepts presented in the test. The results of our study are quite compatible with the findings of literature (Bahar & Öztatlı, 2003; Aydın & Taşar, 2010, Ercan, Taşdere & Ercan, 2010) and support them.

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