Creativity and thinking styles in arts, sciences, and humanities high school students

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Creatività e stili di pensiero negli studenti di licei artistici, scientifici e classici

Riassunto

Questo studio ha esplorato le differenze nei fattori della creatività e negli stili di pensiero tra studenti di età compresa tra 13 e 18 anni frequentanti licei artistici, scientifici e classici. Sono stati usati il Thinking Style Inventory di Sternberg e Wagner (1992) ed il Test of Creative Thinking di Williams (1994). I risultati hanno mostrato che più gli studenti dei licei scientifici preferiscono lavorare con problemi concreti e dettagli, più essi trasformano le idee in differenti set mentali; più gli stessi preferiscono andare oltre le regole esistenti e massimizzare il cambiamento, più sono abili a cambiare set mentale; più gli stessi preferiscono massimizzare il cambiamento più sono abili a produrre idee rare; inoltre, più gli stessi preferiscono lavorare con gli altri e seguire le regole esistenti e minimizzare il cambiamento, meno sono abili ad arricchire le loro idee. Nessuna relazione è emersa tra stili di pensiero e creatività negli studenti degli altri licei. Future ricerche potranno analizzare somiglianze e differenze in altri indirizzi scolastici utilizzando altre misure di creatività e di stili di pensiero.

Parole chiave: stili di pensiero; creatività; studenti di liceo artistico, scientifico e classico.

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Abstract

This study aimed to explore the differences in factors of creativity and thinking styles among students aged 13-18 attending to arts, sciences, and humanities high schools. Thinking Style Inventory of Sternberg and Wagner (1992) and Test of Creative Thinking of Williams (1994) were used. Results showed that the more sciences students preferred to work with concrete problems and details, the more they transformed ideas from one to another different mental set; the more sciences students preferred to go beyond existing rules and maximize change, the more they were able to change ideas in different mental set; the more sciences students preferred to maximize change, the more they were able to produce uncommon and meaningful ideas; in addition, the more sciences students preferred to work with other people and to follow existing rules and minimize change, the less they were able to enrich and elaborate their ideas in different way. No relationships between thinking styles and creativity in other types of schools were observed. Future researches will investigate similarities and differences in other curricula studies using other measures of creativity and thinking styles.

Key words: thinking style; creativity; arts, sciences and humanities students.

Introduction

The present article, anchored in Williams' Model of Divergent Thinking (1994) and Sternberg's Theory of Mental Self-Government (1988), considered the main results of an investigation focused on the comparison among students attending to arts, humanities, and science high schools about thinking styles and divergent thinking. Findings in this topic of research are contradictory, based mainly on the comparison between the so-called *Two cultures* "arts" and "sciences" (see Hudson, 1973), and demonstrate opposite results probably because of different methodologies applied to investigate creativity and thinking styles in the same domains of interest (Charyton & Snelbecker, 2007; Williamson, 2011).

Sternberg and Lubart (1995) contend that thinking styles are one of the six major resources that give rise to creativity that is one of the most salient process to produce originality, generate new ideas, and realize uniqueness. On the hand, creativity is referred to the abilities to produce a variety of ideas concerning possible solutions to problems (fluency), to adapt oneself to a change, to be free from the 'inertia of thought', and to use a variety of approaches (flexibility), to generate uncommon responses, remote and unconventional associations (originality), to transform something well known into a new context (elaboration), to keep an 'open mind' while processing the information (resistance to premature closure) and to synthesize processes of thinking (abstractness of ideas) (Guilford, 1950; Torrance, 1962). These factors were further investigated by model of Williams (1969, 1994), which represented the framework of the present study for the analysis of creative thinking. This model included a set of four affective factors of creativity including curiosity, risk taking, complexity, and imagination, and a set of four cognitive factors. The first cognitive factor, *fluency*, explains the generation of a large number of ideas and production of meaningful responses; the second factor, *flexibility*, is connected to changing ideas passing from one category to a different one; the third factor, *originality*, is linked to the ability to produce uncommon ideas; finally, *elaboration* is the competence to embellish and enrich ideas with details.

On the other hand, thinking styles have been studied in Sternberg's Theory of Mental Self-Government (MSG), according to which the organization of thinking metaphorically reflects the organization of political government and individuals govern themselves consistently with their profiles of thinking styles. As reported by Sternberg and Grigorenko (2001), thinking style is related to "habitual patterns or preferred ways of doing something

(…) that are consistent over long periods of time and across many areas of activity" (p.2). MSG theory proposed that thinking styles are included in five dimensions that are similar to facets of government (Sternberg, Grigorenko, & Zhang, 2008): functions (legislative, executive, and judicial style), forms (monarchic, hierarchic, oligarchic, and anarchic style), levels (global and analytic style), scopes (internal and external style), and leanings (liberal and conservative style) (Sternberg, 1997). In relation to functions, 1) *legislative* thinkers prefer to decide for themselves what to do and how to do it, and choose situations that they have never experienced and like to solve problems in their own way; 2) *executive* thinkers are prone to follow established rules and value problems that are pre-structured and prefer to solve problems by following other's supervision; 3) *judicial* thinkers are well-disposed towards the analysis and evaluation of existing rules and procedures and the critique of other people's work. With reference to forms, 4) *monarchic* thinkers are described as "single minded and driven individuals", focused exclusively on single activities of interest; 5) *hierarchic* thinkers recognize the need to view problems from several perspectives establishing setting priorities; 6) *oligarchic* thinkers show the tendency to consider simultaneously several goals of equal importance, tend to be "multi-taskers" and flexible in their approaches to learning, but have difficulty with control of the conflicting demands; 7) *anarchic* thinkers tend to handle problems with a random approach, contrasting the rigidity of systems. In relation to levels, 8) *global* thinkers prefer to deal with large and abstract issues rather than details, while 9) *analytic* thinkers have a preference for working with concrete problems and details. With reference to scopes, 10) thinkers with *internal* style wish to work alone, are more introverted and task oriented, but less socially sensitive than 11) thinkers with *external* style which benefit by working with other people. Lastly, with regards to leanings, 12) *liberal* (or radical) thinkers look for the opportunities to go beyond existing rules and to maximize change while 13) *conservative* thinkers tend to prefer to follow existing rules, avoid unfamiliar situations, and minimize change. Most people are flexible in their use of thinking styles and try to adapt themselves to the stylistic demands of a specific situation; in fact, an individual with a style preference in one situation may have a different preference in other situations.

Thinking styles have been related to other psychological dimensions, as academic achievement (Grigorenko & Sternberg, 1997; Zhang & Sternberg, 1998; Cano-Garcia & Hughes, 2000; Zhang, 2001), personality traits (Zhang, 2002; Fjell & Walhovd, 2004), self-

esteem (Zhang & Postiglione, 2001), and so on. In fact, Zhang and Sternberg (1998) observed that executive, local, internal, and conservative Chinese students scored higher than other university students in academic achievement as well as Cano-Garcia and Hughes (2000) found that Spanish university students with high academic achievement tend to use executive and internal thinking styles. In relation to personality traits, as noted by Zhang (2002), individuals with legislative, judicial, and liberal thinking styles tend to be open to experience; individuals with executive and conservative thinking styles are emotionally unstable, easily embarrassed and pessimistic, and with low self-esteem.

Scholars have found significant relationships also between creativity and thinking styles in adults and high school students (Jacobson, 1993; Kim & Michael, 1995). For example, Kim and Michael (1995) verified that Korean high school students classified as using a thinking style preference (Torrance et alii, 1988) associated with right-brain dominance were likely to achieve significantly higher scores on creativity measures (Tests of Creative Thinking) than those who were classified as showing both thinking style preference linked to left-brain dominance and integrated-brain dominance. An individual with holistic mode of thinking (defined by right-brain profile) preferred to process information in synthesized manner instead of an individual with analytic mode of thinking characterized by left-brain profile oriented to process information in sequential way (Zhang, 2002); in addition, holistic individuals tend to use more creativity-generating thinking styles (that is, legislative, judicial, global, and liberal styles) instead of analytic individuals that tend to use norm-favoring thinking styles (that is, executive, local, and conservative style). As reported by Kaufman (2002) and Sternberg (2006), creative individuals are more likely to develop a divergent thinking, to show high levels of cognitive complexity and flexibility, and to cope with unstructured and ambiguous situations.

In relation to different curricula studies, Helson (1996), Hartley and Greggs (1997), Simonton (1999), Kersting (2003), and, more recently, Zare (2011) suggested that students with convergent thinking moved towards physical sciences whilst those with divergent thinking moved towards humanities sciences and found that artists have higher creativity levels than scientists and engineers. As noted by Kaufman (2002), creative writers and journalists differ in thinking styles in the sense that the former preferred the legislative style more than the latter whilst the latter preferred the executive style more than the former. In addition, Haller and Courvoisier (2010) investigated the comparison among visual art, music,

and psychology university students in personality traits and thinking styles, showing that visual art students were more neurotic, open to experience and inclined to heuristic thinking than psychology students, whereas music students were more extraverted and agreeable than visual art students and more inclined to heuristic thinking than psychology students. Furnham, Batey, Booth, Patel, and Lozinskaya (2011) found that arts students have a divergent style while science students a convergent style, and arts students believe they are more creative than science students.

On the contrary, Charyton and Snelbecker (2011) found that there are no substantial differences in creativity between engineers and musicians and Williamson (2011) observed that there are no differences between arts and science undergraduates students in creative problem solving skills. Little evidences about differences or similarities in the relationship between types of thinking styles and creativity comparing arts, sciences, and humanities students were analyzed, but this was done largely between arts and science students or between arts and social science students.

Purpose of study

In relation to empirical literature findings about the relationship between creativity and thinking styles, recognized by Zhang and Sternberg (2009) to be far from sufficient, and to the need to deepen the differences for curricula studies, the aim of this study was focused on the exploration of the differences among students attending to arts, sciences, and humanities high schools in factors of creativity and thinking styles. We chose three domains of thinking styles analyzed in Sternberg's MSG (1997) related to levels (global vs. analytic), scopes (internal vs. external), and leanings (liberal vs. conservative), linked respectively to the processing of information, type of work-style relationships, and attitudes toward change. We expect that arts and humanities students will score significantly higher than sciences students in factors of creativity (H1); arts and humanities students will prefer global and liberal styles more than sciences students (H2); lastly, arts students will prefer internal style more than sciences and humanities students (H3). Differences for classes and sex will be analyzed both in creativity and thinking styles.

Method

Participants

A total of 440 Italian students (196 boys and 244 girls) attending to State High Schools, aged from 13 to 18, participated in this study and were divided into three groups for

type of schools: 175 students of arts schools, 140 students of science schools, and 125 students of humanities schools. All students were randomly chosen from the first, third, and fifth classes of six State High Schools in Catania, Sicily (Italy). All students were briefed on the general purpose of this investigation and instructed on the drawing up of the following materials in an absolutely anonymous way.

Materials and procedure

Test of Creative Thinking (TCT) by Williams (1994). For the exploration of factors of creativity, we used the Italian version of TCT consisting of a protocol with 12 frames, containing incomplete graphic stimuli shown to students who were asked to draw a picture. It was used to measure the mean scores of divergent thinking factors: fluency, flexibility, originality, and elaboration. The "fluency" score was the total number of meaningful pictures created by students (range 1-12 points). The "flexibility" score was the number of changes of mental set (range 1-11 points). The "originality" score was the total number of pictures drawn inside or outside each incomplete stimulus (range 1-36). The "elaboration" score was the number of asymmetric pictures drawn by students (range 1-36 points).

Thinking Styles Inventory (TSI) by Sternberg and Wagner (1992). We used the Italian version of TSI with 48 statements, selected by the initial 104-item inventory, to measure the global vs. analytic, internal vs. external, and liberal vs. conservative thinking styles (8 statements for each style). Students were asked how well each statement describes them, responding to the question on a 7-point Likert scale in which value equal to 1 indicates that the statement does not describe them at all, while value equal to 7 indicates that the statement describes them very well. Examples of items from the inventory were the following: for global (e.g., "I tend to emphasise the general aspect of issues or the overall effect of a project") vs. analytic style (e.g., "I pay more attention to the parts of a task than its overall effect or significance"); for internal (e.g., "When faced with a problem, I like to work it out by myself") vs. external style (e.g., "I like to participate in activities where I can interact with others as part of a team"); lastly, for liberal (e.g., "I enjoy working on projects that allow me to try novel ways of doing things") vs. conservative style (e.g., "I like to do things in ways that have been used in the past"). High scores in one of these thinking styles indicated the tendency to use the specific style.

Statistical analyses were carried out by using SPSS 15, with MANOVA, t for paired sample, and Spearman's rho correlations. The type of schools, sex, and classes were

considered as independent variables and scores obtained in factors of creativity and thinking styles as dependent variables.

Results

Factors of creativity: differences for type of school, sex, and class

A 2 (sex of participants) x 3 (class of participants) x 3 (type of schools) x 4 (factors of creativity) analysis of variance was carried out on mean scores obtained in TCT. There were significant interactions for sex and type of schools [$F(8, 840)=5.60$, $p<.001$] and separately for sex [$F(4, 419)=7.50$, $p<.001$] and for type of schools [$F(8, 840)=10.61$, $p<.001$] (Table I). It meant that boys attending to sciences schools scored higher in fluency [$F=4.55$, $p=.011$] than the others, boys attending to humanities schools scored higher in flexibility [$F=4.05$, $p=.018$] than the others, boys attending to arts schools scored higher in elaboration [$F=8.35$, $p<.001$] than the others. In addition, boys reached higher scores than girls in fluency [$F=8.92$, $p=.003$] (boys=11.84 vs. girls=11.67) and elaboration [$F=23.08$, $p<.001$] (boys=15.55 vs. girls=13.04). Lastly, humanities students obtained significantly higher scores in flexibility [$F=5.29$, $p=.005$] than the others (humanities: 8.26 vs. arts: 7.90 vs. sciences: 7.66), art students scored higher in originality [$F=13.72$, $p<.001$] than the others (humanities: 25.67 vs. arts: 28.43 vs. sciences: 27.10), and sciences students reached higher scores in fluency [$F=15.76$, $p<.001$] than the others (humanities: 11.61 vs. arts: 11.65 vs. sciences: 12). Post hoc analyses with Bonferroni's test confirmed these differences among arts, sciences, and humanities students.

Thinking styles: differences for type of school, sex, and class

A 2 (sex of participants) x 3 (class of participants) x 3 (type of schools) x 6 (thinking styles) analysis of variance was carried out on mean scores obtained in TSI. There were significant interactions for sex and type of schools [$F(10, 838)=5.05$, $p<.001$] and separately for type of schools [$F(10, 838)=8.70$, $p<.001$] (Table II). It meant that boys attending to humanities schools preferred global [$F=3.24$, $p=.04$] and external styles [$F=3.14$, $p=.044$] than the others; boys attending to arts schools preferred internal style than the others [$F=6.08$, $p=.002$]. In addition, students attending to humanities schools preferred global [$F=10.78$, $p<.002$] and external styles [$F=7.34$, $p=.001$], while those attending to arts schools preferred analytic [$F=7.11$, $p=.001$], internal [$F=6.64$, $p=.001$] and liberal styles [$F=6.30$, $p=.002$] more than the others.

T for paired sample was computed for each type of schools. Arts students preferred analytic more than global thinking style [$t(174)= -2.86$, $p=.005$] and liberal more than conservative thinking style [$t(174)= 10.58$, $p<.001$]; sciences students tended to use analytic more than global thinking style [$t(139)= -2.69$, $p=.008$] and liberal more than conservative thinking style [$t(139)=7.14$, $p<.001$]; lastly, humanities students applied only liberal more than conservative thinking style [$t(124)=7.13$, $p<.001$]. This datum showed significant similarities among arts, sciences, and humanities students in relation to liberal thinking style and between arts and sciences students in relation to analytic thinking style.

Correlations between factors of creativity and thinking styles

Spearman's rho correlations were computed between factors of creativity and thinking styles with modest differences for type of schools. In fact, no correlations in arts and humanities students were found, while significant positive correlations were observed in sciences students between flexibility and analytic thinking style (rho=,25, $p=.003$), flexibility and radical thinking style (rho=,29, $p<.001$), originality and radical thinking style (rho=,27, $p=.001$), and negative correlations were noted between elaboration and external thinking style (rho= -,24, $p=.004$), elaboration and conservative thinking style (rho= -,25, $p=.003$).

Discussion and conclusion

The main purpose of this investigation was to explore the differences among students attending to arts, sciences, and humanities high schools in factors of creativity and thinking styles. About the first issue, we hypothesized that arts and humanities students would score significantly higher than sciences students in factors of creativity (H1). Results were partially confirmed in the sense that humanities students were more able to change mental set for producing new ideas (flexibility) than the others, arts students were more able to elaborate uncommon and unfamiliar ideas (originality) than the others, and sciences students produced meaningful responses (fluency) more than the others. Specifically, boys attending to sciences schools were more able to produce a large number of ideas than the others, boys attending to humanities schools were more able to change mental set than the others, boys attending to arts schools were more competent to develop and enrich new ideas with details than the others. In addition, boys resulted more capable to produce a large number of ideas embellished with details than girls.

About the second issue, we hypothesized that arts and humanities students would prefer global and liberal styles more than sciences students (H2) and that arts students would

prefer internal style more than sciences and humanities students (H3). In this case, results substantially confirmed the initial hypotheses, in the sense that humanities students preferred global and external thinking styles, whilst arts students preferred analytic, internal, and liberal thinking styles more than the others. In addition, we found significant differences in interaction between sex and type of schools, without significant effects for classes, in the sense that boys attending to humanities schools preferred global and external styles more than the others, while boys attending to arts schools preferred internal style more than the others. These data demonstrated that boys of humanities schools are global and external thinkers because they preferred to deal with large and abstract issues rather than with details and tended to work with other people; further, boys of arts schools wished to work alone, are more introverted and task oriented, but less socially sensitive than the others.

About the relationship between creativity and thinking styles, results demonstrated that, only for sciences students, positive correlations were observed between a) flexibility and analytic style (the more sciences students transformed ideas form one to another different mental set, the more they preferred to work with concrete problems and details), b) flexibility and radical style (the more sciences students were able to change ideas in different mental set, the more they preferred to go beyond existing rules and maximize change), and c) originality and radical style (the more sciences students were able to produce uncommon and meaningful ideas, the more they preferred to maximize change). In addition, also in this case only for sciences students, negative correlations were found between elaboration and external style, and elaboration and conservative style: the more sciences students were able to enrich and elaborate their ideas in different way, the less they preferred to work with other people and to follow existing rules and minimize change.

The observed differences among arts, sciences, and humanities students were of modest effect, but indicated interesting evidences that require further investigations with other measures of creativity in different domains and other thinking styles linked to specific curricula studies.

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Table I
Factors of creativity: differences for type of schools

Factors of creativity	Type of schools	N	Mean	SD
Fluency *	Arts	175	11,65	0,7
	Sciences	140	12,00	0,0
	Humanities	125	11,61	0,8
	Total	440	11,75	0,6
Flexibility *	Arts	175	7,90	1,5
	Sciences	140	7,66	1,6
	Humanities	125	8,26	1,3
	Total	440	7,93	1,5
Originality *	Arts	175	28,43	4,1
	Sciences	140	27,10	3,8
	Humanities	125	25,67	3,9
	Total	440	27,22	4,1
Elaboration	Arts	175	14,67	5,0
	Sciences	140	14,34	4,9
	Humanities	125	13,22	4,1
	Total	440	14,15	4,8

Note. Fluency range 1-12 points. Flexibility range 1-11 points. Originality range 1-36. Elaboration range 1-36 points. Factors with asterisk * indicated significant differences among the three type of schools

Table II
Thinking styles: differences for type of schools

Thinking Style	Type of schools	N	Mean	SD
Global	Arts	175	4,18	0,8
	Sciences	140	3,79	0,8
	Humanities	125	4,23	0,8
Analytic	Arts	175	4,45	0,8
	Sciences	140	4,08	0,9
	Humanities	125	4,43	0,9
Internal	Arts	175	4,86	1,1
	Sciences	140	4,39	0,9
	Humanities	125	4,72	1,2
External	Arts	175	4,88	1,0
	Sciences	140	4,56	1,0
	Humanities	125	5,05	1,1
Radical	Arts	175	5,08	1,0
	Sciences	140	4,62	1,1
	Humanities	125	4,99	1,1
Conservative	Arts	175	3,99	0,9
	Sciences	140	3,61	0,9
	Humanities	125	3,90	1,0

Note. Factors with asterisk * indicated significant differences among the three type of schools