Innovation 101:

Promoting Undergraduate Innovation Through a Two-day Boot Camp

Richard E. West
Isaku Tateishi
Geoffrey A. Wright
Melia Fonoimoana

Brigham Young University

Corresponding Author

Dr. Richard E. West
150-H MCKB
Instructional Psychology and Technology Department
McKay School of Education
Brigham Young University
Provo, UT 84602

801.422.5273

rickwest@byu.edu

Original Submission Date: January 5, 2011
Revision Submission Date: September 1, 2011

Citation:
Abstract

Over the years many training methods for creativity and innovation have been developed. Despite these programs and research, further improvement is necessary, particularly in schools of technology and engineering education, where previous efforts have focused on developing solutions to defined problems, not in identifying and defining the problems themselves in ways that promote creative outcomes. This study presents initial efforts to develop an instructional program designed to teach innovation to undergraduate technology and engineering students. Results from a pre/posttest analysis using both the Torrance Tests for Creative Thinking and a survey with self-reported data indicate that the Innovation Boot Camp was successful because it (a) encapsulated innovation into a process that students could learn and apply, (b) engaged students in multidisciplinary groups, and (c) provided a hands-on, activities-oriented curriculum explicitly designed to enhance innovation. Notwithstanding, ideas for improvement and further research and development of the curriculum are described.
Innovation 101: 
Promoting Undergraduate Innovation Through a One-Week Boot Camp

Innovation is critical to economic and societal success (McAloone, 2007), and educational institutions need to help their students acquire this ability (Coakes & Smith, 2007). However, institutions of higher education are still struggling to implement instructional programs to teach creativity and innovation (Ramocki, 1994; Smoot, 2006). Helping students become innovative is challenging, particularly as traditional education tends to focus simply on distribution of knowledge. In order to prepare students for their future careers, this challenge cannot be avoided. This paper presents a review of the research on teaching creativity and innovation, as well as a description of the implementation of a successful one-week innovation training boot camp, along with initial data on its effectiveness through analysis of participant surveys and creativity assessment scores.

Comparing Creativity and Innovation

Creativity and innovation are commonly used interchangeably; however, they do have distinguishing characteristics. Creativity is often used to refer to creative individuals, cognitive processes used in creative activities, and creative products (Amabile, 1996). Creativity in these contexts embodies originality and appropriateness (Jackson & Messick, 1967; Mumford & Simonton, 1997; Runco, 2004). Originality means creative outputs must be considered as novel and unique, while appropriateness means creative products are useful or meaningful to the intended audience.

While creativity emphasizes the generation of creative (i.e., novel, unique, and useful) ideas, innovation gives more attention to the successful development and implementation of creative products, procedures, theories, and strategies (Mumford & Gustafson, 1988; West &
Farr, 1990). Furthermore, Bel (2010) stated that innovation is “marketable invention: the act generating an idea AND transforming it into a new product, service, solution, or business model that can be sold to customers” (p. 47). Thus to help students become innovative, instructors need to teach them how to (a) generate creative ideas and (b) transform them into more realistic, practical, and marketable solutions. In the following sections is discussed a few common instructional approaches for teaching creativity and innovation.

**Teaching Creativity**

Over the years hundreds of creativity training methods have been developed (Bull, Montgomery, & Balloche, 1995). A few studies have described training programs and evaluated their effectiveness (Clapham, 2003; Lau, Ng, & Lee, 2009; Nickerson, 1999; Scott, Leritz, & Mumford, 2004a; Scott, Leritz, & Mumford, 2004b). Reviewing these studies reveals two major objectives of creativity training: (a) stimulate the development of creative potential and (b) help individuals acquire skills and knowledge necessary to generate creative ideas.

**Developing creativity potential.** Training programs such as Hemisphericity, Psychogenics, and Psychosynthesis are designed to develop the brain’s ability to make the mental associations necessary for creative activities (Clapham, 2003) through imagery and relaxation, as well as through artistic, musical, and physical exercises. Lau, Ng, and Lee (2009) reported on other programs focused on similar objectives (e.g., Lucid Dream Technique and Controlling Imagery Technique).

**Generating creative ideas.** Unlike the training to develop creative potential, other creativity training programs teach participants practical skills for generating creative ideas. Most of these programs teach participants to use divergent thinking—a cognitive process for generating multiple and complex ideas from a simple idea (Guildford, 1950). Perhaps the best
known and best researched creative idea generation training programs are Osborn’s brainstorming program and the Creative Problem Solving (CPS) program (Clapham, 2003; Puccio et al., 2006). In his program, Osborne established team rules and procedures to maximize the effectiveness of a group of people in generating a large number of ideas. The CPS uses these principles of brainstorming, but additionally helps participants create plans for the development and implementation of their creative ideas. The CPS has five stages: fact-finding, problem finding, idea finding, solution finding, and acceptance finding (Isaksen & Treffinger, 2004).

Similar to brainstorming, CPS encourages participants to work in groups. Both programs utilize the diverse perspectives provided by different team members to generate unique and novel ideas.

Additional programs or techniques have been developed to encourage divergent thinking. Synectics uses analogies and metaphors (Gordon, 1961; Prince, 1968). The Six Thinking Hats, an application of lateral thinking, teaches participants to use six different mindsets, such as logical, emotional, and critical, to understand a problem (de Bono, 1985; Lau, Ng, & Lee, 2009). The SCAMPER technique requires participants to identify key attributes of a problem and substitute, combine, adapt, modify, put to other uses, eliminate, or rearrange these attributes (Nickerson, 1999). The SCAMPER activities are believed to help participants make unusual associations of different attributes, leading to creative ideas. Theory of Inventive Problem Solving (TIPS or TRIZ) teaches participants to systematically analyze a problem and create a solution using algorithmic procedures (Altshuller, 1979; Terninko, Zusman, & Zlotin, 1998).

According to Scott, Leritz, and Mumford’s meta-analysis (2004b), past studies have shown that these creative idea generation training programs are effective ($\Delta = 0.64$; $SE = 0.07$. aggregated effect across all criteria in this study). The CPS was found to be the most effective on standardized divergent thinking tests and analysis of participants’ actual performances.
Teaching Innovation

To promote the transformation of creative ideas into innovative solutions, three instructional approaches are commonly used. First, innovation training often teaches user- or human-centered design (Brown, 2008; Lindfors, 2010). Second, participants are often asked to work in multidisciplinary teams (Gorman et al., 1995; Kostoff, 2003). Third, these teams typically engage in project-based learning (PjBL) (Dym et al., 2005).

**User-centered design.** Marketability is an important aspect of innovation. It suggests that the final product has to be a reliable and useful product with a target audience to benefit. User-centered design increases product marketability. To be user-centered emphasizes identifying and evaluating the relationship between users, products, and environments (Lim & Sato, 2006). User-centered design forces designers to focus on the experience of actual users. The product has to work reliably, but it has to be easy and pleasant to use. Prototyping is strongly encouraged, and prototype evaluation by actual users begins early (Lindfors, 2010).

**Multidisciplinary teams.** The second main feature of innovation training is its emphasis on multidisciplinary teams. Team diversity is a major indicator of creative performance (Austin, 1997; Jackson et al. 1995; Guzzo & Dickson, 1996; McLeod, Lobel, & Cox, 1996). According to Kostoff (2003), teams consisting of individuals with diverse expertise from various professional fields facilitate dynamic synergies often leading to innovation. For example, Bantel and Jackson (1989) showed that financial institutions that introduced innovative products and services benefited from diverse expertise among top executives. Hoffman and Maier (1961) found that heterogeneous groups with diverse personalities that included both genders generated higher quality problem solutions. In addition, products or services provided by many
organizations now require expertise from multiple professional fields due to increasing complexity. In such organizations multidisciplinary teams are essential.

**Project-based learning.** Finally, innovation training often utilizes project-based learning (PjBL). PjBL is an instructional methodology used to provide more authentic and engaging learning experience (Newell, 2003). Participants are required to find and investigate the problem, then develop and evaluate the solutions. Design and engineering courses taught in many U.S. universities apply this methodology in their capstone projects, in which students form teams and design and develop a product for actual clients (Dutson et al., 1997; Pimmel, 2001). Dym et al. (2005) argued that such practical and authentic experience should be used more often to teach students to be innovative.

**Current challenges.** Despite these programs and research, further improvement is necessary (Smoot, 2006; Todd & Magleby, 2004). In efforts to help students become more innovative, scholars must first answer fundamental questions: e.g., “What are the best sequences for teaching innovation?” “What specific activities help students the most?” “How can the effectiveness of a training program be measured?” In this paper is presented initial efforts to develop an instructional program designed to teach innovation as well as research data about its effectiveness.

**Research Questions and Research Design**

Two research questions were addressed in this study:

1. To what degree do students improve their creative thinking potential by participating in a one-week Innovation Boot Camp?
2. According to student perceptions, how valuable is the Innovation Boot Camp experience in promoting their ability to be innovative?
To answer these questions, a mixed-methods approach was used. To address the first question, students completed Torrance Tests of Creative Thinking (figural version) both before and after the boot camp experience. To address the second question, students completed a survey before and after the boot camp with questions related to their perceptions of their own creativity, motivation, and abilities to be innovative related to specific areas of boot camp training.
Methods

Boot Camp Context

The Innovation Boot Camp (IBC) is an intensive hands-on, collaborative, experiential learning experience focused on educating students about principles of innovation through solving real-world design problems. It was developed with an explicit goal to increase student innovation in the college of technology and engineering at our university. The college assembled a team of professors to identify methods and ideas for teaching innovation based on ideas from industry and academia (Wright, Skaggs, Fry, & Helps, 2009; Wright, Skaggs, Fry, Howell, & West, 2010; Wright, Skaggs, & West, 2010). The structure of the IBC was a two-day experience (with six days separating the two), blending students and faculty from four different programs/departments in the school of technology: Technology Engineering Education, Manufacturing Engineering, Industrial Design, and Information Technology. The curriculum for the IBC was based on well-known innovation and creativity models. The curriculum designers studied the creative processes from IDEO, the Stanford D-School, and others. From their research they identified five key components: 1) Idea Finding, 2) Idea Defining, 3) Idea Refining, 4) Idea Refining, and 5) Idea Communicating. Below each of the five components are briefly discussed.

1. Idea finding. Idea finding is a stage of discovering and/or identifying a product, system, or service to create, modify, or develop, which can be accomplished by observation and/or experience, coupled with inquiry. Research has shown Idea Defining is an integral component of creativity and innovation (Sternberg, 1993; Flemming, 2001; Ulrich & Eppinger, 2004). For example, Dyer (2009) suggested that this phase (what he calls observing) is one of the discovery tools “that contribute to one’s ability to generate
novel insights that result in new products, processes or business models” and is “critical to triggering innovative ideas” (p. 5).

2. Idea shaping. This stage involves using organizational tools to clarify and simplify the data collected from the idea finding stage to create a strong “problem statement” that encapsulates the primary issue being developed, modified, or created. Various authors call this component or phase “exploration” or “idea generation” (Osorio, 2009). Osorio suggests that the output of this phase should include “discovering the best possible user experience, enabled by a product, service, and process mix” (p. 5).

3. Idea defining. This stage introduces a series of tools that help the user create potential solutions for the problem statement through random association, purposeful association, and various connection activities. Osorio (2009) reviewed various other authors and researchers such as Christensen, 2000; Christensen, Scott, & Roth, 2004; Sull, Ruelas-Gossi, & Escobari, 2003 and concluded an important aspect of the innovation process is clearly defining the innovation challenge before proceeding towards production. This component or phase involves “reframing the problem” (Osorio, p. 5), in order to clearly understand the problem or issue that was observed.

4. Idea refining. Historically this stage might be thought of as the “prototyping stage”; however the term prototyping doesn’t do justice to this stage, as prototyping typically concerns only the creation of a particular solution. In contrast, idea refining involves visualizing multiple solution ideas through sketches, mockups, and simulations. The multiple iterations of the potential solutions help validate a potential solution. Several researchers have suggested this phase is the iteration phase—where the system, product, or service being developed goes through several “mock-up” scenarios and is analyzed in
various settings, with multiple different designs, materials, and so forth (Kelly, 2001; Osorio, 2009).

5. Idea communicating. This final stage involves showing, describing, and demonstrating the possible solutions to the problem. This stage involves much more than simple discussion and presentations, rather dictating that the developers “act out” the problem statement and possible solutions they iterated. Idea communicating can be thought of as an opportunity for marketing and for receiving peer and audience feedback. However, this stage should not be a simple presentation of data and ideas—this stage must include mockup situations where context and audience can be considered, and where the new product, system, process is “launched and exploited” in a semi-real or actual situation or context (Andrew & Sirkin, 2006). Figure 1 shows the overall process flow.

Insert Figure 1 here

On the first day of the boot camp, students were split into multidisciplinary groups of 4-6 students each, were introduced to the need for innovation, and were taught the five principles of innovation through design challenges and innovation discussion. The capstone project on the first day was for groups to prototype a group solution to a common social problem found on campus (e.g. keeping bike seats dry, finding available parking spaces, establishing study groups, etc.)

During the week, the student groups were asked to revisit the process as they completed a more refined prototype of a solution to a new social problem they identified. The students then presented their designs to the other groups in a capstone evening session and evaluated each
other’s projects. Awards were given to the top teams based on peer feedback and instructor assessments.

**Participants**

In the 2009-2010 school year, 93 students (30 groups) participated in the IBC. Participants were in their junior or senior year in one of the following undergraduate majors: manufacturing engineering, industrial design, technology engineering education, and information systems. Ages ranged from 19-35; however, most participants were between 22-28 years old. Approximately 13% of the participants were female, and 87% were male. Table 1 gives a breakdown of the number of participants from each represented major.

<table>
<thead>
<tr>
<th>Major</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing Engineering</td>
<td>20</td>
</tr>
<tr>
<td>Industrial Design</td>
<td>15</td>
</tr>
<tr>
<td>Technology Engineering Education</td>
<td>15</td>
</tr>
<tr>
<td>Information Systems</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
</tr>
</tbody>
</table>

**Assessment**

**Creativity thinking assessment.** Two forms of the figural version of the Torrance Tests of Creative Thinking (TTCT) were used as a pre- and posttest assessment of the students’ abilities to think creatively before and after their Innovation Boot Camp experience. The TTCT has proved to be the most influential test of creativity (Baer & Kaufman, 2006; Amabile, 1996) over the years and is currently used in approximately 40 percent of all studies with college students and adults (Torrance & Presbury, 1984). Several studies have documented its test-retest reliability (e.g., Torrance, 1966, 1974, 1998; Mackler, 1962; Yamamoto, 1965; Grover, 1963; Ebrahim, 2006). Most of the studies indicated that the reliability coefficient ranged from .50 to .93.
In the figural version of the TTCT, participants are asked to sketch and explain different objects in response to visual stimuli presented in the test (e.g., circles, lines, abstract drawings) within restricted time limits. The tests are scored according to how many meaningful original ideas are produced, as well as the participants’ ability to elaborate on their ideas, resist closing off options too quickly, and think abstractly. Studies have found the TTCT to be significantly correlated with creative achievement in 9-month, 7-year, 22-year, 40-year, and 50-year longitudinal studies (Runco, Millar, Acar, & Cramond, 2010; Torrance & Wu, 1981; Millar, 2002) and in participants’ adulthood (Yamada & Tam, 1996).

The TTCT data were analyzed using a one-way repeated measures ANOVA comparing the participants’ pre- and post-TTCT scores to identify the impact of the boot camp in improving the TTCT scores of the participants.

**Pre and post participant survey.** Students completed a pre- and post-IBC survey, with items that were generated to represent the different innovation principles taught in the boot camp, as well other elements theorized to be relevant to the emergence of creativity and innovation, such as motivation and team innovation climate (Anderson & West, 1996), emergence of a strong community structure (Rovai, 2002; Rovai, Whiting, & Lucking, 2004), and elements of innovative communities (West, 2009). The survey also included several open-ended questions related to what the students felt was most and least effective about the IBC, and at which part of the IBC they felt most innovative.

Forced-response survey items were aggregated and reported descriptively, comparing pretest with posttest averages. Open-ended responses were first categorized by one researcher and then verified by a second with 84% agreement. These categories were then reported according to emergent themes.
Findings

TTCT Findings

In the one-way ANOVA calculation, comparing the differences between the pretest and posttest scores, a significant effect was found \((F(1, 85) = 4.35, p < .04)\), indicating an overall TTCT score increase. The follow-up protected \(t\)-test revealed that scores increased significantly from pretest \((m = 86.09, sd = 17.48)\) to posttest \((m = 90.65, sd = 17.28)\). Although the ANOVA showed that the means were statistically significantly different, the effect size was small. (Partial Eta squared, a measure of effect size, was .049, meaning the boot camp accounted for only 4.9% of the overall variance of the posttest).

Additionally, a one-way repeated measures ANOVA was completed to identify the impact of the boot camp for each sub-component of the TTCT (i.e., fluency, originality, elaboration, resistance to premature closure, abstractness of title, and creative strengths). A significant effect was found for Resistance to Premature Closure \((F(1, 85) = 5.425, p < .022)\) and Creative Strengths \((F(1, 85) = 7.358, p < .008)\). The effect size was small for these components. (Partial Eta squared was .06 for Premature Closure, and .08 for Creative Strengths.) These results are summarized in the Table 2.

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Insert Table 2 here

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Survey Findings

Forced-response findings. Participants were asked to respond to several questions on a 7-point rating scale. These findings were mixed, although trending towards positive outcomes. For example, participants \(n=71\) pre, 79 post) responded to six questions that they believed the
boot camp helped them think more creatively than they had previously (average improvement = 0.4 on a 7-item scale). In contrast, on four items participants indicated the boot camp did not help them improve, but the average decrease was negligible (0.1, see Table 3). Overall, survey findings might indicate that the boot camp had a positive influence on student abilities to use some creative thinking skills, but the improvements are small and additional research is needed to determine if the findings could be replicated or maintained over time.

**Open-ended response findings.** Two items on the survey asked students to describe the best and worst aspects of the boot camp. Nearly all students responded to both questions. These responses were analyzed by identifying categories into which they could be grouped.

Student answers about the best part of the boot camp were grouped into three categories: learning a process for innovation (coded 16 times), interacting and working in a group with people from other majors (coded 17 times), and completing hands-on applications of the innovation process (coded 7 times). These three categories represented 56% of the 72 coded categories (with some comments coded twice). The following comments were typical of these codes:

“The best thing was working with a really good team. I know not all of the teams meshed as well as mine did, but I’ve developed friendships and learned things about working with people outside of my field that I find really important.”

“The activities were fantastic. I learn best hands on, and I doubt I will forget the innovation process any time soon.”

“Being able to network with people from different majors.”
“The best part was the content. It made me really look and think about how I look at things and helped me to change the way I now look at things. The material helped me to understand innovation.”

“I think showing this process and breaking it down was good. This allows you to think of each step, and have more focus on each step.”

Besides these main themes, a few students also shared that they appreciated being able to experience and learn the innovation process in a one-day instructional period, along with an initial activity to apply the principles (coded 4 times). Others felt that they were more confident and aware of their creative abilities (coded 4 times), and some were more aware of opportunities for creatively solving practical problems around them in the world (coded 4 times).

When asked on the survey what they disliked about the boot camp, most students mentioned the timing of the one-week experience, which didn’t afford them course credit but took them away from other classes and employment, making group meetings difficult to schedule. This problem was described in 24 out of the 70 total coded comments (with some comments coded twice). In addition, at least five students felt the instruction on the first day was too long, and this may have also been tied into concerns about the timing of the boot camp outside of their other coursework. Six students felt it was inappropriate to have students judge each other’s final projects, as doing this encouraged them to be overly critical of others in order to increase the likelihood of their own team winning the final prize, even though course instructors also judged the final projects with their evaluations carrying the heaviest weight.

**Discussion**

The purpose of the Innovation Boot Camp was to expose technology and engineering students to the purpose, process, and tools of innovation, with the intent of helping them gain an
appreciation and skill set for collaboratively developing innovative ideas and products. The curriculum was specifically designed to encourage the students to engage in divergent thinking, because typical technology and engineering curricula focus on the convergence phase instead.

The statistical increase in TTCT scores might indicate that the Innovation Boot Camp training can help students improve their divergent thinking, particularly their abilities to resist closing off ideas prematurely while considering more innovative options, which was an explicit focus in the course. However, the effect size was small, and thus the findings are tentative pending further study. In future iterations of the course, the curriculum should be improved to focus equally on other domains of the innovation process that were not as explicitly taught, including other aspects of divergent thinking as well as convergent thinking, group collaboration, and idea visualization strategies.

The TTCT findings, along with the overall positive survey findings, provide initial indications that the boot camp appears to have been successful, particularly considering it was only a two-day experience with only seven hours of instructor-led sessions. However, the curriculum could be improved in several areas. First, many of the students and faculty have expressed an interest in making the IBC a regular semester course (16 weeks) or at a minimum a block class running for eight weeks. If a semester or block class system is implemented, scheduling and grading issues could be alleviated. However, a longer course might detract from the focused learning environment offered by a two-day intensive experience. This aspect will need to be explored further in future research. In addition the longitudinal impact the current (or future) efforts will have on student innovation is still uncertain. The students’ survey responses and the TTCT test scores appear to demonstrate that the boot camp might make a difference in
student understanding and use of innovation after one week, but does not predict how long the impact will last. This question will be explored in future iterations of the project.

Several additional areas will be addressed in future iterations of the course. First, more opportunities for feedback during the team activities (an issue mentioned by three students) will be included, as well as more expert feedback and evaluation of participant products, relying less on peer evaluation. Second, opportunities to improve intrinsic motivation and ownership of the projects, perhaps by allowing more flexibility in the choices available for the kinds of projects developed will be explored. Third, better processes for guiding the students in convergent thinking should be developed. Typically, engineering colleges are effective in teaching convergence (building the solutions to the problems); however because students didn’t actually build final products, systems, or services from their IBC projects, many participants felt the process was only half completed. A database of the ideas developed during the boot camp experience needs to be aggregated and then used at a later time for capstone projects, where students could bring ideas developed in the IBC to completion and implementation. Fourth, developing student and faculty support for innovation, creating a culture of innovation within the college, is a continual goal. Technology and engineering colleges have traditionally avoided explicitly teaching innovation, but perhaps if more of the professors and faculty are trained in innovation—by including them in the research, inviting them to participate in the boot camp, etc.—a culture of innovation might start to spread throughout the college, enhancing the practice and use of innovation for students throughout multiple courses.

In conclusion, the boot camp appears to be successful because it (a) encapsulates innovation into a process that students can learn and apply, (b) engages students in multidisciplinary groups, and (c) has a curriculum explicitly designed to enhance innovation,
using a hands-on, activities-oriented pedagogy to apply and teach the principles. Improvement resulting from further research and curriculum development should be undertaken.
References


http://uai.academia.edu/CarlosOsorio/Papers/113671/Design_Thinking-Based_Innovation


doi:10.1007/s11423-008-9107-4


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immersing them in an intensive designing thinking workshop. In C. Crawford et al. (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2010 (pp. 3396-3400). Chesapeake, VA: AACE.
Tables

Table 1
*Number of Participants from Each Major.*

<table>
<thead>
<tr>
<th>Major</th>
<th>Number</th>
<th>Percentage of whole sample</th>
</tr>
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<tbody>
<tr>
<td>Industrial Design</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Information Technology</td>
<td>27</td>
<td>29%</td>
</tr>
<tr>
<td>Manufacturing Engineering and Technology</td>
<td>50</td>
<td>54%</td>
</tr>
<tr>
<td>Technology Engineering Education</td>
<td>10</td>
<td>11%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93</strong></td>
<td></td>
</tr>
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</table>

Table 2
*Pre- and Posttest Comparison of TTCT Subconstructs*

<table>
<thead>
<tr>
<th></th>
<th>Mean Pre</th>
<th>SD Pre</th>
<th>Mean Post</th>
<th>SD Post</th>
<th>p</th>
<th>F</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>86.09</td>
<td>17.48</td>
<td>90.65</td>
<td>17.28</td>
<td>.04</td>
<td>4.35</td>
<td>.049</td>
</tr>
<tr>
<td>Fluency</td>
<td>20.16</td>
<td>5.6</td>
<td>19.99</td>
<td>7.97</td>
<td>.84</td>
<td>1.30</td>
<td>.0004</td>
</tr>
<tr>
<td>Originality</td>
<td>17.06</td>
<td>5.19</td>
<td>18.26</td>
<td>5.22</td>
<td>.099</td>
<td>2.78</td>
<td>.032</td>
</tr>
<tr>
<td>Elaboration</td>
<td>10.72</td>
<td>5.19</td>
<td>10.80</td>
<td>2.89</td>
<td>.796</td>
<td>.067</td>
<td>.001</td>
</tr>
<tr>
<td>Resistance to Premature Closure</td>
<td>15.5</td>
<td>4.11</td>
<td>16.72</td>
<td>3.63</td>
<td>.022</td>
<td>5.425</td>
<td>.06</td>
</tr>
<tr>
<td>Abstractness of Title</td>
<td>9.76</td>
<td>5.28</td>
<td>10.71</td>
<td>5.33</td>
<td>.112</td>
<td>2.572</td>
<td>.029</td>
</tr>
<tr>
<td>Creative Strength</td>
<td>12.95</td>
<td>4.44</td>
<td>14.30</td>
<td>3.88</td>
<td>.008</td>
<td>7.358</td>
<td>.08</td>
</tr>
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</table>
Table 3
Pre- and Posttest Survey Responses (on a 7-point rating scale).

<table>
<thead>
<tr>
<th>Survey item</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre: Based on past experiences, I feel I am able to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post: Innovation Boot Camp helped me learn to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Be flexible and adaptable---willing to change thoughts and activities as</td>
<td>5.7</td>
<td>5.5</td>
</tr>
<tr>
<td>needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Draw associations from distinctly different things to inspire creativity</td>
<td>5.3</td>
<td>5.7</td>
</tr>
<tr>
<td>Refrain from prematurely making a judgment so I can consider new ideas</td>
<td>5.2</td>
<td>5.7</td>
</tr>
<tr>
<td>Accept criticism as part of the process of improving my ideas without</td>
<td>5.4</td>
<td>5.5</td>
</tr>
<tr>
<td>rejecting my ideas prematurely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break out of my own limiting patterns, norms, and prejudices</td>
<td>4.7</td>
<td>5.4</td>
</tr>
<tr>
<td>Discover new skills, unrelated to things I had done in the past, to complete</td>
<td>5.3</td>
<td>5.3</td>
</tr>
<tr>
<td>this project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerate uncertainty and risk</td>
<td>4.8</td>
<td>5.2</td>
</tr>
<tr>
<td>Reframe failures positively and learn from them</td>
<td>5.2</td>
<td>5.1</td>
</tr>
<tr>
<td>Evaluate choices and ideas in a neutral and open way</td>
<td>5.6</td>
<td>5.5</td>
</tr>
<tr>
<td>Become more innovative</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Apply the process and steps of innovation</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Break out of my own limiting patterns, norms, and prejudices</td>
<td>5.4</td>
<td></td>
</tr>
</tbody>
</table>

Additional questions

|                                                               | Pre | Post |
|                                                               |     |      |
| How innovative do you think you are (understanding, skill set, etc.)? | 4.9 | 5.2  |
| How motivated were you to do well in your group project?       | 6.0 | 5.7  |
**Figure 1.** The Stages of the Innovation Boot Camp Process.