Differences in Creative Thinking Between American and Japanese College Students in Education

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DIFFERENCES IN CREATIVE THINKING BETWEEN AMERICAN AND JAPANESE COLLEGE STUDENTS IN EDUCATION

by

Noriko Saeki

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE in

Psychology

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1997
ABSTRACT

Differences in Creative Thinking Between American and Japanese College Students in Education

by

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Utah State University, 1997

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Fifty-one American and 54 Japanese college students in education were tested to investigate whether there were any cross-cultural differences in creative thinking. No gender differences were found in both cultures, but the American college students had higher scores on the Torrance Tests of Creative Thinking (TTCT) figural test than the Japanese college students. The difference was statistically significant and the effect size was large. Very low correlations were found between the TTCT and the American College Testing (ACT) for the American college students and between the TTCT and the Center Test for the Japanese college students.

(57 pages)
I would like to thank Dr. Xitao Fan for giving me a lot of advice in every step to finish this thesis. I would like to thank my committee members, Drs. Lani Van Dusen and Deborah E. Hobbs, for their support and assistance throughout the entire process.

I give a special thanks to professors Michitaka Takada and Seiji Tsuruta at Tsuru University for arranging testing in Japan and supporting me. I also give a special thanks to my friends, especially Barbara Soriano for great help in every step, Nanae Tsukuda for her help as my research assistant, and Dune Ives and Steve Jones for their help in conducting testing sessions. I could not have finished it without all of your help.

Noriko Saeki
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CHAPTER I
INTRODUCTION

What is the most important ability to have as a chief executive officer (CEO) of a company? According to Sternberg and Lubart (1996), many people think that creativity is the most important ability for CEOs, because a company's success is often dependent on the creative vision of its leadership. The importance of creativity in our society is not only recognized in the United States, but also in other countries, such as in Japan. Stern (1992) reported the results of a 2-year study about the development and expression of creativity in Japanese companies. He described the relationship between human resource development (HRD) and corporate creativity. The results indicated that HRD, education and training in particular, can influence corporate creativity. Thus, people begin to realize that creativity is currently one of the essential abilities to develop and maintain our society. But how is the ability of creative thinking fostered? What do we know about it? What has been done in the research of creativity?

Theoretical Perspectives

Creativity is generally defined as the cognitive ability to produce novel and valuable ideas. Solso (1991) stated that creativity is a cognitive activity that results in a new or novel way of viewing a problem or situation. Torrance (1988) described creativity as the following: “Creativity is the process of sensing difficulties, problems, gaps in information, missing elements, something askew; making guesses and
formulating hypotheses about these deficiencies; evaluating and testing these guesses and hypotheses; possibly revising and retesting them; and finally communicating the results” (p. 47).

Guilford (1959) explained creativity in terms of divergent thinking. According to Guilford, intellectual abilities can be classified into five major groups based on the process or operation performed: cognition, memory, convergent thinking, divergent thinking, and evaluation. Guilford explained that the two kinds of productive-thinking operations (i.e., convergent and divergent thinking) generate new information from known information and resembled information. The product of convergent thinking is what is commonly associated with intelligence; the product of divergent thinking, on the other hand, is closely related to creativity.

Most researchers agree that fluency, flexibility, and originality are the essential components of creativity. On creative tests, fluency is often assessed by asking an examinee, for instance, to name as many round things as possible. Flexibility may be assessed by asking an examinee to list different uses of brick, for example. Originality is usually assessed by examining how statistically rare the answers are. Assessment instruments have been developed to assess these components of creativity. For example, the Torrance Tests of Creative Thinking (TTCT), one of the best known and most widely used measures for divergent thinking, includes scales on fluency, flexibility, and originality.

The correlation between creative ability and intellectual ability is often discussed. But the results vary from study to study. As most creativity researchers agree, some
relationships exist between them, but the nature of the relationship is not entirely clear. In order to establish more reliable interpretations, we need to study more in this area.

Creativity in Education

Even though our society has begun to realize the importance of creativity, does the idea influence our education system? Some people (e.g., Kim & Micheal, 1995) believe that students go to school and perform according to what their teachers want. The students will make better grades if they conform to their teachers' expectations. If this is true, it means that the education system is structured to encourage students to develop convergent thinking skills, but not to provide students the opportunities to explore, to discover, and to develop their divergent thinking.

This problem has been indicated in other countries. In Japan, the National Council on Educational Reform submitted “Fourth Report on Educational Reform” in 1987 (as cited in Ogawa, Kuehn-Ebert, & DeVito, 1991). The report pointed out that elementary and secondary education in Japan should emphasize the fostering creativity, judgment, the ability to think, and the power of expression. Furthermore, Ogawa et al. (1991) pointed out that Japanese children showed a lower level of creative ability, especially in the area of flexibility, than American children. They discussed that the differences might have been the result of their different education circumstances. Furthermore, this result may be caused by their cultural influences, because the culture in some Asian countries, such as Japan, emphasizes conformity, as opposed to American culture, which emphasizes individualism. Most of the cross-cultural research has been
conducted among only elementary or junior high school children, but not among adults. If cross-cultural differences exist, such differences may be more reliably revealed among older students than among young children because cultural influence is more likely to be cumulative.

Torrance (1979) described his cross-cultural experience in his book, The Search for Satori and Creativity, as follows:

Before coming to Japan I had been aware of the firm discipline of the Japanese people and of the fine elaboration in their arts and technology. I had also been aware of the research findings of Kobayashi (1970) that Japanese ninth-grade boys surpass ninth-graders in the United States in elaboration on the Torrance Tests of Creative Thinking. I had not imagined how much this characteristic of elaboration permeates the Japanese culture and how much this skill is practiced in everyday living. First, we marveled at the precise details with which all arrangements had been planned by sponsor and his associates for all of my speaking engagements, entertainment, and the like. Then, I began noticing the fine details that went into the hotel services; the preparation and serving of food; services in shops, banks, and especially in barber shops (barbering is a truly great artistic, kinesthetic, and dramatic art); flower arrangements--everywhere. (p. 64)

His experiences in Japan so surprised him that he thought the elaboration of creative ability as polished in the Japanese culture. However, the Japanese people may not find nor even feel that their culture fosters creativity in any way. Even though we could understand our own characteristics better by comparing and knowing others, little research has been reported on the cross-cultural aspects of creativity.

Creativity is thought to make students better in divergent thinking, make them better thinkers, or make them more successful. There are some suggestions creativity is
not encouraged in the Japanese culture, especially in their education; but there is little empirical evidence about whether or not there are cultural differences in creativity.

Problem Statement and Purpose of the Study

Little research has been conducted about cross-cultural differences in creative thinking in general, and none has been reported regarding the difference in creative thinking between American and Japanese college students in particular. Even though some scattered information is available, a more focused study in this area will certainly contribute to the literature of creativity and its measurement.

The general purpose of this study is to determine what similarities and differences in creative thinking exist between American and Japanese college students. The specific objectives for this study are:

1. To investigate whether there are significant performance differences on creative thinking tests between American and Japanese college students.

2. To investigate whether gender differences exist in creative thinking among American and Japanese college students.

3. To investigate whether a significant relationship exists between performance on creativity thinking tests and performance on academic tests within cultural groups of American and Japanese college students.
CHAPTER II
LITERATURE REVIEW

Objectives for the Literature Review

There has been relatively little research conducted in cross-cultural comparison on creativity. The general purpose of this review is to report the current findings in the literature regarding cross-cultural difference on creativity. The following related aspects of creativity are reviewed: (a) theoretical framework for creativity, (b) components of creativity, (c) variety of creativity measures, (d) relationship between creativity measures and measures of intellectual functioning, (e) some potential factors for individual differences in creativity, (f) cross-cultural differences on creative thinking, and (g) recommendations for future research.

Theoretical Framework for Creativity

The study of creativity started by investigating how brilliant scholars and artists handled problems. Wallas (1926, cited in Brown, 1989) described the creative process as having four sequential stages: (a) preparation: formulating the problem and making initial attempts to solve it; (b) incubation: leaving the problem while considering other things; (c) illumination: achieving insight to the problem; and (d) verification: the solution is tested and/or carried out. Although there does not seem to be systematic empirical evidence for the validity of Wallas's four stages on creativity thinking, one famous example of these four stages is that of Poincare, a French mathematician, who discovered
the properties of Fuchsian functions. After working on the equations for a long time (preparation stage), Poincare decided to go on a geological excursion. While on the trip, he forgot his mathematical work that he had worked on (incubation stage). Poincare then reached his dramatic moment of insight when he put his foot on the step when entering an omnibus (illumination stage). The idea about the Fuchsian functions came to him. After going home, he tested his solution (verification stage).

After Wallas's work, some researchers have tried to analyze the process of creativity and to measure creativity. Guilford (1959) made a distinction between two types of productive thinking: convergent thinking and divergent thinking. Convergent thinking is underway when being asked to recall factual information. Therefore, the information leads to one right answer or to a recognized best or conventional answer. On the other hand, in the process of divergent thinking, our thoughts go in different directions, searching for ideas, sometimes seeking a variety of answers. According to Guilford, divergent thinking is a general process that underlies creativity. He explained, “The greatest importance of divergent-production abilities is in connection with creative thinking, where many alternative ideas need to be brought to light with ease. Since creative thinking is an important aspect of problem solving, these abilities are also important in that connection” (Guilford, 1977, p. 108, cited in Brown, 1989). Torrance (1988) also described creativity in the similar fashion: “The process of sensing difficulties, problems, gaps in information, missing elements, something askew; making guesses and formulating hypotheses about these deficiencies; evaluating and testing these guesses and hypotheses; possibly revising and retesting them; and finally communicating
the results” (p. 47). Based on his definition of creativity, Torrance (1962, cited in Torrance, 1990) developed the Torrance Tests of Creative Thinking (TTCT), which is the best known and most widely used creativity measure.

Components of Creativity

Researchers have suggested a variety of components for creativity, as shown in Table 1. Some common components for creativity are fluency, flexibility, and originality. Fluency is defined as the ability to produce large numbers of significant ideas. Although it is not always necessary to produce a lot of ideas under pressure of time, fluency would bring a person a greater chance of having significant ideas. On most creativity tests, fluency is measured by asking the examinees to name as many objects as they can within a fixed amount of time, and the objects to be named must have certain specified characteristics, such as, things that are round, things red, or things to eat (Guilford, 1950).

Flexibility is defined as the ability to produce a variety of ideas. Some researchers regard this as spontaneous flexibility because the variety is not specifically called for in the test’s instructions (Seddon, 1983). Flexibility on creative tests is usually measured by asking the examinees to list different uses of a common thing, such as a brick. Guilford (1967) stated, “An originality test should emphasize either (1) ability to produce responses that are statistically rare in the population, (2) ability to produce remotely related responses, or (3) to produce clever responses” (p. 154). According to
Table 1

Components of Creativity

<table>
<thead>
<tr>
<th>Study</th>
<th>Fluency</th>
<th>Flexibility</th>
<th>Originality</th>
<th>Elaboration</th>
<th>Complexity</th>
<th>Sensitivity</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guilford (1950)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Synthesizing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>abilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Analyzing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>abilities</td>
</tr>
<tr>
<td>Wallach &amp; Kogan (1965)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>--</td>
</tr>
<tr>
<td>Jackson &amp; Messick (1967)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Poetic</td>
</tr>
<tr>
<td>(a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torrance (1979)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>--</td>
</tr>
</tbody>
</table>

\textsuperscript{a}As cited in Brown (1989).

Torrance (1979), “Original ideas are statistically infrequent. In fact, some creativity researchers prefer to use the term ‘unique’ rather than ‘original’” (p. 40). Novelty is also associated with originality, and Guilford (1950) stated that it could be tested in terms of the frequency of uncommon answers.

There have been some criticisms that fluency is actually a confounding component. Clark and Mirels (1970) pointed out that measures of flexibility and originality were highly correlated with fluency. To support this criticism, Seddon (1983) mentioned that “it is therefore not at all surprising that these measures of originality and flexibility typically correlate about .8 with measures of fluency” (p. 393). According to
Torrance (1990), only the relationship between fluency and originality is relatively
dependent on each other. The other intercorrelations in figural form of the TTCT are
only in the range of 0.1 to 0.3. This problem of fluency as a confounding factor is still
unresolved, and Michael and Wright (1989) suggested the following:

To provide for a way of controlling for fluency without sacrificing
originality or flexibility estimates, an alternative compromise approach
may be useful. The respondent would be directed to generate as many
possible uses for an object, such as a light bulb, and then be asked to
choose a preselected number of the generated items (e.g., three) which the
respondent considers to be the most ingenious. (p. 48)

Michael and Wright (1989) also mentioned that more empirical research is needed to
study the relationships among the components of creativity and between creativity and
such variables as test-taking experience, maturity level, and intelligence.

Variety of Creativity Measures

Current creativity measures can be categorized into two groups: divergent
thinking measures and personality/biographical inventories (Davis, 1989). Divergent
thinking measures are designed to evaluate critical underlying cognitive abilities. The
TTCT (Torrance, 1990) is the best known and most widely used measure for divergent
thinking. There are several other published creativity tests for divergent thinking, such as
the Guilford’s Structure of Intellect Tests (Guilford, 1967), the Thinking Creatively in
Action and Movement (Torrance, 1981, cited in Cooper, 1991), the Thinking Creatively
with Sounds and Words (Torrance, Khatena, & Cunnington, 1973, cited in Cooper,
1991), and so forth. On the other hand, Davis (1989) stated that “personality/biographical
inventories assess attitudes, awarenesses, motivations, values, interests, and histories of
creative activities and hobbies” (p. 258). This category of personality/biographical
inventories is not directly related to what is commonly known as the major components
of creativity, such as originality and flexibility; therefore, only creativity measures for
divergent thinking are discussed in this review.

_Torrance Tests of Creative Thinking_

In 1966, the TTCT was derived from Torrance’s Minnesota Tests of Creative
Thinking, which were based on Guilford’s Structure of Intellect creativity tests. The
TTCT was intended for grades of kindergarten through adult and had both verbal and
figural tests. The verbal test contains seven subtests: asking, guessing causes, guessing
consequences, product improvement, unusual uses, unusual questions, and just suppose.
These are scored on the basis of fluency, flexibility, and originality (Table 2). The figural
test has three subtests: picture construction, picture completion, and parallel lines. The
picture construction is scored on originality and elaboration; and the others are on
fluency, flexibility, originality, and elaboration. Scores on both verbal and figural tests of
the TTCT are expressed as standard T-scores.

The psychometric quality of the TTCT has been the focus of some empirical
studies. Chase (1985) investigated the test-retest reliability of the TTCT. The
coefficients ranged from .50 to .93, with most of them in the .60s and .70s. Researchers
concluded that this is probably satisfactory as far as evaluating changes within the group
over a period of weeks, but not enough as an individual assessment (Chase, 1985;
Table 2

**Components of Creativity Tests**

<table>
<thead>
<tr>
<th>Creativity tests</th>
<th>Subtests</th>
<th>Fluency</th>
<th>Flexibility</th>
<th>Originality</th>
<th>Elaboration</th>
<th>Set Change</th>
<th>Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTCT</td>
<td>Verbal test</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Figural test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Picture construction</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>- Picture completion</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>- Parallel line</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>SOI-LA</td>
<td>Divergent Production of Figural Units (DFU)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Divergent Production of Semantic Units (DMU)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Divergent Production of Symbolic Relations (DSR)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TCAM</td>
<td>How many ways?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Can you move like?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No (Imagination)</td>
</tr>
<tr>
<td></td>
<td>What other ways?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>What might it be?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Treffinger, 1985; Cooper, 1991). Chase (1985) and Cooper (1991) also implied that the construct validity of the test is weak. Torrance defined creativity in the tradition of scientific inquiry: sensing problems, formulating hypotheses about deficiencies, testing these hypotheses, and communicating the results. Cooper explained, "From this comes
the analytic bent of some TTCT items”; therefore, he suggested that “Torrance may have
to modify his scientific method like the definition of creativity to encompass a broader
spectrum of what it means to be creative” (p. 197).

In summary, the TTCT is designed to assess the important characteristics of
creativity. Research over the last two decades has shown that the TTCT has a reasonable
psychometric quality for group research. The manual for administration is well
developed, and it is clear, concise, and easy to follow.

Structure of the Intellect Learning Abilities
Test

The Structure of the Intellect Learning Abilities Test (SOI-LA) was developed by
Meeker (1969, cited in Cooper, 1991), based on the Guilford’s Structure of Intellect
Model, which schematically integrates 120 cognitive abilities varying on three
dimensions: operations, products, and content. There are 26 subtests of the SOI-LA, and
three of them assess dimensions of creative thinking: fluency, flexibility, and originality.
These three tests are the Divergent Production of Figural Units (DFU), which consists of
16 small rectangles; the Divergent Production of Semantic Units (DMU), which requires
writing a story; and the Divergent Production of Symbolic Relations (DSR), which
measures one’s understanding of relationships between letters or numbers and
understanding symbolic relationships. As we can see in Table 2, these three tests are
scored for fluency, flexibility, originality, set change, and transformation.

The reliability of SOI-LA is acceptable. According to Cooper (1991), interrater
reliability of the three tests is in the .90s. The test-retest reliability ranges between .46 to
.69 among the three tests. However, the content validity is suspect. Meeker (1985, cited in Cooper, 1991), who worked in the area of developing an empirically based theory of intelligence, claimed that "the existence of the model (SOI) forces that developer to create new types of items which may not have been suggested by more global theories of intelligence or cognitive abilities" (p. 199). Coffman (1985, cited in Cooper, 1991) also mentioned that "the extent to which each of these subtests actually measures the hypothesized factor rather than variance specific to the particular test format is open to question, and the authors provide no evidence on this issue in the several manuals that accompany the test" (p. 199). These concerns make the SOI-LA less favorable as an instrument for assessing creativity.

Thinking Creatively in Action and Movement

Thinking Creatively in Action and Movement (TCAM) by Torrance (1981, cited in Cooper, 1991) assesses the creativity of young children 3 to 8 years old. It contains four subtests: How many ways?; Can you move like?; What other ways?; What might it be? These subtests assess originality, imagination, and fluency (see Table 2). Verbal and physical responses are used for scoring. The manual has tables for converting raw scores into standard scores; national norms for originality, fluency, imagination, and overall creativity are available.

The content validity of the four subtests as a whole seems to measure what it was meant to (Cooper, 1991). The interscorer reliability was over .90. Test-retest reliability coefficients ranged from .58 to .79 for subtests, and .84 for the total test. The TCAM
may be comparable to the TTCT when used to assess creativity of young children only.

However, less research had been conducted on the TCAM, and its psychometric quality is less known and less established.

**Thinking Creatively With Sounds and Words**

Thinking Creatively With Sounds and Words (TCWSW) was developed by Torrance, Khatena, and Cunnington (Cooper, 1991). TCWSW has two levels: Level I for third through twelfth grades, and Level II for adults. TCWSW is a battery of two tests: Sounds and Images (SI), and Onomatopoeia and Images (OI). Cooper (1991) described SI and OI as follows:

The Sounds and Images test uses a set of four sounds which have qualities which might be described as huge, expansive, popping, snapping, surging and so forth. On each record two of the four sound end in an open manner. That is, the “open sounds” do not end with a down beat or sharp ending like sound but continue on with the music getting softer. Whereas, two of the sounds end with closure, an abruptness indicating a definite end. (p. 200)

The OI test uses words such as ouch, moan, groan, and so forth, to evoke images to be written down. A nonevaluative and playful atmosphere is used to open up the imagination and let it flow.

Both the reliability and validity estimates of TCWSW vary. Alternate forms reliability ranged form .36 to .92, and criterion-related validity coefficients for SI Form A and B using two criterion measures ranged from .31 to .44. These results were much lower than the TTCT (see p. 10). On the other hand, the utility is a great aspect of TCWSW. Cooper (1991) said that “the sounds and onomatopoeia could be used most
effectively in the classroom to stimulate creative thinking and to allow students insight into their own thinking process” (p. 200-201). In conclusion, TCWSW may be used in research as a valid and reliable measure of creativity as the publisher and some researchers have suggested, but the evidence for TCWSW is weaker than that for the TTCT.

**Summary**

Among the variety of creativity tests, the TTCT is the best known and it has been extensively validated. Because of its popularity and importance, the TTCT is also the most critiqued among the creativity tests. There are more than 1,000 published research studies that used TTCT, and it has been translated into more than 30 different foreign languages. In some countries such as France, Italy, Czechoslovakia, and Taiwan, the TTCT has been published and standardized. About 150,000 children and adults are tested with these instruments each year. Despite its popularity in many countries, cross-cultural creativity comparison studies using the TTCT, however, are rare.

**Relationship Between Creativity Measures and Measures of Intellectual Functioning**

As already mentioned in Chapter I, intellectual abilities can be classified into five major groups as cognition, memory, convergent thinking, divergent thinking, and evaluation (Guilford, 1959). The product of convergent thinking is generally considered as being similar to intelligence. The product of divergent thinking, on the other hand, is
closely related to creativity. Brown (1989) described why the intelligence-testing movement has led to a better understanding of intelligence than the creativity-testing movement has of creativity. He suggested that the initial establishment of criterion validity in the research on intelligence tests had enabled later theoretical constructs to be tied to observable behaviors. However, he mentioned, creativity tests have been developed according to their particular theoretical orientations without establishing adequate criterion validity. As a result, creativity tests only appear to have construct validity, but lack empirical validity evidence.

Most researchers agree that creativity tests are related to intelligence, but the nature of the relationship is not entirely clear. Some researchers have found a low correlation between the scores on creativity tests and intelligence tests (Sattler, 1982). Also, the relationship may depend on the area of creativity. Even if a low correlation is found in one area of creativity, one can hardly draw a general conclusion that intelligence is not related to creative production. Guilford (1967) described the relationship between creativity in divergent production (DP) and intelligence by presenting some correlational information between creativity and educational levels and between creativity and different measures of intelligence, such as IQ, for different age groups. He concluded that those with a high IQ may be found almost anywhere within the range of a DP test. Although those who are low on the DP test may also be found almost anywhere on the IQ score range, those high on the DP test have a high probability of being above average on IQ. His study indicates that higher IQ may be needed for being a highly creative person.
Other researchers also found that high scorers on creative tests are also those who score at least above average on intelligence tests (Sternberg, 1985).

Some Potential Factors for Individual Differences in Creativity

Potential factors contributing to individual differences in creativity can generally be classified into three sources: personality differences, cognitive style or ability differences, and social psychology. Woodman and Schoenfeldt (1989) organized the individual differences in creativity more precisely by using an interactionist perspective. The interactionist model of creative behavior shows five factors underlying individual differences in creativity: antecedent conditions, cognitive style/abilities, personality factors, contextual influences, and social influences. Antecedent conditions include past reinforcement history, early socialization, biological variables (e.g., sex), family position, and birth order. The factor of cognitive style/abilities involves cognitive complexity, divergent thinking, verbal/ideational fluency, problem-solving styles/approaches, perceptual openness, and field independence/dependence. Personality factors are traits such as locus of control, dogmatism, autonomy, self-esteem, narcissism, and intuition. Contextual influences involve physical environment, culture, group/organization climate, and task and time constraints. The factor of social influences includes such factors as social facilitation, evaluation expectations, rewards/punishments, and role playing.

Many researchers have been interested in the potential factors related to individual differences in creativity. For example, gender differences have been investigated in many
studies. But the results vary, depending on age, the procedure of measuring creativity, area of creativity, and culture.

Kim and Michael (1995) assessed gender differences in creativity. They found that Korean high school females exhibited higher average levels of performance on figural and verbal creativity tests than the males. Gupta (1981) observed that Indian boys tended to be superior to girls on verbal fluency, verbal flexibility, and verbal transformation, but the differences were not statistically significant. Richardson (1986) found significant gender differences on verbal fluency among Jamaican students, which favor the girls. These results indicate a lack of agreement among the empirical studies about gender difference in creativity.

Cross-Cultural Differences in Creative Thinking

As mentioned in Chapter I, Torrance (1979) described how much elaboration permeates the Japanese culture and how much this skill is practiced in everyday living. Creativity may be one of the traits that is related to one’s cultural background. Little research has been conducted to investigate potential cross-cultural differences in creative thinking. Ogawa et al. (1991) compared flexibility and fluency of fifth-grade Japanese and American children (Table 3). They found no gender and cultural differences on the fluency test. But American children appeared to be superior to Japanese children in flexibility. They also found that the correlation coefficient between flexibility and fluency for American children was higher than that for Japanese children, which was statistically significant. The results indicate that flexibility may not be a major factor of
Table 3

Summary for Cross-Cultural Research on Creative Thinking

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Size and gender</th>
<th>Grade</th>
<th>Test material</th>
<th>Verbal or figural</th>
<th>Criteria of creativity</th>
<th>Culture difference</th>
<th>Gender difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ogawa et al. (1991)</td>
<td>American (μ1) 41 (17/24)</td>
<td>5th</td>
<td>Original</td>
<td>Verbal</td>
<td>Flexibility</td>
<td>μ1 &gt; μ2**</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Japanese (μ2) 73 (35/38)</td>
<td></td>
<td>Utility</td>
<td></td>
<td>Fluency</td>
<td>μ1 = μ2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim &amp; Michael (1995)</td>
<td>Korean 193 (92/101)</td>
<td>12th</td>
<td>TTCT</td>
<td>Both</td>
<td>Flexibility</td>
<td>N/A</td>
<td>M &lt; F*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fluency</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05. **p < .01.

creative thinking for Japanese children, or alternatively that Japanese children tend to be less flexible than American children. However, they used only two components of creativity in their research, and it is unknown how the results can be generalized to other components of creativity.

Kim and Michael (1995) conducted their study to investigate the extent to which performance on measures of creativity of both verbal and visual tasks were related to school achievement, and to identify possible gender differences of Korean students in learning and thinking styles. In the study, they did not compare any cultural differences directly, but they provided the following discussion about creativity components and school performance:

Typically, high performance in school-related subjects tends to be dependent on convergent abilities that emphasize language and reading as well as mathematical skills to meet highly structured objectives rather than
on divergent thinking abilities that occur in unstructured and fluid learning environments....It has been the experience of the authors that conformity to the expectations of teachers, which tends to be rewarded with higher grades, may be aligned more closely with convergent thinking than with divergent thinking. (p. 71-72)

Based on this reasoning, cross-cultural educational environment differences may potentially contribute to cross-cultural differences in creativity. Because Asian countries, such as Japan, and the United States tend to have very different cultural and education environments, with the Japanese culture emphasizing conformity and American culture emphasizing individualism, it would be interesting to see if the relationship between the performance on creativity measures and performance on academic tests is similar in Japan as in the United States, or if it is different.

Summary of the Review

Since Guilford (1977, cited in Brown, 1989) stated that divergent thinking production was crucial for creativity, creativity has been discussed within the context of divergent thinking. Creativity is described in general as a cognitive ability to produce novel and valuable ideas. Fluency, flexibility, and originality are commonly considered as the components of creativity and are the topic of many studies.

In the last couple of decades, many instruments for assessing creativity have been developed to measure various components of creativity. The TTCT is a well developed and widely used measure of divergent thinking, and it measures four major components of creativity: fluency, flexibility, originality, and elaboration.
As potential factors contributing to individual differences in creativity, cultural background and gender are often discussed. In general, little empirical evidence has been reported and the results did not seem to be consistent.
CHAPTER III
THE STUDY

Purpose of the Study

Little research has been conducted about cross-cultural differences in creative thinking in general. Even though some scattered information is available for children, none has been reported regarding the difference in creative thinking between American and Japanese college students in particular. Therefore, a more focused study in this area will certainly contribute to the literature of creativity and its measurement.

The general purpose of this study is to determine what similarities and differences in creative thinking exist between American and Japanese college students who are education majors. The specific objectives for this study are:

1. To investigate whether there are significant performance differences on creative thinking tests between American and Japanese college students.

2. To investigate whether gender differences exist in creative thinking among American and Japanese college students.

3. To investigate whether significant relationships exist between scores of creativity thinking test and academic tests within each group of American and Japanese college students.
This study was conducted as both causal-comparative and correlational studies (Gall, Borg, & Gall, 1996). In the causal-comparative study, there were two factors as the independent variables: cultural background for American and Japanese college students in education and gender. The dependent variables were the scores on TTCT. Therefore, it is a 2 (culture) × 2 (gender) design.

The correlational study was conducted to investigate whether significant relationships exist between performance on creativity tests and on academic tests required for college admissions. Because American and Japanese college students took different academic tests, the correlational study was carried out separately for American and Japanese college students. Therefore, for the correlational study, the two variables were the scores of academic tests and the scores of TTCT within each group.

Methods

Subjects

The subjects for this study were 55 American (24 males and 31 females, mean age = 21.9 years) and 54 Japanese (27 males and 27 females, mean age = 19.3 years) college students majoring in education. The American subjects were from Utah State University, which is located in northern Utah, in the city of Logan, which is 85 miles northeast of Salt Lake City. Thirty-four subjects (10 males and 24 females) were recruited from an educational psychology class and the other 21 subjects majoring in education (14 males
and 7 females) were recruited from a introductory psychology class during their fall quarter in 1996. They were volunteers for extra credit in their classes. The subjects in this study were those who have spent most of their lives in the United States and speak English as their first language.

The Japanese subjects were recruited from Tsuru University, which is located in the city of Tsuru, Yamanashi prefecture, Japan. Yamanashi is located on the west side of Tokyo. The city of Kofu, the capital of Yamanashi, is 35 miles away from the university. The university is designated as a national or public-funded university. The students who participated in this study were from educational psychology classes during their spring semester in September 1996 (In Japan, spring semester begins in April as a new academic year and ends in September). The study was conducted during regular class time, and class attendance points were given to the subjects. The Japanese subjects were those who have spent most of their lives in Japan and speak Japanese as their first language.

Instrumentation

The figural TTCT--Form A was administered as the test for creativity. A test booklet, which included three exercises for 10 minutes each, was provided to each subject. Pencils were also provided. The three exercises were picture construction, picture completion, and parallel lines. They include an incomplete or abstract sketch, which the subject is asked to complete and label. The reliability and validity for the TTCT have already been discussed in a previous chapter (see the Variety of Creativity Measures section). Administration procedures followed the instructions in the manual.
For the Japanese students, all instructions were translated into Japanese by an experienced translator, who had translated English psychology books into Japanese. After testing, all test booklets were sent to the Scholastic Testing Service TTCT Scoring Center to be scored, and the Scoring Center provided computerized individual and group results. English translation was added in the Japanese students’ booklets next to their answers only for titles of pictures. This translation support was given by two Japanese-English speakers and an English-Japanese speaker.

Scores on five norm-referenced measures and 13 criterion-referenced measures were obtained from the scoring. The five norm-referenced measures are Fluency, Originality, Abstractness of Titles, Elaboration, and Resistance to Premature Closure. According to Torrance (1992), the score of Abstractness of Titles relates as follows:

This score relates to the subject’s synthesizing and organizing process of thinking. At the highest level, there is the ability to capture the essence of the information involved, to know what is important, enabling the viewer to see the picture more deeply and richly. (p. 40)

Torrance also describes Resistance to Premature Closure as follows:

The basis of this score is a person’s ability to keep open and delay closure long enough to make the mental leap that makes possible original ideas. Less creative persons tend to leap conclusions prematurely without considering the available information, cutting off changes of more powerful original images. (p. 40-41)

The 13 criterion-referenced measures are collectively called Checklist of Creative Strengths. They are Emotional Expressiveness, Storytelling Articulateness, Movement or Action, Expressiveness of Titles, Synthesis of Incomplete Figures, Synthesis of Lines, Unusual Visualization, Internal Visualization, Extending or Breaking Boundaries,
Humor, Richness of Imagery, Colorfulness of Imagery, and Fantasy. In the TTCT Streamlined Scoring Guide (Figural), Torrance (1992) advised for the use of this Checklist of Creative Strengths as follows:

Users should not make unwarranted conclusions on the basis of an absence of the checklist indicators. Instead, the occurrence of checklist indicators should be regarded as a strength that can be used in developing appropriate curricular and instructional methods for a particular student, counselee, etc. (p. 41)

In scoring, the five norm-referenced measures are scored, then the Checklist of Creative Strengths is determined as extra points. The TTCT Creativity Index is calculated and standardized on the basis of these procedures and it serves well as “an overall indicator of creative potential” (Torrance, 1992, p. 6).

The Center Test for entering public-funded universities in Japan covers the academic subjects of Japanese, foreign languages (mostly English), mathematics, social studies, and science. The purpose of this testing is to assess applicants’ achievement in the academic subjects of high school classes; the test is administered once a year. The subject areas of Japanese, mathematics (I & II), and foreign languages are worth 200 points each, and social sciences and science are worth 100 points each. Therefore, the highest points possible would be 800 points. According to the official report of the Daigaku Nyushi Center (1996), 521,681 college applicants took the test in 1996. The results for the subject areas of the Center Test in 1996 are presented in Table 4. The Tsuru University requires the Center Test scores only on foreign languages and the highest two academic subjects. The highest scores, therefore, should be 600 points.
### Table 4

**Results of the Center Test in 1996**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Specialtiesa</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese</td>
<td></td>
<td>488,246</td>
<td>67.41&lt;sup&gt;b&lt;/sup&gt;</td>
<td>16.66&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>Japanese History</td>
<td>192,260</td>
<td>57.37</td>
<td>15.83</td>
</tr>
<tr>
<td></td>
<td>World History</td>
<td>126,275</td>
<td>63.52</td>
<td>18.11</td>
</tr>
<tr>
<td></td>
<td>Geography</td>
<td>103,337</td>
<td>72.35</td>
<td>13.78</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Mathematics I</td>
<td>403,770</td>
<td>56.41</td>
<td>20.43</td>
</tr>
<tr>
<td></td>
<td>Mathematics II</td>
<td>371,845</td>
<td>67.44</td>
<td>22.28</td>
</tr>
<tr>
<td>Sciences</td>
<td>Physics</td>
<td>152,495</td>
<td>70.52</td>
<td>17.28</td>
</tr>
<tr>
<td></td>
<td>Chemistry</td>
<td>186,812</td>
<td>60.56</td>
<td>20.93</td>
</tr>
<tr>
<td></td>
<td>Biology</td>
<td>145,766</td>
<td>65.83</td>
<td>17.70</td>
</tr>
<tr>
<td>Foreign Languages</td>
<td>English</td>
<td>517,861</td>
<td>54.76&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.60&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>One specialty in each subject can be chosen by examinees.  
<sup>b</sup>Converted into 100 points-scale from 200 points-scale.

When mathematics, social sciences, and science were counted as a part of the three highest subjects, they were doubled, because they are only 100 points each. The scores on the Center Test were used as measures of academic aptitude/performance for Japanese students. Permission to use the official scores for this study was given by the university committee.

The American College Testing (ACT) assessment is used for many students who are planning to enter universities in the United States. The ACT measures skills in English, mathematics, reading, and science reasoning in order to get the best indication of how well a student will do in college by measuring how well the student can perform the skills necessary for college work. On each of the four tests, the total number of correct
responses yields a raw score. Raw scores are converted to scaled score, and 36 is the maximum score on each of the tests. The average score of the four tests is used as the ACT score for a student. The scores on the ACT were used as measures of academic aptitude/performance for American students. Permission to use the official scores for this study was given by each student on the Informed Consent Form (see Appendix).

Procedure

Data were collected in September 1996 for the Japanese college students and from October to November 1996 for American college students. For American students, all instructions were given in English by English native speakers. For Japanese students, instructions were given in Japanese by Japanese native speakers. University classrooms were used for each testing session. The Informed Consent Form (see Appendix) was provided to each subject before the testing session.

Analysis

Causal-Comparative Study

The two-way analysis of variance (ANOVA) was appropriate for determining whether the differences between mean scores are statistically significant on the result of the factorial experiment, which had a 2 (culture) \times 2 (gender) design. The probability level for achieving statistical significant was set at .05.

Using the two-way ANOVA, the following effects were determined:
1. The interaction effect of culture by gender, which determines whether the two
gender groups have the same TTCT score pattern within the two cultural groups.

2. The main effect of culture on the score of TTCT, which determines whether the
difference between mean scores on the TTCT are statistically significant between the two
cultures.

3. The main effect of gender on the score of TTCT, which determines whether the
difference between mean scores on the TTCT are statistically significant between gender
groups.

Correlational Study

The Pearson product-moment correlation coefficient τ was the appropriate
correlational statistic for determining the magnitude and direction of the relationship
between scores of ACT and TTCT for American college students and between scores of
the Center Test and TTCT for Japanese college students. A test of statistical significance
was obtained to test the null hypothesis that the correlation between the two variables
was zero in the population. The probability level for achieving statistical significance
was set at .05.
CHAPTER IV
RESULTS AND DISCUSSION

Causal-Comparative Study

Sample Descriptive Statistics

Table 5 shows the sample descriptive statistics of means and standard deviations for American and Japanese college students. There are Creativity Index (CI), Elaboration Standard Score (ESS), Fluency Standard Score (FSS), Originality Standard Score (OSS), Resistance to Premature Closure Standard Score (RSS), and Abstractness of Titles Standard Score (TSS).

Assumptions

The following four assumptions underlying the use of the ANOVA test were

Table 5

<table>
<thead>
<tr>
<th>Component</th>
<th>American (n=55)</th>
<th>Japanese (n=54)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>ESS</td>
<td>111.18</td>
<td>14.46</td>
</tr>
<tr>
<td>FSS</td>
<td>93.38</td>
<td>21.80</td>
</tr>
<tr>
<td>OSS</td>
<td>102.89</td>
<td>16.89</td>
</tr>
<tr>
<td>RSS</td>
<td>101.64</td>
<td>19.70</td>
</tr>
<tr>
<td>TSS</td>
<td>108.07</td>
<td>16.60</td>
</tr>
<tr>
<td>CI</td>
<td>115.95</td>
<td>12.90</td>
</tr>
</tbody>
</table>
considered before the results of the ANOVA could be interpreted: (a) the observations within each cell are independent; (b) the observations within each cell are a random sample from a defined population; (c) the populations from which the samples were drawn are normally distributed; and (d) the cell variances in the population are equal. The first assumption is considered as being met. The subjects used in this study were independent within each cell. The second assumption was not met, because convenience samples were used instead of random samples. When this assumption is not met, the meaning of statistical significance testing becomes problematic (Shaver, 1993). For this reason, the results of statistical significance testing should not be too heavily relied upon, and effect size measures both in the form of standardized group differences (Cohen, 1988) and in the form of eta-squared ($\eta^2$) were obtained as one important source of information. For the third assumption, skewness and kurtosis on the score of CI were checked. Skewness measures how the sample distribution is symmetrical. Kurtosis, on the other hand, measures its peakedness. Both measures are centered at 0, and the values between $+2$ and $-2$ indicate an approximately normal distribution. As shown in Table 6, skewness and kurtosis for both groups show that the data were approximately normal. Also the ratios of each statistic to its standard error were not less than $-2$ or greater than $+2$. These indicate that the scores of the CI were fairly symmetrically and normally distributed. The fourth assumption, the assumption of homogeneous variance, is not so important when group sample sizes are approximately equal as in this study. But based
Table 6

Statistics for Normal Distribution on CI

<table>
<thead>
<tr>
<th>Group</th>
<th>Skewness Statistic</th>
<th>Skewness Std. Error</th>
<th>Skewness Stat./S.E.</th>
<th>Kurtosis Statistic</th>
<th>Kurtosis Std. Error</th>
<th>Kurtosis Stat./S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>American</td>
<td>.331</td>
<td>.322</td>
<td>1.028</td>
<td>-.256</td>
<td>.634</td>
<td>-.404</td>
</tr>
<tr>
<td>Japanese</td>
<td>.061</td>
<td>.325</td>
<td>.188</td>
<td>-.378</td>
<td>.639</td>
<td>-.592</td>
</tr>
</tbody>
</table>

on the Levene’s test for equality of variances, the statistic is 3.103 (p = .081). Thus, at the .05 level, the hypothesis of equal variances between the groups could not be rejected.

*The Interaction Effect of Culture by Gender*

The two-way ANOVA was conducted to determine the interaction effect of culture by gender. The interaction effect on Table 7 shows that the result was not statistically significant (F = .073, p > .05). In the other words, cultural group difference patterns are consistent across the two gender groups. Therefore, it is appropriate to proceed to examine each main effect of this study.

*The Main Effect of Culture*

The result (Table 7) shows there is statistically significant difference between American and Japanese college students (F=15.717, p < .05). The eta-squared (η²) is also determined to describe the common variability between the dependent variable and the independent variable (Table 8). For the factor of culture, approximately 13% of the variability in the dependent variable is associated with the cultural background. In other
Table 7

Analysis of Variances for Culture and Gender

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Square</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Effect</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td>3723.580</td>
<td>1</td>
<td>3723.580</td>
<td>15.717**</td>
</tr>
<tr>
<td>Gender</td>
<td>.498</td>
<td>1</td>
<td>.498</td>
<td>.002</td>
</tr>
<tr>
<td>Interaction</td>
<td>17.402</td>
<td>1</td>
<td>17.402</td>
<td>.073</td>
</tr>
<tr>
<td>Residual</td>
<td>24875.745</td>
<td>105</td>
<td>236.912</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>28685.890</td>
<td>108</td>
<td>265.610</td>
<td></td>
</tr>
</tbody>
</table>

**p < .01.

Table 8

$\eta^2$ for the ANOVA

<table>
<thead>
<tr>
<th>Factor</th>
<th>SS</th>
<th>SS$_{total}$</th>
<th>$\eta^2$</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture (Factor A)</td>
<td>3723.580</td>
<td>28685.890</td>
<td>.1298</td>
<td>12.98</td>
</tr>
<tr>
<td>Gender (Factor B)</td>
<td>.498</td>
<td>28685.890</td>
<td>.0000</td>
<td>0.00</td>
</tr>
<tr>
<td>Interaction</td>
<td>17.402</td>
<td>28685.890</td>
<td>.0006</td>
<td>0.06</td>
</tr>
</tbody>
</table>

In words, we have approximately 13% of the information needed to predict what an individual’s score would be when we know what group he/she is in.

Table 9 shows the results of a $t$ test on each component of the TTCT and the effect size measures in the form of standardized group difference ($d$). There are five components on the TTCT and the TTCT CI as the total score. Because multiple $t$ tests were conducted here, the risk of committing a Type I error may have increased. Thus a
Table 9

Effect Size and t Test on Each Component

<table>
<thead>
<tr>
<th>Component</th>
<th>t</th>
<th>d²</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESS</td>
<td>5.320**</td>
<td>1.018</td>
</tr>
<tr>
<td>FSS</td>
<td>0.229</td>
<td>.044</td>
</tr>
<tr>
<td>OSS</td>
<td>1.509</td>
<td>.289</td>
</tr>
<tr>
<td>RSS</td>
<td>0.876</td>
<td>.168</td>
</tr>
<tr>
<td>TSS</td>
<td>5.033**</td>
<td>.962</td>
</tr>
<tr>
<td>CI</td>
<td>4.027**</td>
<td>.773</td>
</tr>
</tbody>
</table>

In calculating d, the pooled standard deviation across the two groups was used.

**p < .01.

**

statistical inferential decision should be based on more conservative α level for each individual test, for example, to use α = .01 instead of α = .05.

On the component of Elaboration (ESS), the American college students had statistically significant higher scores than the Japanese college students (t = -5.320, p < .01). The mean difference between the two groups is one of the biggest among five main components. The effect size d was 1.018. Cohen (1988) suggested that, for social sciences, d = .20, d = .50, and d = .80 could be considered as small, medium, and large effect sizes, respectively (p. 40). Based on this criterion, this effect size indicates that the statistically significant difference on ESS between the two groups also has practically large difference between them. This result was unexpected, because Torrance (1979) described how Japanese culture influences their creative thinking. He also mentioned that Kobayashi found Japanese ninth-grade boys surpass ninth-graders in the United States in elaboration (cited in Torrance, 1979).
There are two possible reasons for the discrepancy of these results. First, the study by Kobayashi was conducted more than 27 years ago. Therefore, some historical change may have happened since then. Second, the age difference, such as ninth-grader and college students, may cause the discrepancy of the result.

No statistically significant difference was found on the component of Fluency (FSS; $t = -229, p > .05$). The effect size $d$ was .044, which indicates that the culture differences did not contribute on the FSS as a factor for individual differences in creativity. This component is the only one on which the American students scored below the mean standard score of 100. Even though Japanese students had slightly lower scores than the American, the difference was very small. The result of no difference in fluency was also reported in the study by Ogawa et al. (1991) in which fifth-grade Japanese and American children were the subjects. Therefore, fluency as a creative thinking component may not be affected by the cultural differences between Americans and Japanese. The result in this study also indicates that college students in education in both countries exhibited a lower level of ability in fluency on the TTCT than other college students in other majors.

The comparison on Originality (OSS) also shows there is no statistically significant difference between American and Japanese college students ($t = -1.509, p > .05$). The effect size on OSS was also small ($d = 0.289$). Because no cross-cultural studies between Japanese and Americans have been conducted on originality, no discussion is available to determine the consistency of this result. The scoring on this component, however, may be affected by who the scorers are. The component of originality is
defined as an ability to produce statistically infrequent responses in the population. But what is considered statistically rare in one culture may not be considered as such in another culture; thus we may need to create independent criteria for each population. For example, when American scorers recognize some responses as highly original ones, Japanese may not consider them as highly original as Americans do. Or reversely, when American scorers assign lower points of originality to some Japanese responses, they may be worth more in the Japanese culture.

The score of Resistance to Premature Closure (RSS) was also not statistically significant between the two groups ($t = -0.876, p > 0.05$). The effect size ($d = 0.168$) is also small. It means that this component shows little cultural difference between American and Japanese respondents. However, this is a component that does not seem to have been well established.

This component is scored from only Activity 2, which is called “Picture Completion.” Each of 10 incomplete figures is scored by three levels (0, 1, and 2 points) based on the criteria and then added up for the total score. Torrance (1992) mentioned the problem in the TTCT Streamlined Scoring Guide (Figural) as follows:

The maximum score is 20 and can be attained only when all figures are used. Unfortunately, those who complete only a few responses are penalized and this gives an untrue picture of the subject’s ability to delay closure. This fact should be considered in making interpretations. (p. 14)

Also Davis (1989) criticized this component as “incorrectly assumed to be an exhaustive list of creative abilities” (p. 261). Furthermore, this component was newly added to the
formal TTCT in 1983, with Abstractness of Titles. Therefore, it will take time and more research to have a better understanding of this component.

Abstractness of Titles on the standard score (TSS) shows a statistically significant difference between American and Japanese college students ($t = -5.033, p < .01$). The absolute score difference between the two groups is the largest in the five components. The effect size was the second largest ($d = .962$).

This result shows an obvious cultural difference on this component of creativity. As previously discussed, Japanese culture is based more on conformity, rather than individualism. Therefore, Japanese students may be more inclined to seek a simplified answer. Even though the test instruction asked respondents to make one’s title as clever and unusual as possible and to use the title to help tell one’s story, the Japanese college students may be less experienced in showing their own unique ideas. As expressed in traditional proverbs, “A tall tree catches much wind” or “The stake that sticks up gets hit,” Japanese culture tends to believe that those who push themselves forward can expect to take a beating. A closer look at the Japanese students’ titles in Activity 1 and 2, that were scored for the TSS, indicate that they tended to use generic titles rather than abstract or descriptive titles. On the other hand, there is another critical factor related to this. The TSS may be influenced by the translation procedure from Japanese to English. Even though close attention was given to the translation process in order to make this process as objective as possible, problems on the reliability of such a procedure may still exist.
The Main Effect of Gender

For the main effect on gender, the results in Table 7 shows that there was not a statistically significant difference between gender groups ($F=0.002, p > .05$). It means that the result obtained can be expected to occur frequently over the long run due to chance.

The $\eta^2$ was also computed to describe the common variability between the dependent variable and the independent variable (Table 8). For the factor of gender, there is almost no variability in the dependent variable associated with the gender groups.

Kim and Michael (1995) found that Korean high school females exhibit higher scores on the TTCT. Their results were different from the Western culture. They mentioned gender difference in the Western culture this way, "However, in visual-spatial tasks, males have been rather consistently reported to perform at a higher level than have females" (p. 72). They speculated that this cultural difference was caused by motivational differences between Korean high school gender groups. They explained, "Possibly, there was a greater desire on the part of the girls than the boys to meet what they anticipated to be the expectations of teachers and adults who were associated with the tests that were administered" (p. 72). If motivational differences between gender groups were counted as one developmental effect on school age, it needs to be determined in further research.

Ogawa et al. (1991) found no gender differences in fluency for their creativity tests in both American and Japanese fifth-graders. Even though the instrumentation and the subjects’ age were not the same as in this study, the result of no gender differences
seems consistent in terms of the cross-cultural aspect between American and Japanese. As they mentioned, there is no explanation now, so this is worthy of further research.

**Correlational Study**

On this correlational study, the following assumptions were determined.

1. The data are on an interval or ratio scale.

2. The relationship between the two variables is approximately linear.

The first assumption is met. All scores from the TTCT, the Center Test, and the ACT are considered to be on interval scale. For the second assumption, scatterplots for both culture groups were checked, and no curvilinear patterns were observed. Therefore, this assumption is considered as being met.

The Pearson product-moment correlation coefficient $r$ was computed between the score of the ACT and the TTCT for American college students and between the score of the Center Test and the TTCT for Japanese college students (Table 10). A test of statistical significance was conducted to test the null hypothesis that the correlation between the two variables was zero in the population.

As we can see in the Table 10, there is no statistically significant relationship between the score of the ACT and the TTCT for American college students and between the score of the Center Test and the TTCT for Japanese college students. This result indicates that a very small amount of variance (3% for American, .8% for Japanese) in the TTCT score is associated with the academic tests. Because there were no previous cross-
### Table 10

**Correlations Between the Scores of Academic Tests and the TTCT**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>American</th>
<th></th>
<th>Japanese</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACT</td>
<td>TTCT</td>
<td>Center Test</td>
<td>TTCT</td>
</tr>
<tr>
<td>$M$</td>
<td>23.10</td>
<td>115.95</td>
<td>468.91</td>
<td>104.14</td>
</tr>
<tr>
<td>$SD$</td>
<td>3.75</td>
<td>12.90</td>
<td>26.39</td>
<td>17.32</td>
</tr>
<tr>
<td>$n$</td>
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<td>55</td>
<td>54</td>
<td>54</td>
</tr>
<tr>
<td>$r$</td>
<td>-.190</td>
<td></td>
<td>.091</td>
<td></td>
</tr>
<tr>
<td>$p$</td>
<td>.185</td>
<td></td>
<td>.512</td>
<td></td>
</tr>
</tbody>
</table>

Cultural studies regarding the relationship between academic tests and creativity tests, further research may be needed to check the consistency of this result.
CHAPTER V
CONCLUSION

Summary

Because the importance of creative ability has been recognized by many, research has been conducted to define components of creativity, to find factors for individual differences in creativity, to develop testing material for creativity, and to foster creativity in education. Fluency, flexibility, and originality are commonly considered as the essential components of creativity in many studies. For the assessment of creativity, the TTCT has been widely used for measuring divergent thinking. As potential factors contributing to individual differences in creativity, cultural background and gender are often discussed. However, there has been little empirical evidence from research, and no well-established results have been reported.

For this study, 51 American and 54 Japanese college students majoring in education were used as subjects. The purpose of the study was to investigate (a) whether there were significant performance differences on creative thinking tests between the two cultural groups; (b) whether gender differences exist; and (c) whether significant relationships exist between scores of the creativity test and academic tests. The American college students showed statistically significant higher scores on the TTCT figural test than the Japanese college students, but no statistically significant gender differences were found in either culture. Also, no statistically significant correlations were found between
the TTCT and the ACT for the American college students and between the TTCT and the Center Test for the Japanese college students.

For the main effect of culture, there is a statistically significant difference between American and Japanese college students on the CI score, which was obtained from the total creative ability on the TTCT figural test. Significant difference was found on two of the five components on the TTCT: Elaboration and Abstractness of Titles. The difference on Elaboration was not expected, and further research may be called for because there is no explanation at this time. On the difference of Abstractness of Titles, the most possible explanation is the effect from their education based on their own culture. Japanese education gives few opportunities to students to explain their own unique ideas and labels.

The results also show that gender groups had no difference on the figural performance of creativity in both countries. In other words, no gender difference on creativity is consistent across the two cultural groups. Also no statistically significant relationship between the TTCT and academic tests indicates that the performances on the two were largely unrelated. Again, this result is consistent across cultural groups.

Limitations

The major limitation of this study was probably the translation process from Japanese into English. Even though these translations were done carefully, no interrater reliability was obtained. Also, to include back-translation from English to Japanese may be helpful as a validity check. However, this validity check does not always work well.
If the translated expressions were really simple and can be expressed in a word in both languages, the validity check would work. But languages do not always correspond on a one-to-one basis. In this study, translations on these words, such as culture-related words, were carefully conducted; but there is still a need for further consideration in the translation process.

There is a limitation concerning the subjects in this study. Convenience samples were used, and only one university in each culture was chosen for selecting subjects. The convenience samples used in this study may pose a threat to the internal validity of this study. More diverse samples are desired in future studies.

Future Studies

This study showed that American and Japanese college students may be different in creative thinking as measured by the TTCT. However, no gender differences were found in either culture, and no interaction was found between culture and gender. No relationships were found between academic tests and the TTCT.

The translation on this study caused some concerns on its validity and reliability. In order to minimize the problem, a couple of changes on testing and scoring may be needed in future studies. First, having interrater reliability will be helpful on the scoring procedure. Two or more independent scoring groups may be needed to translate the same testing materials and send their works to the Scoring Center separately.

Second, some creativity testing materials developed in Japan should be used together with the TTCT for both American and Japanese subjects. Therefore, we may be
able to see whether or not the TTCT results are consistent with those measured by the tests developed in Japan on creative thinking. If there are any discrepancies between the two test results, further research will be needed.

The population of this study was American and Japanese college students who were education majors. Further studies should include subjects from a more diverse background both in terms of different universities and in terms of different majors, so that the external validity of research results can be improved.
REFERENCES


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INFORMED CONSENT FORM

I __________________________ agree to participate in the research on Creativity, which is being conducted by Noriko Saeki and Dr. Fan. My participation is voluntary and the study will require approximately forty-five minutes to complete. I understand that I may discontinue my participation at any time without any penalty, and I only need to notify the experimenter of my decision.

I understand that the purpose of the research is to investigate several areas of creative abilities, and I will be taking several tests. There are no discomforts, stresses, or risks involved. The benefits I can expect from my participation include learning my level of performance on these creative tests and the relative standing of my performance level.

I also hereby consent to release my ACT scores, as held in Utah State University records, to Ms. Saeki and Dr. Fan for the purpose of this research. I understand that my ACT scores will remain confidential, as will the scores from the tests I will be taking as part of this project. I understand that once the scores from all of the tests are combined into a single file, my name will be deleted to ensure anonymity. My confidentiality will be maintained by keeping my questionnaire in a locked file cabinet in a locked room and only Ms. Saeki and Dr. Fan will have access to this information.

At the conclusion of my participation, I will be given an explanation of the experiment. I understand that if I have questions pertaining to the research and my rights as a participant, I can contact Ms. Saeki or Dr. Fan at any time by phone, by e-mail, or in writing to one of the addresses listed below.

_________________________  __________________________
Signature                  Date

_________________________
USU ID Number

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