Research Proposal: Assessing Creativity in Chemistry Students in the Science, Technology, Engineering and Mathematics (STEM) Fields

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Despite its importance to society, creativity has received relatively little attention in psychology relative to other research topics (Feist, 1999; Sternberg & Lubart, 1999). Highly creative people redefine problems, analyze ideas, persuade others, and take reasonable risks to help generate ideas (Sternberg, 2001). "Creativity is certainly among the most important and pervasive of all human activities. Homes and offices are filled with furniture, appliances, and other conveniences that are products of human inventiveness" (Simonton, 2000, p. 151). Although people have been engaged for centuries in creativity, only in the past few decades has this process been considered capable of analysis and improvement (Soibelman & Peña-Mora, 2000).

About 50 years ago, previous discussion concerning creativity focused on artistic and aesthetic creativity (Cropley & Cropley, 2005). After launching Sputnik, attention regarding the importance of creativity in science became emphasized (Cropley & Cropley, 2005; Ferguson, 1992). J.P. Guilford's presidential address to the American Psychological Association (APA) noted the importance of creativity research and the need for assessment (Guilford, 1950). At the same time, Vannevar Bush's interests in engineering creativity led to establishment of the National Science Foundation (NSF) in the 1950's. The NSF has sponsored conferences on "scientific creativity" since the early 1960's. Yet, "as interest in engineering design faded in most engineering schools,

creativity was put on a back burner" (Ferguson, 1992, p. 57). More recently, there is growing interest in and need for the utilization of creativity in the sciences.

Currently, a core mission statement of many educational programs is to address creativity and critical thinking skills in the college curriculum. However, few institutions utilize an empirical method of evaluating creativity. Kaufman and Baer (2005) stated that the published literature suggests that creativity may be domain specific. Even in similar domains—underlying mechanisms may be different.

We are interested in assessing creativity in the Science, Technology, Engineering and Mathematics (STEM) fields. In particular, we are interested in assessing creativity in chemistry students, since these students are often enrolled in STEM majors.

Methodology

Participants

Data will be collected from approximately 300 chemistry students from a large Midwestern university after Institutional Review Board (IRB) approval is obtained for the research. These students will also be assessed in the autumn quarter and reassessed in the spring quarter. The REEL (Research Experiences to Enhance Learning) Program Director will assist with the coordination of test administration with chemistry faculty teaching introductory chemistry courses.

Instruments

Participants were successively administered a demographic questionnaire with self efficacy in science assessment and two general creativity measures consisting of the Creative Personality Scale (CPS) and the Cognitive Risk Tolerance Scale (CRT).

Demographic Questionnaire. A demographic questionnaire will be administered requesting information such as age, gender, ethnicity, major and class rank. Additional questions will address creative self efficacy that is domain specific to science classes.

CPS: Creative Personality Scale. The *Creativity Personality Scale (CPS)* of the *Adjective Checklist (ACL)* (Gough, 1979) was administered to assess creativity attributes. According to Gough (1979) aesthetic dispositions are related to creative potential. This instrument was designed as an appraisal of the self. This test was selected because it is highly regarded, reliable and widely used as a general creativity test (Plucker & Renzulli, 1999; Oldham & Cummings, 1996).

CT: Creative Temperament Scale. The *Creative Temperament Scale* (Gough, 1992) was adapted from the *California Psychological Inventory (CPI)*, which was designed to assess personality characteristics and predict what people will say and do in specific contexts. Gough (1992) suggested that this measure is capable of forecasting creative attainment in various domains, both within and outside of psychology. Any domain requires skills specific to the domain, yet this measure assesses general personality qualities cutting across disciplines. The Creative Temperament Scale is one of the special purpose scales of the *CPI*.

CRT: Cognitive Risk Tolerance Survey. The *Cognitive Risk Tolerance Survey* (Snelbecker, McConolgue, & Teitlebaum, 2001) consists of 35 self report items to assess an individual's ability to formulate and express one's ideas despite potential opposition. Responses are on a Likert Scale ranging from 0 (Very Strongly Disagree) to 9 (Very Strongly Agree). Higher scores indicate higher levels of cognitive risk tolerance. The Cognitive Risk Tolerance Survey was developed as an extension of an earlier risk

tolerance model developed by Snelbecker and colleagues (Roszkowski, Snelbecker, & Leimberg, 1989; Snelbecker, Roszkowski, & Cutler, 1990). Charyton and Snelbecker (2007a) found the CRT measure was moderately correlated with the CPS ($r = .36$, $p < .01$) and CT ($r = .34$, $p < .01$), which were moderately related to each other ($r = .35$, $p < .01$). Cognitive risk tolerance may be a component of general creativity that is moderately related to, yet different from other general creativity measures. This measure was selected as a distinct component of general creativity.

Results

Results will be analyzed to compare chemistry students with high creativity as demonstrated on the general creativity measures and their creative self efficacy as described by questions on the demographic questionnaire. Gender, major and class rank will also be analyzed. Furthermore, the relationship between creativity, self efficacy and college performance will also be analyzed. Results may indicate that students with higher creative self efficacy may demonstrate higher creativity defined by creative person attributes and higher cognitive risk tolerance.