

The Assessment and Characterization of Critical Thinking Skills of Upper Division Technology Students Using the Critical Thinking Assessment Test (CAT)

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Abstract

Critical thinking skills are essential for 21st century citizens to possess (Halpern, 1997). Educators and employers are assessing these skills many different ways ranging from multiple-choice tests to subjective observational protocols. This research focused on the assessment of undergraduate students nearing degree completion in a technology program. The assessment instrument used was the Critical Thinking Assessment Test (CAT), developed by Tennessee Technological University under the sponsorship of the National Science Foundation (Stein & Haynes, 2011). It is an assessment tool that is designed to measure important components of critical thinking. This test also provides feedback that can assist the faculty in determining some measure of the effectiveness of coursework, curricula, and departmental learning activities. Characteristics of critical thinking include the abilities to evaluate information, to think creatively, to learn, and to solve problems. These skills are desired by employers and are a valued capability of technology graduates (Davies, 2013; Scott, 2008). Because they are necessary for the future success of undergraduate technology students, it is valuable to have a direct measure of critical thinking skills. By using an empirical assessment of these skills, faculty can assess what critical thinking skills are present or are lacking in undergraduate students and make curricular improvements to better develop these skills.

Over a three-year period, the CAT exam was administered to six groups of undergraduate students at a large midwestern research university during their final year of study. A total of 209 students from all four different degree program options offered at this institution (Agricultural & Biosystems Management (ABM), Machine Systems (MS), Manufacturing (MFR), and Occupational Safety (OS)) participated in this study. The reported test score national mean was 19.04. The test score mean of this sample of upper division technology students from all options was 18.62. These undergraduate technology students performed with no statistically significant difference from the CAT exam population, $t(208) = 1.22, p = .22$. When considering CAT exam performance by degree option, the ANOVA indicated difference existed, $F(3,205) = 3.27, p = .022$. The application of the Tukey HSD test revealed that the only significant difference between the means, $p < .01$, existed between the Agricultural & Biosystems Management ($M = 19.85, SD = 5.19$) and Occupational Safety ($M = 15.50, SD = 4.42$) students.

This current research confirms that the CAT exam is useful for assessing the critical thinking skills of undergraduate technology students. A difference in exam scores of the ABM students and OS students warrants further investigation. Future research with this same undergraduate student sample includes analysis of individual CAT scores, ACT scores, and high school grade point averages to determine their relationship. Also, the CAT score relationship to grades in prerequisite degree coursework and grades in technology specific courses will be examined. Future research can better assist faculty members in identifying particular course and curriculum opportunities to further develop critical thinking skills in undergraduate technology students.

Keywords

Critical thinking, Critical Thinking Assessment Test (CAT), technology students.

Biography

Matthew Harvey is a Ph.D. candidate in Industrial and Agricultural Technology in the Department of Agricultural and Biosystems Engineering at Iowa State University, Ames, Iowa, USA. He earned a Bachelor of Science in Packaging from Michigan State University and a Master of Science in Administration from Central Michigan University. He is also a graduate of the Advanced Program Management Course of the Defense Acquisition University and earned Master's Certificates in Contract and Project Management from George Washington University. He is a past board chair of the Association of Technology, Management, and Applied Engineering and holds several certifications by the American Society of Quality. A participant in the Center for the Integration of Research, Teaching, and Learning (CIRTL) and Preparing Future Faculty (PFF) programs, he has earned the designation of Scholar in both. His research interests include digital fabrication, safety, packaging, critical thinking, and the scholarship of teaching and learning.