TRIZ in Technology Education: Perceptions of Future Teachers

John Stamey

John W. Stamey, Coastal Carolina University, Conway, SC
jwstamey@coastal.edu
Richard Peterson, North Carolina State University, Raleigh, NC
richard_peterson@ncsu.edu

ABSTRACT

The support TRIZ provides for creativity during the invention process makes it ideally suited for the field of Technology Education. Technology education provides instruction in the content areas of manufacturing, communication, transportation and construction. As creativity has long been an important part of the technology education curriculum in middle schools and high schools, a study of the perceptions of TRIZ by future technology education teachers was seen to be a first step toward the introduction of TRIZ into the curriculum. A group of masters-level and doctoral-level students in Technology Education students at North Carolina State University received a TRIZ workshop which included training on the methodology as well as time to use the techniques to solve problems particular to technology education. This article reports the perceptions of future technology education teachers about TRIZ and its potential use in the classroom.

INTRODUCTION

The field of Technology Education has been organized into four main content areas of Communication Technology, Construction Technology, Manufacturing Technology and Transportation Technology since the publication of Jackson's Mill Industrial Arts Curriculum Theory in 1981. Also, at that time, the field of Technology Education confirmed an emphasis in problem solving. Problem solving was acknowledged as a process of seeking feasible solutions to a problem (Foster, 1994). The current standard for Technology Education curriculum is found in the *Standards for Technological Literacy*, part of the Technology for All Americans project (ITEA, 2002).

TRIZ is a well-known method to foster creative problem solving that has been used in the development of a number of inventions that have received US Patents. TRIZ has a five-part problem-solving methodology that provides a structured approach to assisting a divergent-thinking approach for creative problem solving. The five steps include

- Determining the problem;
- Restating the problem in terms of contradictions;
- Stating the technical conflict in terms of the 39 technical characteristics;
- Looking for the analogous solution from the 40 principles; and,
- Determining the final creative solution.

THE STUDY

The purpose of this study was to examine technology education graduate students' interest in TRIZ in order to determine its feasibility for use in teaching creative problem solving. In this study, the subjects participated in a two-hour workshop in which they were introduced to TRIZ, and its potential in the classroom. The workshop was held on February 14, 2006 in the TED 558/758 Creative Problem Solving class at North Carolina State University.

The method of instruction began with thirty minutes of lecture on the history of TRIZ and the TRIZ method. The thirteen subjects were then divided into groups of either two or three, where they worked for ninety minutes to develop a unit of instruction in TRIZ by identifying

- A problem suitable for high school students
- The engineering parameters found in the physical contradictions posed by the problem
- The technical characteristics needed to solve the problem
- The final solution

The subjects (n = 10) were surveyed using a pen and paper instruments at the ninety minute session in which they were involved in developing a lesson aimed at high school technology education students. The survey instrument incorporated dichotomous and open-ended questions regarding their experiences. The questions sought to determine whether the subjects, as future teachers, perceived the usefulness of TRIZ in technology education, as well as their overall opinion of TRIZ as a creative learning tool in Technology Education.

The instrument used to gather data was developed in a manner similar to Burgess (2003). Descriptive statistics were calculated for the dichotomous items and the qualitative data were analyzed for emerging themes and consistency. Finally, the data was then sorted by opinion for middle school students and high school students. 72% of the subjects were doctoral-level students in Technology Education, 18% of the subjects were masters-level students in Technology Education, and 9% of the students were participating in a lateral entry program (hence, were not advanced degree seeking students). The results of this analysis follow.

RESULTS OF THE STUDY

The figure below shows the data collected from the survey.

Question	Middle School	High School
1. Most Challenging (Mode)	Looking for analogous solutions among the 40 principles	Restating the problem in terms of contradictions
2. Least Challenging (Mode)	Determining the problem	Determining the problem
3. Good for creative problem solving*	4.0	4.2
4. Rank - Communication**	3.5714	3.2500
5. Rank - Construction**	2.5714	2.5000
6. Rank - Manufacturing**	3.0000	2.6250
7. Rank - Transportation**	3.1429	3.2500
8. Grade Level to Introduce	7.8	10.667

*scale 1-5 **scale 1-4

Conclusions reached in the survey are discussed below, along with the presentation of the question prompting the responses.

Question 1: Which Activity do you think the students will find the MOST challenging?

- Determining the problem
- Restating the problem in terms of contradictions
- Stating the technical conflict in terms of the 39 technical characteristics
- Looking for the analogous solution from the 40 principles
- Determining the final creative solution

Respondents felt that looking for analogous solution from the 40 principles would be the most difficult activity for middle school students. They felt that restating the problem in terms of contradictions would be the most difficult activity for high school students.

Question 2: Which Activity do you think the students will find the LEAST challenging?

- Determining the problem
- Restating the problem in terms of contradictions
- Stating the technical conflict in terms of the 39 technical characteristics
- Looking for the analogous solution from the 40 principles
- Determining the final creative solution

Respondents felt that determining the initial problem would be the easiest task for both middle school and high school students.

Question 3: TRIZ will be an asset in helping students learn about creative problem solving.

5. Definitely Agree
4. Agree
3. No Opinion Either Way
2. Disagree
1. Definitely Disagree

Respondents agreed the TRIZ creative problem solving method was a good idea to teach creative problem solving in both middle school and high school.

Questions 4-8: Rank (from 1 to 4), the order in which you think TRIZ is most applicable (where 4 indicates TRIZ is most applicable in this field, and 1 indicates TRIZ is least applicable in this field)

1	2	3	4	Communication Technology
1	2	3	4	Construction Technology
1	2	3	4	Manufacturing Technology
1	2	3	4	Transportation Technology

Respondents felt that, overall, TRIZ was most applicable to the communications technology content area, and least applicable for the construction technology content area. This opinion held for both middle school and high school.

Question 9: Circle the best grade level in which to begin TRIZ training:

Middle School:	7^{th}	8^{th}	9^{th}	None of these
High School:	10^{th}	11^{th}	12^{th}	None of these

Respondents felt that TRIZ should be introduced earlier (rather than later) in both middle school and high school.

CONCLUSIONS

The results of this study show that a collection of future Technology Education instructors believe that TRIZ is worthwhile to introduce in the classroom, at both the middle school and the high school levels. Further research is needed as TRIZ is deployed in the classroom. An initiative in this area is currently underway by the authors of this study.

REFERENCES

Burgess, L.A. WebCT as an E-Learning Tool: A Study of Technology Students' Perceptions. Journal of Technology Education, Volume 15, Number 1, Fall 2003. Retrieved February 10, 2006 from http://scholar.lib.vt.edu/ejournals/JTE/v15n1/burgess.html/.

Foster, P. N. Technology Education: AKA Industrial Arts. Journal of Technology Education, Volume 5, Number 2, Spring 1994. Retrieved February 10, 2006 from http://scholar.lib.vt.edu/ejournals/JTE/v5n2/foster.jte-v5n2.html/.

International Technology Education Association, 2^{nd} Edition, (2002). Standards for Technological Literacy: Content for the Study of Technology. Reston, VA: ITEA.