

Positive Effects of Elementary Visual Art on Problem Solving Ability in Later Years of Life

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The aim of this study was to examine the retrospective effect of elementary visual art in enhancing problem solving ability in later life. Further, the study also explored the impact of different teaching pedagogies. For this purpose 150 college students were selected from the National College of Arts Lahore and Islamabad. The sample was further divided into three groups. Group A (n=50) comprised students who had been exposed to student-centered visual art, group B (n=50) consisted of students who had received teacher-centered visual art and group C (n=50) comprised students who had received no visual art curriculum during elementary school years. The Raven's Standard Progressive Matrices, Wallach & Kogan Creativity Test and the Problem Solving Ability Test were administered to measure the participants' problem solving ability. One-way ANOVA and t-test revealed that visual art received at elementary level did have a positive impact on the problem solving ability of the students in later life. There were also significant differences in problem solving abilities of students exposed to different art teaching pedagogies at elementary level. The findings highlight the importance of visual art for developing a higher level thinking skill that is transferred to later life. It is hoped that this study would contribute to the advocacy for the inclusion of visual art in the national curriculum.

Key words: visual art, creativity, problem solving, convergent thinking, divergent thinking

A problem is "an unpleasant situation, a difficulty" (Rusbult, 2001) that needs consideration and a solution. Many research studies have shown that visual art supports the problem finding and solving approach of individuals. (Jensen, 2001; Perrin, 2008; Chicola, & Smith, 2006; Weiss, 2004). Problems are multi-faceted and each person has a different sensitivity and perception about problems as well as varying intentions about how to solve it. Effective problem solving requires a balance of both analytical and creative thinking skills: analytical or logical thinking is a convergent process while creative thinking is deemed divergent (Arthur, 2006; Guilford, 1967). Convergent process limits the solution to one precise answer whereas divergent process offers a number of possible solutions to one problem depending upon its application on the basis of suitability. Analytical and creative thinking are the skills that each side of the brain or hemisphere is particular in serving, as shown by research. These skills have different origins in brain functioning: the left brain is associated with convergent thinking and right brain imparts and promotes divergent thinking (Luftig, 2000; Murfee 1995). However, the extent to which each hemisphere specializes is different in all people but individuals who use both hemispheres are fast problem solvers (Vohra & Verma, 2012).

The early experiences with visual art might be the most influential for attaining cognitive abilities, such as creative and problem solving. In visual art, problem solving approaches are taught to students to assist them to become familiar with a thinking process that promotes problem solving (Gardner, 2004). Gardner further stated that different classroom environments will impact upon the student's way of approaching problems. Hence, there is an important issue about whether different pedagogies of visual art make any difference in the outcomes of arts learning in respect of problem solving ability. In broad term, pedagogies can be classified into teacher-centered pedagogy and student-centered pedagogy. In student-centered pedagogy, student learning is the focus of the class. In this approach, the focus of teaching is facilitation of student's voice and understanding with an emphasis upon creativity and innovation. In the teacher-centered approach there is an emphasis upon teacher transmission of content and control of the learning (Weimer, 2013). Alter (2010) indicated that the teacher-centered approach diminishes the extent of students' thinking and minimizes opportunity for independent and innovative vision.

For attaining the desired effects of visual art, a student-centered approach should predominate.

The work of John Dewey, Jean Piaget, Maria Montessori and Lev Vygotsky focused on how students learn, was a basic motive for promoting student centered approach (Chegenizadeh, Nikraz & Zadeh, 2012). Following on

from these eminent educationalists, this study utilized a quantitative approach to examine the impact of student-centered pedagogy in contrast to teacher-centered in the context of examining the value of visual art to problem-solving.

It is clear that visual art has an impact upon the academic, social and psychological well-being of an individual (Haanstra, 2007; Smith, 2006). Never-the-less some countries (e.g., Pakistan) are under-estimating its worth by minimizing its significance or omitting it from the curriculum. The formative concrete operational stage of development (Piaget & Inhelder, 1973) stresses not only the importance of developing a logic when using concrete events but also consider multiple parts of a problem at once. This is a time (3rd to 6th grade approximately 7-11 years) when some of the critical foundations of problem solving are emerging. There are clear indications however that visual art at this time can promote higher level thinking but little research has been undertaken about the generalizability of this learning to later life.

This research study undertaken in Pakistan examined whether an elementary visual art could promote problem-solving in later life and evaluated the impact of using different pedagogies in the teaching of art. There is no other known research of this type in Pakistan. The main purpose related to the examination of the impact of visual art on problem-solving abilities later in life and the relationship of this finding to teacher-centered and student-centered approaches. It was speculated that each pedagogical approach could have a different impact on problem-solving.

The educational system and curriculum in Pakistan favors convergent thinking and often overlooks divergent thinking. However, both types of thinking are equally essential for a well-rounded personality. Thus, the study focuses on visual art as a domain for fostering divergent as well as convergent thinking promoting problem solving skills in students. Such a carefully designed curriculum can inculcate creativity, imagination, expressiveness, confidence and self-reliance in an individual with a benefit to the individual, society and nation.

Method

Sample

The sample for the study consisted 150 college students both males (n=81) and females (n=69). All the participants were selected through purposive random sampling technique from National College of Arts Lahore and Islamabad campuses, ranging in age from 18 to 20 years ($M = 19.31$, $SD = .636$).

Hypotheses

1. The visual art received at elementary level will have a positive impact on the problem solving ability of the participants in later life.

2. The visual art received at elementary level will foster the divergent and convergent thinking of the participants in later life.
3. The participants who received student-centered visual art at elementary level will generate multiple solutions on PSAT in comparison to teacher-centered and control group.
4. The participants who received student-centered visual art at elementary level will score significantly high both on divergent (WKCT) and convergent thinking tests (SPM) as compared to teacher-centered and control group.

Instruments

Questionnaire

A questionnaire was devised to collect relevant information regarding demographic characteristics and to acquire information whether the participants had received visual art at the elementary level. Another purpose of the questionnaire was to collect data regarding teaching pedagogy used during the elementary school years of the participants.

Standard Progressive Matrices, SPM (Raven, 1936)

SPM is a reliable test to measure the level of convergent thinking (Jaarsveld, Lachmann, & Leeuwen, 2013). The participants were required to identify the missing elements of all the 60 matrices in order to complete a pattern. The booklet was consisted of five sets (A to E) of 12 matrices each that were given in order of difficulty. The calculated reliability coefficient of the scale in this study was .08 indicating that the scale is highly reliable.

Wallach and Kogan Creativity Tests WKCT (1965)

WKCT is one of the most widely used divergent thinking test (Cheung, Lau, Chan, & Wu, 2004) and is useful in gathering data quickly and effectively. The study utilized three out of five tests from Wallach and Kogan Creativity Test i.e., Alternate Uses, Instances and Pattern Meaning. The study further selected five items for each test. The participants were required to generate alternate uses, instances and meanings for each item. For example, they were asked to identify alternate uses of a brick, different instances of objects that make noise, and unusual meanings of a given pattern. In the present study, reliability coefficient of WKCT was found to be .90 for fluency measure and .62 for originality measure, indicating the scale as a dependable measure.

Problem Solving Ability Test

In addition to the above tests, another technique of measuring problem solving was also developed. Problem Solving Ability Test (PSAT) was comprised of seven (7) items. The four out of seven items described the day to day problem situations. Example: *"There is blood on the ceiling of my bed room. There has been no murder or killing of any*

person. Nobody has played any trick with me. Can you suggest logical explanations”?

The rest of the three items selected were: a matchstick problem, a string tie problem and a candle stick problem. These three problems were presented in picture form.

Example: The matchstick problem required participants to “rearrange the matchsticks in 3 squares by moving any 4 matchsticks”.

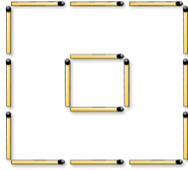


Figure 1: Matchstick Problem

The participants were asked to read the problems carefully, imagine the situation and develop a maximum of three logical explanations or solutions. In this test the maximum score for each item ranged from 0 to 3, subsequently the maximum score for this test or for seven (7) items ranged from 0 to 21. Higher the score on this scale indicated that the participant had an effective problem solving ability. The calculated reliability coefficient of PSAT in the present study is found to be .71 indicating satisfactory internal consistency.

Procedure

The main purpose of the study was to examine the impact of childhood art experiences in later years of life. In this retrospective study, the necessary information regarding the elementary visual art was collected through questionnaire to establish two groups i.e., art students versus non- art students at first. Later on, three different types of instruments were used on sample (N=150) to see the impact of their past learning on their problem solving at later stage of life.

After the final approval from the administration of National College of Arts Lahore and Islamabad Campuses, the newly admitted students were briefed about the purpose of the present research. At first, the whole class of 1st year (consisting of 200 students) was given the questionnaire and asked to report the required information carefully. After filling out the demographic portion of the questionnaire respondents were asked to recall their childhood education specially elementary school years and indicate whether they had received visual art at elementary level or not. If yes, then what type of art curriculum they had? They were required to answer in a Yes or No format. An open ended question was also included to identify any external sources for inspiration to pursue art activities.

The participants who returned incomplete questionnaires or those who gave confused responses were excluded from the study. Only 150 were retained in the final study. The remaining participants were divided into two groups: those who received visual art and those who did not.

Those who did not receive visual art became the control group. Based on the information regarding the mode of prevalent visual art in their elementary art classrooms, the art group was further divided into two groups (i.e., group A and group B) dependent upon the teaching pedagogy. Thus, there were the three groups:

Group A: (n=50) participants received student-centered visual art

Group B: (n=50) participants received teacher-centered visual art

Group C: (n=50) participants who did not receive visual art in their elementary school (Control group)

All the three groups were given PSAT, WKCT and SPM, to assess differences in their problem solving ability. These were administered under test conditions.

Statistical Analysis

Scoring of Raven’s Standard Progressive Matrices was undertaken according to the standard method of scoring indicated in the manual. In scoring WKCT items, measures of fluency and originality were used. Fluency is defined as the total number of given responses by a participant for a particular question. Given responses of a participant were summed up to yield participants fluency score for a particular question. Originality (a unique or novel response) was obtained by scoring unusual and unique responses. Responses that were given by 5% of a group were unusual, while responses that were given by 1% of that particular group were unique. An unusual response received 1 point while a unique response received 2 points. The total points were then summed up. The higher scores indicated creativity (Wallach and Kogan, 1965). To score the PSAT, the total number of logical responses for all the problems was taken as the participant’s total score (each logical response was given 1 point). The analyses were carried out using standard statistical package of SPSS.

Results

The findings of the study revealed that the participants who received visual art at elementary level were better at problem solving in adulthood than those who had not received visual art.

The results indicated significant differences ($p < .01$) in the scores of Problem Solving Ability Test between two groups. Table 1 shows that art group scored significantly high on Problem Solving Test as compare to non-art group. The findings of the study supported the first hypothesis that “the visual art received at elementary level will have a positive impact on the problem solving ability of the participants in later years of life”.

Table 1
Mean, Standard deviation and t test analysis showing differences in PSAT Scores (N = 150) between Art Group & non-Art Group.

Variable	Art Group (n=100)		Non-Art Group (n=50)		t(148)	p	95 % CI	
	Mean	SD	Mean	SD			LL	UL
PSAT	5.82	3.289	4.54	3.065	2.298	.023	.179	2.381

The WKCT was used to measure divergent thinking whereas SPM was administered to measure convergent thinking. There were significant differences ($p < .01$) between scores obtained on these two tests by art and non art group. The results demonstrated that art group was more fluent and original on WKCT and scored high as compared to non art group as shown in table 2. Similarly the same group also obtained significantly high score on SPM which strongly supported the 2nd hypothesis that “the art education received at elementary level will have a positive impact on the divergent and convergent thinking of the participants in later years of life”.

Table 2
Mean, Standard deviation and t test analysis of WKCT & SPM scores (N=150) between Art Group & non-Art Group.

Variables	Art Group (n=100)		Non-Art Group (n=50)		t(148)	P	95 % CI		
	Mean	SD	Mean	SD			LL	UL	
WKCT	Fluency	48.35	19.998	41.44	15.931	2.125	.035	.483	13.317
	Originality	8.60	8.893	3.92	4.580	3.493	.001	2.032	7.328
SPM		52.73	5.103	50.24	6.365	2.589	.011	.590	4.390

The study also aimed at investigating the impact of two different pedagogies i.e., student-centered and teacher-centered visual art on the problem solving performance of the participants. For this reason the study had divided the art group further into two groups i.e., student-centered and teacher-centered to see the difference between these two groups and the control group i.e., non-art group. One-way ANOVA exhibited a similar pattern of responses on all three tests i.e., PSAT, WKCT and SPM amongst all three groups. The findings revealed that scores of student-centered group were the highest, the teacher centered group were moderate whereas the non-art group were the lowest.

The results show that in PSAT the student-centered group generated multiple explanations and solutions to the problems that were logical and practical as compared to other two groups as indicated by table 3. Thus it can be concluded that the deliverance of visual art through student-centered pedagogy has a positive impact on the problem solving ability in later life. The findings supported our 3rd hypothesis that “the participants who received student-centered visual art will generate multiple solutions on PSAT in comparison to teacher-centered and control group”.

Table 3
One way ANOVA on PSAT Scores (N = 150)

Variable	A Student-Centered Group (n=50)		B Teacher-Centered Group (n=50)		C Non-Art Group (n=50)		F	p	i-j
	M	SD	M	SD	M	SD			
PSAT Scores	6.76	3.054	4.88	3.274	4.54	3.065	7.283	.001	A>B,C

The Post Hoc Analysis showed that the participants from student-centered group scored significantly high on fluency and originality measures of WKCT as well as on SPM scores as compared to teacher-centered and non-art groups as indicated by table 4. This shows that student-centered group was good in divergent and convergent thinking than the other two groups. Results show that the student-centered visual art during elementary school years can better foster convergent and divergent thinking and has a potential for higher level thinking skills in later years of life. These findings confirmed the fourth hypothesis that “the participants who received student-centered visual art will score significantly high on divergent thinking (WKCT) and convergent thinking test (SPM) as compare to teacher-centered and control group”.

Table 4
One way ANOVA on WKCT & SPM Scores (N=150)

Variables	A Student-Centred Group (n=50)		B Teacher-Centred Group (n=50)		C Non-Art Group (n=50)		F	p	i-j	
	M	SD	M	SD	M	SD				
WKCT	Fluency	51.32	19.061	45.36	20.653	41.44	15.931	3.557	.031	A>B,C
	Originality	12.04	8.882	5.16	7.533	3.92	4.580	18.326	.000	A>B,C
SPM		53.72	4.743	51.74	5.302	50.24	6.365	5.016	.008	A>B,C

Discussion

This study set out to show the potential of using visual arts to create learning environment that enhances student’s innovation and problem solving ability. The first hypothesis proposed a positive relationship between visual arts and problem solving ability and the results indicated very strong association between the two variables. It demonstrated that students who were continuously involved in art activities during their elementary school years were better adult problem solvers than those who did not have such education. The second hypothesis proposed that art group would be good in convergent and divergent thinking. Table 1 and 2 indicate that art group superseded the non-art group on all three measures including SPM, WKCT and PSAT. These findings are consistent with the earlier studies that also specify that art students perform better than the non-art students (Gardner, 2004). Dewey’s (1916) argument that the role of education was to prepare students for present and later life supports this notion that ideas gathered in childhood are sustainable and helpful in overcoming and

tackling adulthood problems. Eisner (2002) has argued more specifically in stating that art educators can readily create art making tasks as problem solving tasks for practice. Furthermore, as Jensen (2004) and Weiss (2004) indicated, art learning can prepare the children to deal with the problems with multiple solutions.

Previous researches have confirmed the far-reaching effects of an art-rich learning environment. Uptis (2011) believes that visual art contributes in the development of the “whole child”. Farrell & Meban (2003) stated that a “child who is exposed to the arts in school has the potential to become a more creative, imaginative, expressive, confident, self-reliant or critically thinking individual” (p.5). Given these types of findings it seems inequitable not to provide the same opportunities to all groups of students.

The teachers represent a strong social influence on their students with respect to ways they motivate and encourage students to enhance creativity. Development of student expression in a classroom (i.e., a constructivist approach) is more likely to promote variable opportunities to facilitate problem solving. Urgent consideration needs to be given to reflecting upon the current approaches as there has been limited research on current practices and the best way to achieve skill in problem-solving. Hurwitz & Day (2007) defined student-centered art as an act of self expression which has a unique combination of emotions and intellect giving novel order and form to human reactions under permissive environment.

The finding confirms the third hypotheses that student-centered group was superior in problem solving as compared to teacher-centered and control groups. The student-centered approach was related positively to the development of cognitive competencies. Many researchers have agreed that student-centered approach allows “creative freedom” in children art (Peers, 2000).

Convergent and divergent thinking were also investigated in the study. Interestingly it was found that participants who scored high on divergent thinking also scored high on convergent thinking. Table 4 reflected that all these participants had received student-centered art education. So, it can be concluded that student-centered group was superior in convergent and divergent thinking as compared to teacher-centered and non-art groups. According to Lee and Larid (2004) problem solving is a creative process. Jaarsveld & van Leeuwen, (2005) stated that creativity requires both convergent and divergent thinking “in order to arrive at a quality formulation” (as cited in Jaarsveld, Lachmann, & Leeuwen, 2013). This study highlights the importance of the development of convergent and divergent thinking and the development of both of these qualities early in life. These findings deserve the special attention of educators, policy makers and managers in planning the curriculum so that both modes of thinking are

fostered particularly during formative elementary school years. (Azeem, 2011; Dewey, 1916)

Conclusion

It seems that Pakistan’s current education system emphasizes academic progress and regards visual art only as a frill. Art programs are being reduced or even removed from the curriculum particularly in the public schools. Unfortunately, if this tendency is not curbed many students will be denied an education that promotes early development of higher level thinking skills such as problem-solving.

Pakistan is suffering from economic, social and political crisis that has also brought alarming challenges to our youth. Healthy development of youth is crucial for the future and that is only possible by providing a rounded education that includes development of self-realization, problem solving, and decision making skills. The earlier this is done in a child’s life the more is the likelihood of sustained and quality growth. Cognitive growth in children is nurtured early in life and yet the education system is overlooking the framework that can achieve this growth.

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