Editor's Note: Innovation and creativity are associated with higher levels of learning in the Cognitive Domain of Bloom's Taxonomy,. These skills include analysis, synthesis, problem solving, exploration, invention, design, construction, evaluation, and related skills. Ingenious instructors can add vitality to their courses by moving beyond knowledge, conceptualization and application to tasks that inspire creativity in the search for knowledge and the interpretation of events.

Combining Creativity and Civilization:
A Natural Experiment in a General Education University Course

Eric C. Dahlin, A. Brent Strong and Scott D. Grimshaw
USA

Abstract

Improving creativity and innovation is viewed as an increasingly important goal for classroom instruction. This paper evaluates whether a change in creativity occurred for students participating in a university "civilizations" course in which the instructional approach focuses on lateral thinking skills, examines characteristics of world civilizations that exhibited high levels of creativity, and encourages students to practice being creative through a class project and exams. Students in the class who took the Torrance Test of Creative Thinking (TTCT) at the beginning and again at the end of the semester experienced a statistically significant change in creativity scores compared with students in the comparison group, who experienced no significant change.

Keywords: creativity, Torrance Test of Creative Thinking, curriculum, pedagogy, project-based learning.

Introduction

Discussions on public policy frequently suggest that education curricula promoting creativity and innovation is essential to solving problems related to economic development and other social issues (Business Roundtable, 2005; Council on Competitiveness, 2005; McAloone, 2007; OECD, 2004, 2008). For example, in 2009, U.S. President Barack Obama launched a program called "Educate to Innovate." This program is intended to help students excel in science, technology, engineering, and math (STEM). The assumption is that these disciplines provide students with the tools necessary to discover new solutions to existing social and economic problems. The Educate to Innovate website displays a video with prominent leaders advocating the importance of STEM education for innovation. One video clip features Steven Chu, Secretary of Energy and recipient of the Nobel Prize in physics, who endorses the value of STEM education for developing new solutions to address social issues. Chu states, "There will be Nobel Prize-caliber discoveries that have to be made in order for society to better itself. . . . As a scientist or an engineer . . . you will have the tools to do many wondrous things, which will in large part help save the world" (Chu, 2011).

Despite the current rhetoric regarding the importance of education for developing creativity and innovation, education curricula often fail to teach students how to produce knowledge and be creative (Sawyer, 2004). Instead, students are "taught that knowledge is static and complete, and they become experts at consuming knowledge rather than producing knowledge" (Sawyer, 2006, p. 42). Although researchers have explored the benefits of curricula that promote creativity (Covington, Crutchfield, Davies, & Olton, 1974; Craft, Jeffrey, & Leibling, 2001; de Bono, 1973; Feldhusen, 1983; Nickerson, 1999; Sawyer, 2004, 2006; Strom & Strom, 2002; Waring, 2009; West, Tateishi, Wright, & Fonoimoana, in press), traditional teaching strategies persist that focus on scripted communication patterns and planned discussion between the student and teacher; these methods focus on the distribution—as opposed to the creation—of knowledge and reduce creativity in the classroom (Mehan, 1979; Papert, 1993; Rogoff, 1990; Sinclair & Coulthard, 1975). Traditional approaches to knowledge distribution in classroom settings are largely a function of educational and political incentives that reward teaching curricula focused on preparing students for achievement tests rather than on student creativity, ability to improvise, or application of other problem-solving skills. Given the importance of curricula that encourage the production of knowledge, additional research is needed to better understand teaching strategies designed to facilitate and improve student creativity (Smoot, 2006; Todd & Magleby, 2004).

In this paper we conduct an experiment to examine whether principles of creativity taught in a university "civilizations" course effectively increases creativity among college students. The course is designed to examine creativity exhibited by world civilizations in arts and culture, science and technology, and politics and uses examples from world civilizations to illustrate and teach principles of lateral thinking and to help students apply the principles of lateral thinking when completing assignments and exams. We assess whether a change in creativity occurred among students enrolled in the course using the Torrance Test of Creative Thinking (TTCT) (Torrance, 2008).

Course Overview

The civilizations course under investigation is entitled "History of Creativity." The course was developed by one of the authors, and it is taken by students with diverse academic majors, including engineering, the natural sciences, and the social sciences. The creativity class is a general education course and fulfills the civilization requirement for undergraduate students at Brigham Young University (BYU). Course content covers two semesters. Each semester focuses on one of two historical periods: pre-1500 AD and 1500 AD to the present. Material for the first semester consists of the Mesopotamian and Egyptian civilizations and the Greek and Roman Empires, among others. Course material for the second semester begins with the Italian Renaissance and ends with contemporary society. Aspects of contemporary society discussed in class include major conflicts (e.g., World War II, the Cold War, India's struggle for independence, and conflicts in the Middle East), modern arts (music, painting, sculpture, literature), and scientific and technological advances of the 20th and 21st centuries. The course is designed to emphasize aspects of civilization that are relevant across academic disciplines. To this end, the course underscores the creativity of civilizations by describing creativity exhibited in the arts, architecture, science and technology, and politics.

Course Concepts and Applications

Course content not only describes creative aspects of civilizations, it identifies general principles of creativity. The first lecture of each semester includes a discussion of vertical or linear thinking, lateral thinking, and criteria used to evaluate creativity. Linear thinking is based on logic, previous experience, and proven, sequential methods; lateral thinking refers to finding solutions by viewing problems in a new way or through unconventional approaches (de Bono 1970, 1985). Subsequent class lectures highlight examples of linear and lateral thinking exhibited in world civilizations. Linear thinking is taught by describing people and events in historical sequence. Lateral thinking is taught by comparing people, events, and cultural styles from one civilization with those same things in another civilization, such as the philosophies of Sir Francis Bacon and René Descartes, or art and architecture from the Renaissance and Baroque periods. In addition, course assignments and tests provide students with opportunities to practice being creative. Course exams evaluate both linear thinking (i.e., questions ask students to define key terms and match people and places) and lateral thinking (i.e., essay questions require comparing and contrasting people, concepts, and civilizations). Each exam includes a take home question that requires students to create a work of art, literature, sculpture, or invention within certain parameters that are pertinent to the particular time period covered by the exam. For example, the students might be asked to write a sonnet about university dating in the style of Shakespeare or, in another time period, to design a house in both the Baroque and the Classical styles and point out the differences.

Principles of creativity are also taught to provide students with a framework for evaluating the creativity demonstrated by each of the civilizations discussed over the course of the semester. These broad principles include originality and appropriateness or usefulness (Jackson & Messick, 1967; Mumford & Simonton, 1997; Runco, 2004). Originality refers to the novelty of an object or practice. Appropriateness indicates that “creative products are useful for an intended audience” (West et al., in press). Additional principles of creativity discussed in class include the concepts *intent* and *implementation*. Intent suggests that an innovation is not merely the result of serendipity, but of deliberate action. Implementation signifies that a new object is functional and its use is evident in the time period being studied.

An illustration of how these criteria are used to evaluate creativity within a civilization is the lecture on Greek versus Roman creativity. Here the instructor points out that the ancient Greeks were typically interested in original ideas and discovery of the world through science, whereas the Romans were more likely to adapt and implement existing ideas to create a better society through engineering. Examples from each culture are examined and discussed. Classes discuss whether the Romans were truly creative if their contribution was not unique in discovery, but was implemented from other civilizations, and the historical importance of social and cultural artifacts and arrangements produced by each society.

Project-based learning (PjBL) is another key element of class. PjBL is a common method for teaching creativity, especially in design and engineering education. The purpose of PjBL is to create and develop an authentic, or “real life,” project that addresses a problem and provides a solution. “Designing an authentic project means that pupils define their own design problem, deal with needs, and decide on their requirements” (Doppelt, 2009, p. 57). PjBL privileges problem-solving skills and student interests over a “fixed curriculum.” It provides students with direct experience instead of passively absorbed instruction. Accordingly, the role of the teacher changes from an instructor or lecturer to a supportive resource or mentor (Newell, 2003). The project for class can be the invention of a product or service, the creation of a work of art, a creative illustration of a technology, or almost any other creative work that fits the criteria used to evaluate the projects by the instructor, links to the subject of the semester in historical context and subject material, and illustrates principles of creativity. The project promotes lateral thinking by encouraging students to develop a new idea by combining their knowledge of course concepts with their intellectual interests.

The instructor and teaching assistants for this class mentor the students throughout the course. Teaching assistants spend time discussing ideas for the final project with students, and it is not uncommon for the instructor to meet and consult with 100 or more students during a typical semester to help them generate and develop ideas for this assignment. During one semester, a particular student asked the instructor for assistance in generating an idea for her final project. In this situation, the instructor typically asks three questions to determine the student’s personal and intellectual interests: What is your major? What is your hobby? What is your favorite time period that was discussed for this course? The student’s responses to these questions were communications, running, and the Renaissance. With the help of the instructor, the student developed an idea that combined her personal and intellectual interests. The project the student decided on was to create a running magazine situated during the Renaissance. It included advertisements, stories about key actors from the time period, and it was titled *Runaissance*.

Research Design

We expect students enrolled in the History of Creativity Class to develop greater creativity for several reasons. First, class lectures and discussions highlight aspects of civilizations that were creative (or not creative) and explore different ways civilizations could have been more creative. Second, each assignment or test requires students to generate a novel idea or object by applying or recombining ideas from the course in new ways. Moreover, students are required to explain why their ideas are novel. Third, a key element of the course includes the instructor's insistence that everyone can be creative and examples of previous students' creative projects are presented to spark ideas. Lastly, a great deal of one-on-one mentoring takes place to help students develop their ideas into creative projects.

To evaluate whether students' creativity improved, we implemented a natural experiment research design. Advantages of an experimental design include minimizing the effects of potential confounding variables and increasing the internal validity of the study. The experiment consisted of treatment and comparison groups who were evaluated using a pretest and a posttest (Shadish, Cook, & Campbell, 2002). This study constitutes a natural (or quasi) experiment since the students were not randomly assigned to the treatment and comparison groups.

The treatment group was composed of students enrolled in the History of Creativity Class. The students in the treatment group were volunteers from the class. The treatment group consisted of eight male and ten female students, each year in school or class was represented (three freshman, one sophomore, seven juniors, six seniors, and one graduate student), and students had a mean age of 23.2 years. A group of four students who were not enrolled in the class constituted the comparison group. The comparison group was composed of volunteers from the at-large university community who had never taken the creativity class. The comparison group included three males and one female student, one student was a freshman while three students were seniors, and the mean age was 23.0 years. Both groups of students took Form A of the Torrance Test for Creative Thinking (TTCT) as a pretest in September 2009 and Form B of the TTCT as a posttest in December 2009. The students in the treatment group completed the creativity class between the pre- and posttest evaluation, while the students in the comparison group were unlikely to have received any education or training that would influence their scores on the creativity test.

We collected data on student creativity by administering the figural version of the TTCT (Torrance 1974, 2008), and we compared students' scores from the beginning of the semester with students' scores at the end of the semester. The TTCT is the most widely used test for creativity (Amabile, 1996; Baer & Kaufman, 2006; Sawyer, 2012) and the TTCT pre- and posttest research design has been employed by a number of studies with reliable results (Ebrahim, 2006; Torrance, 1981). The figural version of the TTCT consists of a visual component that asks research participants to expand an existing picture, complete an existing picture, and alter a series of lines. The tests were administered by non-university personnel who were employed to administer and grade the exams. The personnel were trained in administering and evaluating the test by Torrance employees. The Torrance Creativity Index is calculated as part of the exam scoring for the pre- and posttests. We examined how the Creativity Index changed between the pre- and posttests, and compared the results for the treatment and comparison groups.

Results

To assess the extent to which student participation in the creativity class was associated with increases in student creativity, we examined and compared TTCT scores for students in the Creativity Class (treatment group) with scores from the comparison group. First, we will report the TTCT pretest and posttest scores and discuss differences between the two groups. Second, we will evaluate the change in scores between the pre- and post-tests for each group.

Results of the pretest are reported in Table 1. The mean score for students in the Creativity Class is 134. This score places students in the Creativity Class in the 99th percentile compared with the national norm for individuals of a similar age (Torrance, 2008, p. 33). The mean score for the comparison group is 120. This score represents the 95th percentile as compared with the national average (Torrance, 2008, p. 33). Students in the sample are considerably more creative than the national average as measured by the TTCT. This finding is relatively unsurprising since our sample is more educated than those in the same age group from which the national percentile was developed. Creativity research finds a direct link between creativity and education (Ai, 1999; Naderi, Abdullah, Aizan, Sharir, & Kumar, 2010).

Table 1
Pre-test Torrance Creativity Index

	Min	Q_1	Median	Mean	Q_3	Max
Comparison group	112.0	114.2	120.0	120.2	126.0	129.0
Creativity Class	107.0	124.2	136.0	134.7	142.2	161.0

The highest score among students in the Creativity Class was 161 compared with a high score of 129 for the students in the comparison group. Moreover, students in the top quartile of the Creativity Class scored between 142 and 161 compared with students in the top quartile of the comparison group, who scored between 126 and 129. This likely indicates a selection bias for the students in the Creativity Class. Students who are already more creative than average may be more likely to have enrolled in the Creativity Class. Another implication based on these figures is that because these highly creative students already score well on the pre-test, there is little room for improvement on the post-test. In other words, it is difficult for these students to improve their scores significantly, making it difficult for these students to improve their scores on the post-test.

Although the data included students with high pretest scores on the Creativity Index, the treatment group still experienced an 11.6 point increase in post-test scores compared with their scores from the pretest (see Table 2). Alternatively, students in the comparison group scored an average of 0.8 points lower than their own scores on the pretest. There is a statistically significant difference in the change in the Creativity Index between the comparison group and the Creativity Class ($t = 2.224$, p-value = 0.0378). These results suggest that the instructional activities that are part of the creativity class have a significant impact on student creativity scores. Given the predisposition of some students in the Creativity Class toward creativity as indicated by the high pre-test scores, it is all the more remarkable that the treatment group demonstrated a statistically significant increase in creativity compared to the comparison group.

Table 2
Change in Torrance Creativity Index

	Min	Q_1	Median	Mean	Q_3	Max
Comparison group	-9.0	-6.8	-2.5	-0.8	3.5	11.0
Creativity Class	-4.0	2.3	11.5	11.6	17.8	30.0

Conclusion

Can individuals learn to be more creative? Traditionally, the prevailing notion has been that creativity is a fixed individual trait or attribute that could not be improved. While there is still much debate, this view is being challenged, and many scholars across academic disciplines believe that educational programs that promote teaching and applying certain cognitive skills can increase student creativity (Ansburg & Dominowski, 2000; Cunningham & MacGregor, 2008; Davis, 2003; Scott, Leritz, & Mumford, 2004; Sternberg & Williams, 1996; Torrance, 1972). Among those who promote the view that creativity can be taught was the renowned creativity scholar Paul Torrance, who observed:

> I know that it is possible to teach children to think creatively and it can be done in a variety of ways. I have done it. I have seen my wife do it; I have seen other excellent teachers do it. I have seen children who had seemed previously to be "non-thinkers" learn to think creatively, and I have seen them continuing for years thereafter to think creatively. I have seen, heard, and otherwise experienced their creativity. Their parents have told me that they saw it happening. Many of the children, now adults, say that it happened. I also know that these things would not have happened by chance because I have seen them 'not happening' to multitudes of their peers (1972, p. 114).

The findings reported in this paper suggest that creativity can indeed be taught. Our study employs a natural experiment and the results of bivariate statistical analysis provide evidence that pedagogy can increase students' creativity. We find that students enrolled in a university civilizations course that examines characteristics of creativity exhibited by world civilizations significantly increases creativity in students enrolled in the course, while students in a comparison group experienced no increase in creativity. Although this class does not explicitly teach students how to be creative, student creativity increased in these students as a byproduct of learning to identify creative principles and having opportunities to put those principles into practice. Furthermore, despite the long history of creativity research, future education researchers should consider using experimental designs, which remain underutilized (Gersten, Baker, & Lloyd, 2000; Gersten, Fuchs, Compton, Coyne, Greenwood, & Innocenti, 2005; National Research Council, 2002).

It is critical to teach skills that improve creativity to keep pace in today's ever-changing global landscape. Although there are obstacles to teaching creativity in the current educational system, which is more adept at transmitting static knowledge than teaching students how to analyze and generate novel solutions to problems, it is imperative that we make creativity research and curricula a larger part of our social and policy agendas. It is not only critical to continue to find new approaches to teach students, but to make serious and concerted efforts to implement current knowledge about increasing creativity and updating antiquated educational programs that inhibit creativity.

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About the Authors

Eric C. Dahlin is an assistant professor of sociology at Brigham Young University, Provo, Utah.

e-mail: eric.dahlin@byu.edu

A. Brent Strong is the Lorin Farr Professor of Entrepreneurial Technology in Manufacturing Engineering Technology at Brigham Young University.

e-mail: strong@byu.edu

Scott D. Grimshaw is professor of statistics at Brigham Young University.

e-mail: grimshaw@byu.edu

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