A study of the relationship between Creative Thinking and Spatial Intelligence among middle school students

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Abstract

The purpose of this study was to explore the relationship between spatial intelligence and creative thinking of middle school students from Yangon area. Myanmar version of the Torrance Tests of Creative Thinking was adapted from the original instrument developed by E. Paul Torrance's (1966). Another test, spatial intelligence test, the original test was developed by Ishii and it was adapted into Myanmar version by Dr Nu Nu Khaing, University of Education (Yangon). Both tests were used in this study. Cronbach Alpha reliability for special intelligence test was .87 and test-retest reliability for creative intelligence test was .61. A representative sample of 291 middle school students from BEMS No.5, Hlaing Thar Yar, BEHS No.2, Tarmway and Practicing High School, Yangon University of Education participated as sample. In order to test hypotheses, correlation analysis and ANOVA analysis were used in this study. Students from Practicing High School were found to have significantly higher in creative thinking and special intelligence than the other student groups. There was evidence of a positive relation between spatial intelligence and creative thinking of middle school students. Overall we concluded that the findings of this study were consistent with the previous research reports.

Key words: Creative Thinking, Spatial Intelligence

1.0 Introduction

Creative thinking is regarded as great importance in the facets of daily life. In the ever changing world of daily living, education, health, business and life style, more creative thinker seemed to be on the winning side, than the conventional and close minded thinkers. Although it is hard to define creative thinking, various definitions have been put forward. Creative thinking can be described as a series of dimensions or attributes of an individual's ability to produce valuable ideas, or novel and workable tasks, or a unique talent, or to use imagination (Amabile, 1996; Ausubel, 1963; Boden, 2001; Lubart, 1994; National Advisory Committee on Creative and Cultural Education, UK (NACCCE), 1999; Onda, 1994a; Rogers, 1954; Zabelina & Robinson, 2010). There is substantial literature on creative thinking, with the early theorists being Guilford and Torrance (Sternberg, 2006a). Building on Guilford's work, Torrance developed the Torrance Test of Creative Thinking (TTCT) in the 1960s as a measure of divergent thinking which is predictive of creativity, and the foremost extant test was revised several times, the last being in 1998. The Torrance test comprises two verbal forms, termed A and B; and two figural forms, also A and B (AL Zyoudi, 2009; Rudowicz, Lok, & Kitto, 1995). This study utilizes the TTCT figural form B as this form removes possible bias from the verbal tests that require a particular language and is deemed the most appropriate for Myanmar children, who are the intended population sample.

This research is undertaken on a premise that there are differences in creative thinking between the groups and that this difference is to the detriment of outer suburb students. The outer suburb population can thus be affected by inadequate buildings, teachers, and equipment to meet the students' needs (Al-Issa, 2005, Hamed et al., 2007). Craft (2005) also notes issues for engendering creative thinking that relate to the curricula; the teachers' flexibility, including time, to encourage creative thinking; and the inherent tensions between teaching for creativity, and learning to think creatively.

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As we understanding so little about students' creative thinking in Myanmar, the present study should explore the nature of creative thinking in middle school students.

Spatial intelligence, it also has been referred to as spatial ability, involves the manipulation of information presented in a visual, diagrammatic or symbolic form in contrast to verbal, language based modality (Lohman, Pellegrino, Alderton, & Regain, 1987). Spatial intelligence may manifest as a particular aptitude for thinking and communicating spatially. Spatial ability may be defined as the ability to generate, retain, retrieve, and transform well-structured visual images. It is not a unitary construct. There are, in fact, several spatial abilities, each emphasizing different aspects of the process of image generation, storage, retrieval, and transformation.

High levels of spatial ability have frequently been linked to creativity, not only in the arts, but in science and mathematics as well (Shepard, 1978; West, 1991). Other physicists (such as James Clerk Maxwell, Michael Faraday, and Herman Von Helmholtz), inventors (such as Nikola Tesla and James Watt), and generalists (such as Benjamin Franklin, John Herschel, Francis Galton, and James Watson) also displayed high levels of spatial abilities and reported that they played an important role in their most creative accomplishments.

Many studies showed that there was a relationship between logical thinking abilities and spatial abilities (Delialio_Lu, 1996; Geddes, 1993; Tai, 2003). Geddes (1993) claimed that studying geometry, in other words developing spatial sense, provided opportunities for divergent thinking and creative problem solving while developing students' logical thinking abilities. Thus the focus of in the present study, the relationship between spatial abilities and creative thinking abilities was investigated.

The analysis for this study comprises testing three middle school students using the TTCT and spatial intelligence test to measure creativity and Spatial intelligence. The student participants in the study were selected from Grade 7 and 8 are 12-17 years of age. This decision was underpinned by Piaget's developmental theory of 1972, which states that the formal operational (abstract thinking) stage starts around 12 years of age.

1.1 The main objective of this study is

To examine the relationships between spatial intelligence and creative thinking among middle school students

1.2 Hypotheses

(1) There is positive relationship between spatial intelligence and creative thinking of middle school students.

(2) There are differences in creative thinking of students among three types of middle schools.

(3) There are differences in spatial intelligence of students among three types of middle schools.

Method

2.1 Participants

Participants of this study were 291 students from grade 8 and grade 9 middle school students from Practicing High School, Yangon University of Education, BEMS No.5, Hlaingtharyar and BEHS No.2, Tarmway. This subject group consists of 129 male and 162 female students. The age of subjects were ranged from 12 to 17 years.

2.2 Procedure

Permission for research with the participants was first obtained from the principals. Then, survey questionnaires were distributed to the 291 student participants. All data were collected in classrooms by trained researchers. Before the participants filled in the questionnaire, the researchers gave a short announcement to the participants, stating that all data would be kept confidential and informed the participants should feel free to answer the questionnaire. Before the test administration, students were provided necessary instructions and explanations on how to complete the tests.

2.3 Measures

Torrance Tests of Creative Thinking (TTCT)

The TTCT test consists of three drawing activities: activity 1 is the construction of a picture with a curved shape, activity 2 is the completion of a picture by adding lines to the incomplete figures, and activity 3 requires participants to add lines to the circles to complete the picture. This test is known to be suitable for all ages from kindergarten to adults, and can be administered either individually or in groups. All students who participated in this study completed the creative thinking test in 30 minutes. As a result of the reliability analysis of the Myanmar version of the Torrance Tests of Creative Thinking, the interrater reliability were found to be .78.

Spatial Intelligence Test

Spatial Ability Test for Myanmar Middle School Students was developed by Nu Nu Khaing et al. (2011). The Test has two parallel forms: Form A and B. Each form consists of 40 items. This study used only Form A consisting of four subtests, namely Spatial Perception Test, Spatial Orientation Test, Spatial Visualization Test, and Spatial Manipulation Test (SP, SO, SV, and SM). Cronbach alpha for the Spatial Ability Test was found to be .87. So it is obvious that the reliability coefficient of the scale is high enough to warrant a safe application.

3.0 Results and Discussion

3.1 Results

The demographic breakdown of the respondents is as follows: Of the 291 participants, 129 (44.3%) were male students and 162 (55.7%) were female students. As shown in Table 11, of students, 105 (36.1%) were from BEMS No.5 Hlaingtharyar, 98 (33.7%) were from BEHS No.2 Tarmway, and 88 (30.2%) were from Practicing High School, Yangon University of Education. Age distribution of middle school students showed that 21.6% were aged 12, 48.5% were aged 13, 25.8% were in the age of 14, 3.4% were in the age of 15, 0.3% were in the age of 16, and 0.3% were in the age of 17. In this study, 142 (48.8%) were grade 8 students and 149 (51.2%) were grade 9 students.

Correlation Analysis

Table 2 displays the means, standard deviations, and correlations two variables in the study. The results indicated that creative thinking had a significant positive correlation with spatial intelligence ($r = .52$, $P<.01$).

Table 1. Distribution of Demographic Variables

Variables	N	%
Gender		
Male	129	44.3%
Female	162	55.7%
Middle School Students		
Students from BEMS No.5 Hlaingtharyar	105	36.1%
Students from BEHS No.2 Tarmway	98	33.7%
Students from Practicing High School	88	30.2%
Age		
12 years old	63	21.6%
13 years old	141	48.5%
14 years old	75	25.8%
15 years old	10	3.4%
16 years old	1	0.3%
17 years old	1	0.3%
Education		
Grade 8	142	48.8%
Grade 9	149	51.2%

N= 291

Table 2 Correlation between Creative Thinking and Spatial Intelligenc (N=291)

Variables	Mean	SD	r	Sig
Creative Thinking	66.04	24.57		
			.52	.01
Spatial Intelligence	20.92	8.95		

****** Correlation is significant at the 0.01 level (2-tailed)

Analysis of Variance

The analysis compared the mean differences in creative thinking of students among the three types of middle school based on one-way ANOVA. The mean scores and standard deviations for each group are shown in Table 3, where *F* ratios from the ANOVA appear together with results of the Tukey's test for the list-wise comparisons among the three schools. The *F* values for creative thinking scale was statistically significant, $p<.001$.

Examination of the pattern of group differences in *Table 3* indicates that students from Practicing High School scored significantly higher than students from BEMS (5), Hlaingtharyar and BEHS (2), Tarmway on creative thinking.

Table 3. Differences in creative thinking of students among three types of middle schools

School	Mean	SD	*F* Value
Hlaing Thar Yar (N = 105)	95.84	14.48	
Tarmway (N = 98)	90.03	15.44	64.03***
Practicing High School (N = 88)	116.11	19.31	

(P<.001)

Examination of the pattern of group differences in Table 4 indicates that students from Practicing High School scored significantly higher than students from BEMS (5), Hlaingtharyar and BEHS (2), Tarmway on spatial intelligence.

Table 4. Differences in spatial intelligence of students among three types of middle schools

School	Mean	SD	*F* Value
Hlaing Thar Yar (N = 105)	15.69	5.29	
Tarmway (N = 98)	16.87	6.04	246.61***
Practicing High School (N = 88)	31.68	4.94	

(P<.001)

3.2 Discussion

The outcome of ANOVA and correlation analyses indicates that creative thinking is a meaningful correlate of spatial intelligence. These results suggest validity of the Myanmar version of the Torrance Test of Creative Thinking translated from the original English test (Torrance, 1965) and tested on Myanmar middle school students.

The main hypothesis was that there is a positive relationship between spatial intelligence and creative thinking among middle school students. The results of correlation analyses indicated that higher in spatial intelligence significantly predicted higher in creative thinking.

In the 1980s, a number of educators endorsed using creativity tests to identify talented students for visual arts programs (Khatena, 1982, 1989; Hurwitz & Day 2001; Greenlaw & Macintosh; 1988). Creative achievements in writing, science, medicine, and leadership, however, were found to be more easily predictable than creative achievements in music, the visual arts, business, or industry (Torrance, 1962: Khatena, 1982). Others, however, claimed

that visual and performing arts abilities are closely associated with creativity as a measurable construct. The importance of spatial ability has been linked to measures of practical and mechanical abilities that are quite useful in technical occupations (Smith, 1964). A link was also established between spatial ability and abstract reasoning abilities. Spatial imagery is tremendously important in art, creative thinking (Shepard, 1978). Thus, our hypothesis 1 was supported.

This study also showed that there are significant differences in creative thinking of students among three types of middle schools. In support of hypothesis 2 and 3, results indicated that students from Practicing High School have higher score in creative thinking and spatial intelligence than students from Hlaingtharyar and Tarmway. In terms of human capital, teaching methodology, teaching aid, exam system, passing percent, discipline and general conditions of school environment, it is generally assumed that there are differential effects of enriched environment at school on creative thinking of students.

In other studies, the TTCT categories of the students tested in the urban school were significantly higher than those students in the rural schools. The students in Saudi Arabian urban schools score higher in creative thinking ability than those in rural schools (e.g., Dharmangadan, 1981; Hongli & Yulin, 2006; Sharma, 2005; Shutiva, 1991). There are several influences which impact on this outcome. Specifically, urban students' parents are proactive in encouraging creativity, urban areas have more facilities and greater stimulation, and the teachers in urban areas are more knowledgeable with regard to initiating creative thinking practice (Lee, 2008).

4.0 Conclusions

The purpose of this study was to examine the relationship between spatial intelligence and creative thinking. The results of this study tend to support the hypotheses that creative thinking is positively associated with spatial intelligence.

Then, in order to test hypotheses, correlation analysis and ANOVA analysis were used in this study. According to the result of ANOVA (Analysis of Variance), students from Practicing High School were found to have significantly higher in creative thinking and spatial intelligence than the other student groups. This finding highlight the important role that enriched environment plays in creative thinking of middle school students in Myanmar.

As a result of correlation analysis, the positive relation found between spatial intelligence and creative thinking of middle school students are consisted with previous research on creative achievement (Clark & Zimmerman, 2001b, 2005; Zimmerman, 2004). Overall, the general consistency between our findings and those of previous research lends credence to the present report that the creative thinking explains significant variance in spatial intelligence.

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