Teaching Creative Thinking Skills: A Longitudinal Study

Hyunjoo Im¹, Brad Hokanson¹, and Kim K. P. Johnson¹

Abstract
With an increasing degree of complexity in the retail business, future business success for retail professionals will likely require creative problem-solving abilities. Therefore, there is a need for retail merchandising programs to emphasize creative problem solving because creativity can be learned. In this study, we share how an undergraduate-level creative problem-solving class is designed and implemented to enhance retail merchandising students’ creative problem-solving skills. A longitudinal analysis of creativity scores of 45 undergraduate students in a retail merchandising program was conducted to test both short-term and long-term effects of creative problem-solving training on students’ creativity scores. The results provide support for creativity training.

Keywords
creativity, Torrance test, longitudinal study, divergent thinking

“Being creative means you’re thinking”

–Tanner Christensen (creativity strategist, writer)

A little more than a decade into the 21st century, we are experiencing change at an ever-growing rate (Zacko-Smith, Puccio, & Mance, 2010). We have a retail marketplace that is extremely competitive, and apparel producers are interested in production that does not damage human and environmental resources (Curwen, Park, & Sarkar, 2013). Consumption is rapidly undergoing change, as many consumers are concerned about the harmful impacts that both apparel production and retailing can have on many aspects of our natural environment (Bonini & Oppenheim, 2008) and at the same time are adopting technologies that are altering the way they shop and buy (Woodward, 2011). Clearly, the next generation of apparel retail professionals will be facing complex issues and management problems never encountered previously, which requires creative problem-solving skills.

It has been recognized that decision making in business frequently will require unconventional thinking to solve problems with limited information and resources and that creative problem-solving skills are critical in such circumstances (Butler, 2010). There is evidence that creativity and

¹University of Minnesota, St. Paul, MN, USA

Corresponding Author:
Hyunjoo Im, University of Minnesota, 240 McNeal Hall, 1985 Buford Ave., St. Paul, MN 55108, USA.
Email: hjim@umn.edu
problem solving are closely related. Highly creative people are good at problem solving, and problem-solving capability has been used to measure creativity of individuals in the past (Hirschman, 1980). Particularly in retail, researchers have noted the importance of finding a balance between having a strong customer service orientation and the need to be innovative (Merlo, Bell, Mengüç, & Whitwell, 2006). Coelho, Augusto, and Lages (2011, pp. 31–32) also emphasized the importance of creativity in frontline retail store employees because “creative employees are more likely to uncover customers’ latent needs, to develop a good rapport with customers, and to solve their service problems creatively and effectively, ultimately creating a superior experience.” Cuddleford-Jones (2014), in writing about the role of chief creative officers in retail organizations within the United States (e.g., Land’s End), noted that retailers are constantly challenged to innovate, win, and keep their customers. Thus, future business success for retail professionals, including those working in apparel, will likely require application not only of their own creative problem-solving abilities but also of their ability to evoke and nurture creativity in those they lead (Zacko-Smith et al., 2010).

Although the need for creative problem solving as a skill is clear (Trilling & Fadel, 2009), and the skill can be developed within the classroom (Karpova, Marcketti, & Barker, 2011; Scott, Leritz, & Mumford, 2004), in a review of business programs nationwide (e.g., master of business administration), Yudess (2010) found few programs offered courses or specific content that focused on its development. One exception is a report of the development of exercises that could be implemented in a range of courses (Karpova et al., 2011). These researchers were part of a university-wide initiative focused on how creative thinking could be increased and developed a set of four learning modules with multiple exercises designed to develop abilities in three areas, namely, the ability to see things from different perspectives, ability to generate ideas, and ability to evaluate ideas. They used the Torrance test of creative thinking (TTCT) to assess the effectiveness of the exercises and reported a short-term increase in creative thinking of their students after they had completed the exercises.

In recognition of the importance and need for developing creative problem-solving skills, in fall semester 2008, a 15-week creative problem-solving course was developed at a Midwestern university for the purpose of increasing the creative problem-solving skills of undergraduate students. As developing a lasting change in beliefs and habits requires an extended period of time to achieve, a full term experience was implemented. Identifying the need for creative problem solving in conducting successful retail businesses, the retail merchandising program added the course as a degree requirement in 2008. Our purpose is to share the content and philosophy behind the course structure and the results of a longitudinal assessment of its effectiveness on the creative problem-solving ability of undergraduate students majoring in retail merchandising.

**Literature Review**

Creative problem solving is a series of cognitive processes that identifies a relevant problem, generates alternative ideas, and evaluates these ideas. Ingenuity significantly contributes to this process (Reiter-Palmon & Illies, 2004). Thus, to discuss creative problem solving, a definition of creativity is necessary.

Creativity has attracted a vast amount of researchers in diverse disciplines such as psychology, education, and organizational behaviors. Because creativity has been understood at different levels with different foci, no single definition of creativity is present. Rather, several definitions exist, many of which are tied to specific disciplines. For example, in the context of consumer psychology, creativity is “the capacity to generate novel cognitive content” (Hirschman, 1980, p. 285). Similarly, within psychology, Franken (1994, p. 396) defined creativity as “the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems,
communicating with others, and entertaining ourselves and others.” Within education, Sawyer (2006) presented multiple definitions of context-dependent creativity. At the individual level, two kinds of creativity exist, labeled “big C” creativity and “small c” creativity. Big C creativity is the ability to generate socially valuable products to solve significantly difficult problems, whereas the small c creativity is defined as the ability to generate something new in everyday activities. Generally, big C creativity focuses on understanding creativity through the work of eminent individuals, while small c creativity examines the broad population. At the group level, creativity is defined as the ability to collaboratively generate novel and appropriate products through interactions among members of a group. And finally, at the societal level, creativity refers to the ability for a society to generate a new system that benefits members of a society.

In addition to unclear operationalizations of creativity, the dispersion of creativity researchers across various disciplines often kept scholarly findings within a single field. These fragmented investigations contribute to the lack of consensus in the very definition and measurement of creativity because researchers from different disciplines pose questions from their own perspectives. Scott, Leritz, and Mumford (2004) concurred on this issue of diverse and disconnected methods that previous researchers used for creativity in their meta-analysis of creativity training studies.

Recognizing this fragmentation of the field of research, Hennessey and Amabile (2010) argued for a need to integrate diverse approaches to advance creativity research. They developed the concentric model of creativity, which enables visualization of diverse perspectives and levels of analysis addressing creativity (see Figure 1 for model). Although most previous creativity researchers focused on a single level (e.g., individual level of creativity), this model illustrates the close relationships among the creativity of individuals, social groups, and culture. The authors acknowledged a lack of perspectives that cross different levels of creativity and emphasized the importance of the interconnected relationships among both the creativity of individuals and the creativity of social groups and whether and how the culture and society at large foster creativity.

Regardless of the issues surrounding the development of an agreed-upon definition of creativity, it seems that most researchers at least agree that creativity is related to the generation of new ideas, products, or solutions to problems that can add value to individuals and/or society. However, what is even less established than an agreed-upon definition of creativity are the causes of or contributors to creativity. There seems to be no clear idea on what exactly contributes to the generation of new ideas, products, or solutions and/or what makes an individual creative.
Approach Implemented to Cultivate Creative Problem Solving

As noted previously, creativity can be learned (Hokanson, 2006; Karpova et al., 2011; Scott et al., 2004). Creativity is a result of cognitive development wherein individuals gain knowledge and the capability to logically think and organize information (Hirschman, 1980). Individuals are induced to learn and reason by being exposed to diverse environmental stimuli, and schools are one of the major sources of environmental stimuli (Hirschman, 1980). The educational setting can encourage the creativity of students by providing a cultural context and social norms that promote creativity. Reflecting this perspective and the emphasis on interrelationships among creativity of different levels (Hennessey & Amabile, 2010), the creative problem-solving course was developed. Although the course was designed to expand students’ horizons by including some training in interpersonal-/intergroup-level creative problem-solving skills, course activities are centered at the individual level. The working definition used to define the creativity to be developed is small c creativity, that is, “daily problem solving and the ability to adapt to change” (Hennessey & Amabile, 2010, p. 572).

In addition to a focus on developing small c creativity, the course mirrors two beliefs. The first belief is that diverse stimulations and experiences contribute to divergent thinking, which correlates with creativity. Divergent thinking requires searching around and developing numerous “correct” answers or possibilities in contrast to convergent thinking, which focuses on arriving at a single, correct answer (Plucker & Makel, 2010). Researchers investigating creative behaviors provided evidence that changing beliefs and making individuals accepting of novel experiences is closely related to creativity (George & Zhou, 2001; Silvia, Nusbaum, Berg, Marin, & O’Connor, 2009). McGrae (1987) found openness to experience, which conceptually includes intellectual curiosity, aesthetic sensitivity, emotional differentiation, and liberal values, was commonly present among creative individuals. According to these researchers, openness to experience (novelty-seeking tendencies) makes individuals prone to various thoughts, feelings, and ideas due to the wide range of experiences they encounter, which consequently leads to divergent thinking. Similarly, it has been proposed that novelty seeking influences consumer creativity because it increases the repertoire of consumption situations, which in turn serves as a source for novel problem solving (Hirschman, 1980). Therefore, it is reasonable to believe that encouraging students to break their regular routine behaviors and experience something new in their daily lives can increase their ability to generate creative solutions to problems.

The second belief shaping the course is that behavioral change can be very effective in shaping beliefs and actions in the future. This belief is supported by generativity theory (Epstein, 1999). Generativity theory states that novel behaviors are created by previously established behaviors and are strongly influenced by training because of the fact that the new behaviors are essentially the results of combining old behaviors in novel ways (Epstein, 1999). Through a series of experiments, Epstein presented empirical evidence that new behaviors of humans and animals can be predicted and intervened by introducing training of certain behaviors. In this study, individuals changed their habits and generated a novel solution by combining old (trained) behaviors when the previous behaviors were not successful in obtaining goals. Those individuals who received the training were able to find successful solutions by combining the trained behavior with old habits.

Taken together, generativity theory and extant research on the traits of creative individuals provided the basis to build the creative problem-solving course. The leading goal of the course is to change students’ behaviors, which subsequently impacts their willingness to try new experiences, and eventually enhances their creative problem-solving ability. Therefore, exercises and assignments are designed both to (1) increase students’ openness to experience and to (2) have students engage in a large and wide range of diverse experiences. Moreover, this pattern of expanding the pool of experiences (behavior) and of creatively combining them to generate novel solutions eventually can become habitual aspects of one’s character.
Development of the Creative Problem-Solving Course

The class is designed as a first-year offering applicable to students from any discipline; retail merchandising students are encouraged to enroll in the course during their first semester. The course is offered twice a year. Enrollment is not limited to first-year students. In addition to retail merchandising students, the course attracts students from a wide range of majors who are frequently not first-year students.

As noted previously, the core exercises of the creative problem-solving class are composed of activities designed to break existing habits and encourage new behaviors. These activities are accompanied by theoretical knowledge of creativity. Combined with theoretical knowledge of creativity are specific skills to use for developing students’ creative problem-solving talent. The activities and knowledge are strengthened through discussions and debriefings of all class exercises. The course consists of the following four major areas: knowledge, habits, skills, and beliefs.

Knowledge. Theoretical knowledge of creativity assists students in the development of creative skills and, in addition, provides a rational basis for the learning activities of the course, strengthening learners’ acceptance of course content (Feldhusen & Kolloff, 1978; Renzulli, 1977). Therefore, the course provided knowledge to students through various methods. Assigned readings illustrate the value of creativity in society and provide theoretical explanations for it. These readings also offer historical examples of the development of innovative ideas and products. Lectures reinforce the content of readings. The course has four quizzes on the readings and a final exam that asks students to demonstrate various creativity processes on paper.

Habits. Merriam-Webster (Habit, 2014) defines a habit as “something that a person does often in a regular and repeated way.” Habits can be viewed as detrimental to creativity in that they are often perceived as routine and unimaginative, preventing individuals from engaging in new behaviors. This generally accepted notion of habit is not compatible with creativity. However, Epstein (1999) has demonstrated that creativity-encouraging behaviors can become a habit. Thus, with the goal of developing creative problem-solving skills, the intentional changing of habits can lead to increased creativity—first by breaking repetitive and conformative habits and then by developing habits of exploration, divergence, and invention.

To begin to impact their regular and repeated ways of behaving, students complete 12 activities labeled “differents.” These activities, continuously completed over the length of the 15-week term, engage students in divergent behaviors with the goal of developing habits of exploration and risk taking. At the same time, assumptions, beliefs, and personal limits on action are challenged. For example, in one differents exercise, students are required to identify one thing their significant other does each day or all the time and to adopt that behavior for a period of time (e.g., my child drinks milk from a bottle so I drink milk from a bottle). Another example is a requirement that students eat a food that they have never consumed previously. Students are required to write a short reflection paper after each different exercise to reflect on how it has affected them.

Skills. Specific skills have been shown to be valuable in increasing divergent ideas and general creativity (Finke, Ward, & Smith, 1992). These skills include “heuristics for generating creative ideas as well as cognitive styles, working styles, and personality traits” (Amabile, 1983, p. 394). Development in skills used to generate divergent ideas, evaluate ideas, and recognize opportunities are effective in improving both measured creativity and creative outcomes (Amabile, 1983; Finke et al., 1992; Scott et al., 2004; Sternberg & Lubart, 1995). In-class exercises and directed practices of creativity techniques are used to introduce and improve these skills. For example, in class, students are frequently challenged to develop lists of alternative uses for common objects and trained in the use of...
of the attribute listing method as a structured aid to idea generation. The attribute listing method forces students to think about an object from multiple perspectives (e.g., physical, social, price, process, and psychological). (See “Attribute listing” in the *Encyclopaedia of New Media and Educational Planning* [Vol. 1] by Hota [2000] for additional description and details of this method). In-class exercises such as these develop skill in the generation of divergent ideas through understanding the use of structured aids to idea generation.

**Beliefs.** Belief in one’s own creativity can lead to increased creative output (Bandura, 1986; Hill, Tan, & Kikuchi, 2008; Tierney & Farmer, 2002). Sternberg (2000), for example, found that creative people are creative in large part because they decided to be creative, describing creativity inherently as “an attitude toward life.” Additionally, researchers have shown that both intelligence and creativity are dynamic and developable psychological traits (Florida, 2002; Michalko, 2006). Inherent in the course is the development of students’ creative self-efficacy. Learners who hold a belief that they are creative and that they can increase their creativity are more likely to do so (Bandura, 1986; Sternberg, 2000). Thus, through training and successful experiences in a classroom environment, students can develop corresponding beliefs. Students experience success through multiple means. For example, measurable increases in Torrance scores provide positive feedback on learners’ creative capabilities. The conquering of the “different” challenges increases students’ confidence as frequently noted in their anecdotal comments.

**Course Outline**

The course does not progress in the traditional didactic manner, with specific content units; rather, each of the activity types is interwoven in a long-term learning experience in a repeating pattern. For example, drills and exercises take place each class meeting, and the main effort of the course, the differents, occurs weekly. This ongoing nature of the practice of creativity builds the habits component of the course. Toward the end of the semester, students demonstrate their creative problem-solving skills by building a Rube Goldberg Machine (an overengineered device) that performs a very simple task. The overall organization of the course with learning objectives and activities is provided in Table 1.

**Hypotheses**

The main questions for investigation were (1) Do the students improve their creativity in the short term (i.e., a semester) as a result of their completing the creative problem-solving class and (2) How much creative problem-solving ability do students retain in the long term (i.e., from the completion of the course to graduation). The first question requires a direct measure of the effectiveness of their creativity training, that is, to measure the level of creativity at the start of (i.e., pretest) and at the end of the course (i.e., posttest). The second question can be answered by an assessment of the impact of the course over time. If the students learn creative problem-solving abilities from the course and if creative problem solving is a transferable skill, their enhanced skill should last over a long period of time. Transferable skills are those applicable to different tasks than the context wherein one obtained the skills originally. A skill can be transferred to many domains, particularly when the skill uses deliberate and mindful abstraction (Billing, 2007). The long-term effect can be revealed by reassessing the level of creative problem-solving skills after a time interval (i.e., delayed posttest). Previous literature on creativity training provides ample evidence for short-term effectiveness of creativity training. Diverse kinds of efforts to enhance creativity in education and business settings have been proven to be capable of increasing creative output (Karpova et al., 2011; Scott et al.,
Moreover, it has been documented that creative problem-solving skills are transferable (Billing, 2007). Thus, we developed the following hypotheses:

**Hypothesis 1:** There will be a significant improvement in creativity as a result of the creative problem-solving class. That is, the pretest (TTCT1) score will be lower than the posttest (TTCT2) score.

**Hypothesis 2:** The increased level of creativity achieved will be retained. Specifically, the delayed posttest (TTCT3) scores will be significantly higher than pretest (TTCT1) but not different from the posttest (TTCT2) scores.

**Method**

**Study Design**

In order to test the effectiveness of the creative problem-solving class in enhancing students’ creativity, a quasi-experimental study was conducted. To test the short-term effectiveness of the creative
problem-solving class, a repeated measure (i.e., pretest or posttest) design was employed. To test the long-term impact of the course, a mixed design with a within-subject factor (TTCT measure: pretest, posttest, and delayed posttest) and a between-subject factor (no training vs. training) was employed.

**Measurement.** Measures of creative processes focus on the development of divergent rather than convergent thinking. Because divergent thinking leads individuals to think in various directions (Runco, 1999), divergent thinking tests require individuals to produce as many ideas as they can in response to a stimulus. The quantity of responses is referred to as ideational fluency or ideation. The idea that more is better is a key to ideation but not the sole component of creative processes (Plucker & Makel, 2010).

Additional components of divergent thinking include originality, flexibility, and elaboration. Originality in this context refers to the uniqueness of responses resulting from a stimulus. Flexibility refers to a change in the meaning or use of something. Finally, elaboration refers to the extension of ideas within a specific category of responses, that is, the ability to fill in the details. For example, if an individual was trying to decide on what to make for dinner, he or she could come up with as many ideas for dinner (fluency), ideas that no one else would think of (originality), a list of different types of foods (flexibility), and/or a list of the different types of foods within a category of foods (elaboration).

The TTCT is the dominant measure of divergent thinking as it captures the major components of divergent thinking (Sternberg, 2000). Thus, we used the verbal version of TTCT. The TTCT has been widely used in testing individuals’ creativity and is the most dominant measurement (Plucker & Renzulli, 1999; Scott et al., 2004). In addition, it has been well validated in education settings (Karpova et al., 2011).

The verbal version of the test consists of three assessments. The first part measures fluency. In TTCT, fluency is measured by counting the number of ideas generated in response to a prompt in a set period of time. The second part evaluates flexibility. Flexibility is measured by the divergence within the ideas generated. The final part assesses originality. Originality is measured by the uniqueness or unusualness of the ideas. Elaboration is not measured in the verbal version. The test consists of six sections that ask for multiple written responses to illustrations and verbal prompts. Each section is timed, with responses measured over 5 or 10 min. All tests were scored by the Scholastic Testing Service, Inc., the publisher of the test. The three subarea scores were summed to a single Torrance test score for all three administrations of the test.

**Data Collection Procedure and Analysis**

Participants who took the course generated three test scores. From the inception of the course, the TTCT was administered 2 times during a semester for the pre and posttreatment evaluation. All students who enrolled in the creative problem-solving class took form A of the TTCT during the first week of the class. In the 12th week, students took form B of the TTCT as the posttest. These two versions of the test are designed to complement each other and be used interchangeably. Also, they were intended to be used for pretest–posttest comparisons. As a result, each class session generated a set of pretest and posttest scores of the TTCT for every student who took the course. The pretest and posttest data included in this study were gathered each semester beginning in Fall 2009 and ending in Spring 2012. These test scores were the basis for the test of the short-term effectiveness of the creative problem-solving class. In order to evaluate the long-term effect of the course, we located as many of these students as possible in two senior-level classes offered in the retail merchandising program during Fall 2013 and administered an additional TTCT (delayed posttest) to see whether there had been changes in the students’ scores since their posttests. All three test scores were matched by student identification number.
We recruited the participants from senior-level classes in the retail merchandising program to test the long-term effect of creative problem-solving training. Students in the senior-level classes were likely to have completed the creative problem-solving class as the class was required. A total of 54 students from the selected senior classes participated and took form B of the TTCT, the delayed posttest. One response was incomplete and was dropped from the data set. Among the 53 participants, 11 never took the creative problem-solving class. Because these participants did not get the training, these 11 served as a control group. The other 42 students took the class, but eight of those students’ previous test results were partially missing (i.e., missing either pretest or posttest scores) and were eliminated from the sample, leaving 34 participants. The semester these participants took the course varied, resulting in 1–4 years of time lapse from the completion of creative problem-solving training. The 34 participants who completed the course were divided into three cohorts based on the interim between the time of their delayed posttest and their completion of the creative problem-solving class: (Cohort A) students who took the course 2 years ago or less (≤2), (Cohort B) those who took the course less than or equal to 3 years (≤3) ago, and (Cohort C) those who took the course more than 3 years (>3) ago. For example, a student who took the course during fall 2011 would have completed the pretest during week 1 of the semester, the posttest during week 12 of the semester, and the delayed posttest in the fall of 2013. The interim between the posttest and the delayed posttest is 2 years, and the student would be a member of Cohort A. The separation of the cohorts allows researchers to observe the nature of the long-term effect of the course systematically.

Results

Participant Characteristics

All of the students (N = 45) were in the retail merchandising program. Their ages ranged from 19 to 26 years, with a mean of 21.36. Thirty-nine (84.8%) of the participants were women and the majority (n = 34, 73.9%) were Caucasian. Participants who took the course also answered questions on their evaluation of the course. Overall, the participants evaluated the creative problem-solving course positively. They answered that the course was worthy of their time (M = 5.03; 1 = strongly disagree, 7 = strongly agree) and they felt that the course helped them to approach problem solving more positively than before (M = 5.04).

Hypotheses Testing

Because our interest was in any significant changes to the participants’ creativity scores as a result of training at the individual level rather than on an assessment of participants’ creativity relative to a national sample, raw scores rather than standardized scores were used in the analysis. In the analysis, raw scores of three areas were summed to create a single overall score for individuals. The first TTCT score (TTCT1) reflected the level of creativity of participants before they took the creative problem-solving class (i.e., the pretest). The second TTCT score (TTCT2) represented the level of creativity of participants after they took the class (i.e., the posttest). The third TTCT score (TTCT3) is the level of creativity measured in fall 2013 (i.e., delayed posttest). Table 2 presents the mean scores.

A mixed 3 × 3 analysis of variance (ANOVA; the TTCT as the within-subject factor, and the interim between the course and the delayed posttest as the between-subject factor) was conducted using SPSS 20 to address the two hypotheses. There was significant difference among the levels of the within-subject factor, the TTCT, F(2,62) = 45.679, p = .000, partial η² = .596. At least one score among three TTCT scores was significantly different. The post hoc test revealed that only the first TTCT score (M₁ = 206.01) was significantly different (i.e., lower) from the other two TTCT scores (M₂ = 309.44, M₃ = 297.62). TTCT2 and TTCT3 were not statistically different.
Therefore, the students improved their creative problem-solving ability after taking the class (TTCT2 higher than TTCT1), supporting Hypothesis 1.

Because we followed several groups of students over time, a quasi-experiment was employed to test the hypotheses. Therefore, there is a possibility that the cohorts could have been different in their scores because of some peculiar events in the class, class dynamics, particular members of the class, and so forth. To ensure no such group difference exists, the TTCT scores were examined across the cohorts to test for potential group differences. The scores of TTCT1 and TTCT2 were not significantly different among the three cohorts. This confirms that there was no systematic discrepancy among the interim cohorts, and all students showed an equal amount of improvement in their creativity after the course. The data confirm that the improvement in creativity was likely to be a result of the course, not due to other factors such as sample characteristics and idiosyncratic characteristics of the class.

Although students improved their creative problem-solving skills significantly while taking the course, it was unknown whether the improvement was temporary or long lasting. Hypothesis 2 posited that students retain learned creative problem-solving skills acquired through the course. We investigated the long-term retention of the creative problem-solving training effect systematically by testing whether there was a significant decrease in TTCT scores when more time passed after participants’ completion of the course. The retention level was calculated by subtracting TTCT3 (delayed posttest) from TTCT2 (posttest). The difference scores between TTCT3 and TTCT2 were then entered as a dependent variable of a one-way ANOVA with the interim between the two tests as the independent variable. If students retain creative problem-solving capability, the difference scores will not change among three cohorts. If students lose creative problem-solving skills, the difference score will be larger for the cohort who took the course earlier (i.e., cohort C) than later (i.e., cohort A). The test of group difference was not significant, $F(2,31) = .849, p = .437$ (See Table 3 for mean scores). That is, participants retained their creative problem-solving skills, some of them for up to 4 years, supporting Hypothesis 2.

One possible alternative explanation for this result is that students may have forgotten the explicit creative problem-solving skills after completing the course but somehow naturally developed creative problem-solving skills through other courses and experiences in college. In other words, by the time students became seniors, they developed creative problem-solving skills regardless of the freshman-level creative problem-solving class. The inclusion of seniors who did not take the creative problem-solving course in the data set enabled us to test this alternative explanation. To test that it was truly the course that contributed to students’ creativity, an additional ANOVA was performed comparing scores between those who completed the course to those who never took the course (control group). The results revealed that the control group score was significantly lower than the scores of all other three interim groups, $F(3,42) = 3.211, p = .032$. This result not only confirms the

<table>
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<th></th>
<th>N</th>
<th>Interim</th>
<th>TTCT1 (T1)</th>
<th>TTCT2 (T2)</th>
<th>TTCT3 (T3)</th>
<th>Improvement (T2-T1)</th>
<th>Retention (T3-T2)</th>
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<td>314.21</td>
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<td>103.85</td>
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<td>337.50</td>
<td>314.38</td>
<td>118.00</td>
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<td>309.35</td>
<td>297.62a</td>
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Note. TTCT = Torrance tests of creative thinking.

aInterim = the time between the course taken and the time of delayed posttest (TTCT3). bThe overall mean scores of TTCT3 is calculated excluding the control group for a fair comparison of means across test scores.
positive effect of the creative problem-solving course on students’ improvement in creativity and their retention but also eliminates the possibility of the alternative explanation that students naturally gained creative problem-solving skills, as they progressed through the retail merchandising degree program.

**Discussion and Conclusions**

This study contributes to enhanced understanding of the effectiveness of creative problem-solving training by providing longitudinal data that indicates the effect of such training does not quickly diminish. The results also provide additional evidence that creativity can be trained and developed through classes (Scott et al., 2004). Indirectly, our results support a technique consistent with generativity theory that states a creative solution can be generated by combining and applying old experiences in new ways. Thus, participants may have benefited from expanding their base of experiences via the “differents” exercises to be able to continue to generate innovative ideas over time. Moreover, our results imply that apparel educators can be active in motivating and educating students to enhance their creativity. One clear means to do this is through courses such as the creative problem-solving class.

However, one course alone may not be optimal. Individuals’ intention to be engaged in an activity is highly influenced by social environment (Hennessey & Amabile, 2010). It has been noted that schools frequently encourage students to be rigid and inflexible by not only imposing strict structures and rules but also by providing an environment that forces students to conform to the norm (DeCocker, 2000; Scott, 1999). Thus, it is critical that schools provide both educational programs and environments to encourage and enhance students’ creative problem-solving abilities. Building creative problem-solving skills can be particularly significant for retail merchandising students, as the industry is faced with challenges due to technological developments and cultural changes impacting both the business and the consumption process.

This study is also a response to the call for a need to develop creativity training effectiveness studies that eliminate potential internal validity concerns (Scott et al., 2004). Initially, the effects of training in creativity were measured immediately after training. Because posttest results have often been obtained immediately after training and by the authority figures who conducted the training, there have been questions about the internal validity of the findings of previous researchers. However, the delayed posttest reduces internal validity concerns by eliminating alternative explanations such as conformity pressures or demand effects created by the test administrator.

Increases in measured creativity that have been observed at the conclusion of the course are substantial. Our study indicates that skills developed during the course are generally retained by the learner for a substantial period of time after the conclusion of the course. These skills do not develop independent of the course, as students who did not take the course did not show similar levels of creative problem-solving capability. Given the value of creative skills in the business world, the development of comparable courses in other retail merchandising programs could be valuable.

<table>
<thead>
<tr>
<th>Pair</th>
<th>Mean</th>
<th>SD</th>
<th>95% CI</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1-T2</td>
<td>-101.65</td>
<td>66.69</td>
<td>[-124.92, -78.38]</td>
<td>-8.89</td>
<td>.00</td>
</tr>
<tr>
<td>T1-T3</td>
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<td>74.80</td>
<td>[-117.01, -64.81]</td>
<td>-7.09</td>
<td>.00</td>
</tr>
<tr>
<td>T2-T3</td>
<td>10.74</td>
<td>54.50</td>
<td>[-8.28, 29.75]</td>
<td>1.15</td>
<td>.26</td>
</tr>
</tbody>
</table>

Note. CI = confidence interval.
Limitations and Suggestions for Future Research

One of the perils of longitudinal research is participant dropout. Thus, one limitation of this research is the small sample size, particularly in some of the comparison groups. Although the effect size of the treatment (i.e., creative problem-solving class) estimated by the partial $\eta^2$ suggests a large effect of the treatment on the participants’ creative problem solving, a future study that replicates the findings can enhance the external validity of the study. A second limitation may be linked to the use of the TTCT. Although it is a widely accepted measure of creativity and captures the major components of divergent thinking, there may be other indicators of creativity that should be assessed. For example, Tegano (1990) found that tolerance of ambiguity and playfulness are correlated with creativity. Thus, reliance on a measure of divergent thinking alone may have been insufficient in capturing the scope of creative problem solving gained as a result of the course. Future research could include use of an array of creativity indicators to address this limitation.

We offer several additional suggestions for future research. Because our results indicate creative problem-solving ability can be developed within the classroom, researchers may want to study retail merchandising educators to gauge their perceptions of creativity and their willingness to incorporate creativity training within their program’s curricula. In addition, comparisons of subarea scores of the TTCT would provide an in-depth understanding of the exact aspects of creative problem-solving skills that experience the greatest gain and/or loss over time. Researchers might also want to identify cognitive abilities that hinder or enhance the development of creative problem-solving skills within students. Investigations of the influence of individual difference variables (e.g., risk aversion and openness to new experience) on creative problem-solving development would also be useful in designing effective creative problem-solving classes.

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Note

1. Because the students are in the courses, their ID numbers are naturally attached in the roaster. We explained the procedure to institutional review board and because the data used are more of an exam result rather than a survey, it was approved without an issue.

References


**Author Biographies**

**Hyunjoo Im** is an assistant professor in the Retail Merchandising program at the University of Minnesota. She has published research works on consumer psychology, particularly in the context of multichannel retailing, visual information processing, and the impact of digital technology in the retail industry.

**Brad Hokanson** is a professor in graphic design at the University of Minnesota and serves as director of Educational Futures for the College of Design. He has published his research in the fields of creativity and educational technology. He teaches in the areas of creative problem solving and critical thinking.

**Kim K. P. Johnson** is a professor in the retail merchandising program within the College of Design at the University of Minnesota. Her research and teaching interests include social responsibility within the fashion industry, creativity, consumer behavior applied to apparel, and the social psychology of dress.