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THE ADAPTATION OF THE NATURE OF TECHNOLOGY SCALE TO TURKISH

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ABSTRACT: The purpose of the present study was to adapt the instrument for assessing students' concepts of the nature of technology scale developed by Pey-Yan Liou to Turkish language in order to assess its reliability and validity, and to analyse the gender and school differences. The scale consists of 29 items and six sub-dimensions named technology as artifacts, technology as an innovative change, the current role of technology in society, technology as a double-edged sword, history of technology, and technology as a science-based form. Data in this study were collected from a total number of 360 students studying at four different high schools. Validity and reliability studies were carried out. As part of validity studies expert opinion was collected, linguistic equivalence and confirmatory factor analysis were used. As part of reliability studies Cronbach Alpha's coefficient of internal consistency was calculated. In accordance with the analyses carried out in this study, the scale was adapted to Turkish language as a valid and reliable scale.

Key words: Nature of technology, scale development, reliability, validity

INTRODUCTION

The answer we get can be remarkably different when we ask the question "What is the (nature of) technology?" to a young student or an old man. In our age, even infants suddenly find themselves in a technological world in all areas of the life. That's why we need to investigate how new generations' concepts of nature of technology are formed. Technology plays a significant role in meeting the future challenges and fulfilling the demands of the global economy for a nation's growth. The nature of technology has been rarely discussed despite the fact that technology plays an essential role in modern society (Liou, 2015).

What is the nature of technology?

There is considerable disagreement over the definition of technology. Although there is a lack of consensus over the role technology should play in the curriculum, technological concepts are being taught, are expected to be taught, and should continue to be taught (DiGironimo,2011). The definition of the nature of science has been more widely discussed than the definition of nature of technology. The concept of nature of science is dynamic and involves systematic thinking about science which has changed through the development of science (Celik and Bayrakçeken 2006). The meaning of NoT can be broadly defined as human-made systems and processes (NRC, 2011). In Technology for All Americans Project, the standards to get a concept of the nature of technology are defined as an understanding of the characteristics and the scope of technology; core concepts of the technology and the relationships among technologies and the connections between technology and the other fields of the study (ITEA, 2000).

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Purpose of the Study

The purpose of this study was to adapt the instrument for assessing students' concepts of the nature of technology scale developed by Pey-Yan Liou (2015) to Turkish language in order to assess its reliability and validity.

METHODS

The Participants

Table 1: The Participants

School Type	Grade			Gender	
	9th	10th	11th	Male	Female
Science High School	27	24	28	37	42
Anatolian High School	93	83	55	88	143
Anatolian Religious Vocational High School	51	-	-	51	-
Total	171	107	83	176	185

The participants included 361 high school students of whom 185 were female, 176 were males. The participants study in three different high school types in the Province of Karaman/Turkey. It took about 15 minutes for students to answer the scale.

The scale consists of 29 items and six sub-dimensions. First, to understand students' perceptions of technology, Liou collected students' written statements via an open ended question. Content analysis was utilized to discuss and categorize students' statements regarding technology and its related issues. Third, a revised questionnaire, modified from the results of the second stage, was administered to a whole new sample. Finally, exploratory factor analysis and reliability analysis were applied to determine the structure of the items and the internal consistency of each scale. The Student Concepts of the Nature of Technology Questionnaire was developed based on the proposed theoretical framework and was supported by the students' qualitative data.

After getting the permission from Liou for the study, the items were translated into Turkish language by three experts who are fluent in both English and Turkish. The original scale and the translated ones were sent to English teachers. The backtranslation process which means translating a document that has already been translated into a foreign language back to the original language - preferably by an independent translator, was completed in this way. According to the expert opinion the scale items were organized again.

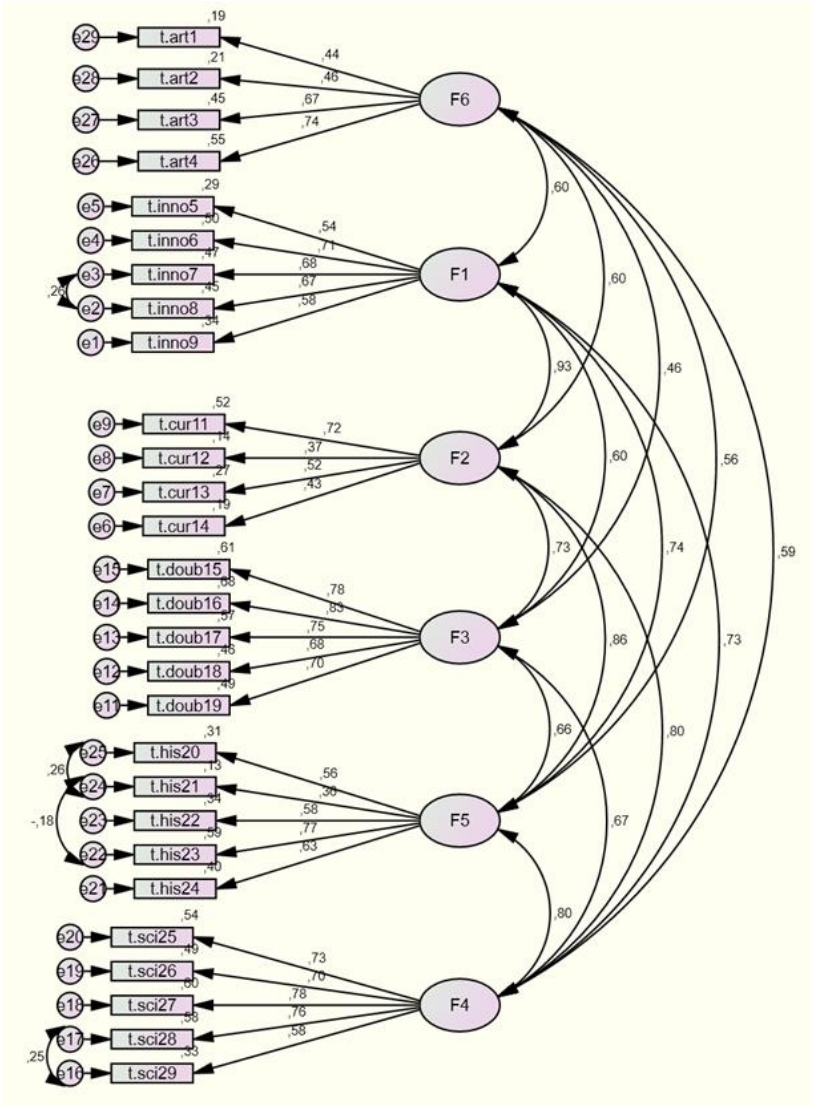
RESULTS and FINDINGS

Confirmatory Factor Analysis

An explanatory factor analysis had already been made by the developer of the scale. So the theoretical pattern of the scale had already been revealed. Therefore the researchers felt no need to make an explanatory factor analysis again. Confirmatory factor analysis (CFA) was employed to model a six factor solution through the use of AMOS program. According to the first confirmatory factor analysis item-10 in the dimension of "The current role of technology in society" eliminated whose factor load was .21. Because this score was below .30 which is regarded as a breakpoint (Kline,2005).

After ruling out the item-10, another CFA was performed on the dataset obtained from 361 participants. As a result of the analysis conducted, goodness of fit indices of the 6-factor model were examined and it was found that chi-square value ($\chi 2$=535,311 sd= 331, $\chi 2$/sd=1.617 p=0.00) was significant. In confirmatory factor analysis, if the $\chi 2$/sd rate obtained is smaller than 3, then this shows that the model has favorable goodness of fit values (Kline, 2005; Tabachnick & Fidell, 2007).

According to the model formed, the standardized factor loads are between .82 and .36. All these values are above .30 which is regarded as a breakpoint (Kline,2005). It is also observed that the covariance value between the dimensions of the model is high. Additionally, the Cronbach Alpha value was calculated as .91. All items were contributing to the reliability with high item-total correlations.



In this sense, it was observed that the 6-factor model was highly compatible with the data. When the other indices included in the model were examined, it was seen that CFI value was .95, IFI value was .95, and RMSEA value was .041. The values obtained for the specified indices are regarded as indicators of good fit values in model studies (Kline, 2005; Tabachnick and Fidell, 2007).

Table 2: The Goodness of Fit Indices of CFA

Fit Indices	Perfect Fit	Good Fit	The Scale Results
χ2/df	≤ 5	≤ 3	1.61
RMSEA	≤.05	≤.08	.041
SRMR	≤ .05	≤.08	.044
CFI	>.97	>.95	.95
NFI	>.95	>.90	.87

CONCLUSION

Students are more easily educated to become technologically literate than adults through formal education. Therefore, it is logical and necessary for researchers and educators to capture students' perceptions of nature of technology and further develop instruction to equip them with advanced technological capability and to be technologically literate (Liou, 2015). With respect to the human and social aspects of technology we can observe that young people often see technology as something positive. There are not that many pupils and students that show awareness of the negative impacts of technology. Maybe this is because of their strong focus on technology as artifacts. It is their direct experience that these artifacts often make life easier and more comfortable, and the negative impacts of technology are at a different level that they do not yet get to see or that does not yet appeal to them very much (de Vries, 2005:107).

If an average student is asked if (s)he can describe technology, the most probable answer is a list of technological artifacts. And most pupils and students have no problems in mentioning a whole variety of artifacts: radio, television, lasers, robots, and many others. However the list is not as rich as it may seem to be at first sight. The first limitation is the prominent place of the computer in the lists that pupils and students generate. Technology is in the very first place: computers. A second limitation is that technology is primarily 'high tech'. Once in an interview a 13-year-old boy responded to a researcher's question about what technology is by mentioning the steam engine. But he immediately took back his answer by stating that this was not an appropriate example of technology, because it was too old. Clearly something has to be at least a 20th century invention in order to be called technology. 'Technology' then is all these almost magic things that can help the country get to the level of modern, industrialized countries. In general we can see that children reflect what society tells them about technology. Watching television and reading magazines constantly enhances the idea that technology is 'high tech' (de Vries, 2005:106).

REFERENCES

Celik, S., & Bayrakçeken, S. (2006). The effect of a 'Science, Technology and Society'course on prospective teachers' conceptions of the nature of science. *Research in Science & Technological Education*, *24*(2), 255-273.

De Vries, M. J. (2005). *Teaching about technology: An introduction to the philosophy of technology for non-philosophers* (Vol. 27). Springer Science & Business Media.

DiGironimo, N. (2011). What is technology? Investigating student conceptions about the nature of technology. *International Journal of Science Education*, *33*(10), 1337-1352.

Kline, R. B. (2005). Principles and practice of structural equation modeling. Guilford Press. *New York*, 59.

Liou, P. Y. (2015). Developing an instrument for assessing students' concepts of the nature of technology. *Research in Science & Technological Education*, *33*(2), 162-181.

National Research Council. (2011). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: National Academy Press.

Tabachnick, B. G., & Fidell, L. S. (2007). *Experimental designs using ANOVA*. Thomson/Brooks/Cole.

Technology for All Americans Project, & International Technology Education Association. (2000). *Standards for technological literacy: Content for the study of technology*. International Technology Education Association.