creative abilities in early childhood
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The aim of this study is to explore creativity in Spanish children during their early years and to explore differences regarding gender and age. We have used a sample of 285 children between five and seven years old. To measure their creativity we used the Torrance Test of Creative Thinking (TTCT). We have used the test of figured expression that is orientated to evaluate the level of imagination in producing pictures. It consists of three subtests: making a picture; finishing a picture; and making different patterns using parallel lines. The abilities that are assessed with this test are: originality, which consists in considering innovative answers, neither familiar nor inappropriate; elaboration, which refers to the amount of detail the child adds to the picture with the aim of enriching it; flexibility, the variety of categories in the answers; and fluency or the number of pictures with titles (Torrance, 1966, 1974). The results show significant evidence of differences relating to gender and age.

KEYWORDS divergent thinking, early childhood, elaboration, flexibility, fluency, originality
creativity and school context

The first studies regarding creativity and education took place in the United States in the 1950s. For example, divergent thinking was first proposed by Guilford (1950) in his 'Structure of the Intellect' model. Guilford recognized that thinking is far more complex than the fairly limited set of skills tapped by intelligence tests. Guilford's model included 120 different thinking skills in a complex three-dimensional taxonomy of cognitive skills. Guilford's goal was to create a map that would contain, and to some degree explain, all possible varieties of human thought. A key group of these factors are those he called 'divergent production' skills. He believed these skills (which have in more recent years come to be called divergent thinking skills, rather than divergent production skills) are important parts of creative thinking. Divergent thinking is a kind of thinking that aims not at producing correct answers, but rather at coming up with a variety of unusual, original, or even off-the-wall ideas.

Divergent thinking is often contrasted to 'convergent' thinking, which refers to thinking that focuses (or 'converges') on a single correct answer. Convergent thinking is what is tested on most intelligence and achievement tests.

Guilford was the first major theorist to argue that divergent thinking, the ability to produce many (not necessarily correct) ideas, to produce unusual and original (but, again, not necessarily workable) ideas, and to take an idea and spin out elaborate variants of the idea, was every bit as important as convergent thinking. Convergent thinking produces correct answers, but divergent thinking produces interesting, imaginative, and potentially creative ideas (Baer, 1997).

After Guilford, Getzels and Jackson (1962); Taylor (1956); and Torrance (1962) focussed their work on evaluating and developing creativity in children. But it was Torrance who dedicated his life towards enhancing the recognition, acceptance, and development of the creative personality in both education and the workplace. In addition to developing the most widely used test of creativity (Torrance Test of Creative Thinking, TTCT, Torrance, 1966), Torrance (2001), includes the results of his 40-year longitudinal study of creativity, the only one of its kind.

Torrance defined creativity as a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies and so on, and he stated a Decalogue to train teachers to foster the creativity in childhood, that is:

1. To provide children with materials that incite/stimulate the imagination;
2. To facilitate resources that enhance fantasy;
3. To allow time to think and day dream. Not to oppress children with conformist activities;

278
4. to encourage children to express their ideas, when they have something to say;
5. to recognize new ideas to stimulate creative thinking;
6. to accept their tendencies to adopt different viewpoints;
7. to appreciate children’s individuality while working, instead of demoting it;
8. to correct, value and give importance to novelty products;
9. to stimulate children to engage in creative games;
10. to appreciate the creativity of pupils and for them to perceive such support.

In summary, the main dimensions of divergent thinking are:

- Fluency refers to the number of different ideas one can produce.
- Flexibility refers to the variety of ideas one produces.
- Originality refers to how unusual are the ideas one produces.
- Elaboration refers to richness of detail in the ideas one produces.

Several creativity researchers, including Csikszentmihalyi (1996), Gardner (1993), and Sternberg and Lubart (1995), have written about the fluency of ideas and similar concepts as being characteristic of creative individuals, especially in the context of being able to train people to enhance these characteristics. There is consensus among researchers that creativity should be defined as the production of both novel and appropriate work (Lubart, 2000; Sternberg and Lubart, 1996). Novel refers to original work, work that could not be predicted. Appropriate simply concerns the usefulness of the product towards a certain need.

Furthermore, the assessment of creative work can only be conducted in the social and historical context of its making (Amabile, 1983; Csikszentmihalyi, 1996; Lubart, 1999; Sternberg and Lubart, 1995). Novel and appropriate products do not arise in a vacuum. Thus, finding the factors that influence creativity drives most of current research efforts. In recent years, Sternberg (2000) says that people are creative largely by dint of their decision to go their own way. They make decisions that others lack the will or even the courage to make; they are daring.

Csikszentmihalyi essentially sees creativity as a social construct that is the result of an interaction between the producer and the audience (1999). Important aspects in his model are the individual (personal background), the field (society), and the domain (culture). Interaction between domain and individual transmits information; interaction between field and domain selects novelty; and interaction between the individual and the field stimulates novelty.
Although Amabile recognizes that creativity is culturally and historically bound (1983), it is not explicitly mentioned in her three-componential model. The relevant factors working together are domain-relevant skills (or expertise), creative-thinking skills, and motivation. Creative potential relies on expertise because new insights in a domain can only be gained through prior knowledge of the domain. The importance of expertise is accepted by most researchers (Amabile, 1983; Csikszentmihalyi, 1996; Sternberg and Lubart, 1996). Creative-thinking skills relate to cognition as well as personality characteristics. Motivation looks at the reasons why a person engages in a task and the attitudes one might have toward the task. Amabile has identified intrinsic motivation as more likely to produce creative results than extrinsic motivation. Sternberg and Lubart (1995, 1996) undertake a type of goal-setting approach. They compare creativity to a thriving investment process of buying low and selling high. Creative people purposefully engage in foremost unknown or unpopular ideas (buying low) in order to successfully disseminate them later (selling high). Sternberg and Lubart (1995, 1996) identify six resources that contribute to creativity: intellectual processes, knowledge, intellectual styles, personality, motivation, and environmental context. Of note is the differentiation between intellectual processes and styles. Processes refer to problem definitions, use of analogies and metaphors, synthesis etc.; things that are commonly recognized within cognition approaches. Intellectual styles relate to the preference for how thought processes are applied. Sternberg and Lubart (1995, 1996) identify three main dichotomies in thinking styles with the assumption that some styles are more conducive to creativity than others are: legislative (invent rules) versus executive (follow rules), conservative (old approaches) versus liberal (new approaches), and global (general aspects) versus local (detail-oriented). Furthermore, they identify a monarchic style which means the sequential completion of tasks.

In summary, these authors define the factors or dimensions of creative thinking as follow:

1. Sensitivity to or the ability to see problems, for example, the ability to state difficulties or deficiencies in common products or in social institutions; the ability to make a judgement that desired goals in a described situation have not been achieved.
2. Fluency of thinking; the ability to think well and effortlessly. It includes: (a) word fluency; (b) associational fluency; (c) expressional fluency; (d) ideational fluency.
3. Flexibility of thinking; the capacity to abandon old ways of thinking and add new ones easily, which implies: (a) spontaneous flexibility; (b) adaptive flexibility.
4. Originality; the ability to come up with ideas that are statistically unusual; referred to: (a) remote associations; (b) responses are judged to be clever.
4. Redefinition, which consists of giving up old interpretations of familiar objects and using them in new ways.
5. Elaboration: the ability to fill in details given a general scheme.
6. Tolerance of ambiguity: the willingness to accept some uncertainty in conclusions, not using rigid categories.
7. Interest in convergent thinking: thinking towards one right answer.
8. Interest in divergent thinking: open-ending thinking, where there is not a single right answer.

Again, these dimensions were found to be common properties of creative individuals. There was a considerable effort put into training people to have these characteristics, in the hope of increasing their creativity. Indeed, according to several authors, such as Csikszentmihalyi (1996), this is still done, and most creativity training involves these characteristics. However, while such training can increase the level of the characteristics, it does not do much for increasing levels of creativity. What is going on? Gardner, Csikszentmihalyi and others mention that evidently creative individuals must have these characteristics at some level, but other factors are much more important. This is similar to the situation with intelligence. Up to a certain level, intelligence helps, but there are many people who are not creative, who are more intelligent than people who are creative. Objective mental characteristics and abilities are apparently only a very small part of the creativity puzzle. Motivation – living the work – seems to be much more important. And some luck in childhood, of having close but not confining contact with a field of interest and some early success in that field, is important (Guillford, 1959).

Following this introduction regarding the evaluation and training of creativity, we focus our empirical study on the evaluation model by Torrance (1974).

**why we used the TTCT**

We used TTCT because it can be used from preschool up to graduate students. It is easy and amusing for children. It is a useful screening instrument in order to identify high as well as low creative potential (Bermejo et al., 2005).

The TTCT is especially useful for identifying and educating gifted and talented students (Castelló and Batlle, 1998; Collangelo and Davis, 1997; Davis and Rimm, 1994; Parra et al., 2005; Prieto et al., 2004; Torrance, 1966, 1974); that is, the TTCT gives some information about how gifted children tend to use the different processes of creativity more effectively than their peers.

Not only is the TTCT the most widely used test to measure creativity, but its use is supported by more evidence of validity than any other creativity test (Khatena, 1989). The TTCT has been translated into 35 languages (Millar, 2001),
including Spanish, and it also it has been used in our school context (Castelló, 1986).

According to the TTCT figural manual (Torrance, 1966, 1974) the reliability has been assessed at 0.50; Torrance indicated that motivation conditions affect the reliability (Torrance, 1966, 1974). Manual recordings, however, show the reliability above .90 (Torrance, 1990). Therefore, given the complexity of creative thinking, the TTCT figural can be seen as having reasonable reliability (Cramond, 1993, 2002; Treffinger, 1985).

**method**

The objectives of the study were:

- To analyse the utility or effectiveness of Torrance's Test of Creative Thinking (TTCT) with children from five to seven years old.
- To study the internal structure and the reliability of the TTCT.
- To analyse any differences in creativity related to gender or age.

**participants**

The research was carried out with 285 children from five to seven years of age, attending different public and private schools (from the regions of Alicante and Murcia, Spain).

**instrument**

Our instrument was the Torrance's Test of Creative Thinking (TTCT).

The aim of the test was used to evaluate creativity among the children and adolescents. The test consists of two subtests (verbal and figurative), each of which has two forms (A and B). Students give multiple answers to verbal and figurative problems that are marked according to fluency (the number of ideas), flexibility (the variety of the perspectives represented in the ideas), originality (statistical infrequency) and the production of ideas beyond the requirement of the problem. In this study the test of figural expression was used to evaluate the level of imagination demonstrated by drawing pictures. There were three subtests: (1) drawing a picture; (2) finishing a picture; and (3) generating a range of patterns using parallel lines.

In the first subtest, making a picture, the child was asked to make a picture from the pattern given. It is a piece of coloured sticky paper, oval in shape. We have to emphasize that if the child didn't indicate any title a score couldn't be awarded. The aim is to give a meaning to something that previously didn't have one. The abilities that were assessed with this first test are: (a) originality,
consisting in considering the innovative answers, neither familiar nor unusual; and (b) elaboration, referring to the amount of detail the child adds to the picture with the aim of enriching it.

The second subtest, finish the picture, consisted of 10 lines, a starting point that the child had to use to draw different pictures and to give the pictures a title. What is valued is the elaboration (number of details added to the picture); originality (unusual and unconventional responses); flexibility (variety of categories in the responses) and to a lesser degree, fluency (number of pictures with a given title).

The third and final subtest, parallel lines, consisted of 30 pairs of parallel lines. The aim was to make as many pictures as possible using the 30 pairs. Fluency was assessed by the aptitude for making multiple associations from a single encouragement, flexibility, from the aptitude for originality and elaboration (Torrance, 1974).

procedure

The TTCT was presented in the classroom by different members of the research group adopting the procedure, criteria and rules established by Torrance.

The analysis of the data was carried out using the statistics programme SPSS 12.0.

results

exploratory factor analysis of Torrance test of creativity

An exploratory factor analysis was carried out using a method of main components extraction and the varimax rotation of the method, in order to check the internal structure of the TTCT. The findings suggested the existence of four differentiated factors which account for 74 per cent of the total variance (Ferrando, 2004).

The Barlett sphericity test suggested we should proceed with the factorial analysis. (Chi-squared 1174.22; df.45; $p=0.000$); because of this it was appropriate to apply factor analysis.

With regards to the total variance explained in the findings; it indicated that the first four components account for 74.0 per cent of the total variance.

The unrotated solution suggests that the 33 per cent of the variance is explained by an overall score for subtests 2 and 3. Interestingly, subtest 1 plays no part in this. Eighteen per cent of the variance is explained by the difference between scores for subtest 2 and subtest 3 (omitting elaboration in subtest 2). Together these factors explain 50 per cent of the variance and no attention has
yet been drawn to sub-scores within the subtests. A third factor, explaining 13 per cent of the variance and still more important than the overall subtest 1 performance, consists of the elaboration scores for subtests 2 and 3 contrasted with the elaboration scores for subtest 1. The overall subtest 1 score explains only 11 per cent of the variance.

The correlation rotated matrix showed that three of the factors corresponded with each of the subtests, and the third factor represented the elaboration variables associated with subtests 2 and 3 (see Table 1).

The first extracted factor was composed of the variables fluency, flexibility and originality for subtest 3, with very high correlation above 0.9 for all variables.

The second extracted factor was formed by the variables fluency, flexibility and originality of subtest 2 with high correlation between 0.80 and 0.87.

It is notable that the third extracted factor does not represent variables from test 1, but the ‘elaboration’ variables in subtests 2 and 3; with correlations around 0.80.

Finally, the fourth extracted factor corresponded to the variables originality and elaboration in subtest 1 with moderate correlations of 0.76 and 0.72. Regarding the analysis of variance, we found that the first factor, represented by the variables fluency, flexibility and originality of subtest 3, explain the higher percentage of the total variability (26.5%); followed by factor 2, represented by the variables fluency, flexibility and originality of subtest 2; this factor explained 22.4 per cent of the total variance. The final two factors explained a percentage of variability much less than the first ones, being very similar between them. The third factor, represented by the variable of elaboration in subtests 2 and 3, explained 13.8 per cent of the total variability while the fourth

<table>
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<td>Subtest 2 elaboration</td>
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<td>Subtest 3 elaboration</td>
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Note: Extraction method: analysis of main components. Rotation method: normalization: Varimax with Kaiser. The rotation has converged in five iterations.
factor, represented by the variables comprised in subtest 1, explained 11.3 percent of the variance.

In summary, the data showed that the three subtests in the test generated independent factors. Only ‘elaboration’, especially in subtests 2 and 3, had any importance as a separate component of the tests.

The three subtests were of very different natures. For example, subtest 1 (composing a drawing) was related to ‘originality’ and ‘elaboration’, which in the activity context formed a complement link with creative functioning. Subtest 2 (finishing a drawing) implied a ‘resistance to fixation’, the main cognitive operation being ‘escape’ from the more common figures, suggested by the figures. Subtest 3 (parallel lines), was the most complete and technically suitable and allowed the evaluation of fluency, flexibility and originality efficiently without a conditioned answer. Finally, elaboration seemed to follow a different path, because it is the only characteristic of the tasks that is agglutinated separately.

reliability analysis

In order to analyse the internal consistence of TTCT and because the test measured different dimensions of creativity through the same items, we used the two halves technique for each of the dimensions evaluated in the test in order to establish its psychometric characteristics. For this we chose subtest 3 as it was the one with more items. Also, according to the factor analysis, this subtest represented the first extracted factor and explained the higher percentage of variability of the measures collected by the test (TTCT).

Subtest 3 was divided in two halves for each participant (for example: if the child had made 18 drawings, these drawings were divided in two halves, one half was the first nine drawings and the second half was the last nine drawings) and a direct score was obtained for each of the halves in the different dimensions. The correlation between the two sets of scores was 0.85, giving a Spearman–Brown split half reliability coefficient of 0.92 (see Table 2). This shows a good internal consistency of such subtests and adds consistency to the obtained results in the factor analysis.

As there were theoretically different dimensions, we considered it convenient to find out the consistency between the halves of each of the different dimensions of subtest 3.

First, the Spearman–Brown coefficient for the flexibility of half 1 and half 2, was 0.93, indicating a high consistency of the variable.

Second, for the dimension of elaboration of half 1 and half 2, the coefficient of Spearman–Brown was 0.85, suggesting good consistency.

Third, the Spearman–Brown index for originality was 0.84, which in spite of being the lowest of the three dimensions was still high.
In summary, the data indicated a high consistency and reliability for subtest 3 of the TTCT. Within that subtest, the dimension with the higher internal consistency was flexibility (the capacity to offer answers belonging to different categories); as evaluated from the parallel lines (subtest 3) subtest in which children were required to offer the highest possible number of diverse answers.

**creativity, age and gender**

In this stage we studied the differences with regard to gender and age.

With regard to age, the findings suggested significant statistical differences for the dimensions of fluency ($t(283) = -5.4; p = 0.000$), flexibility ($t(283) = -3.7; p = 0.000$) and originality ($t(283) = -3.5; p = 0.001$) evaluated in subtest 3 of TTCT; in other words, for the variables that comprised the first extracted factor the older children are more creative. Also, there are significant differences in the dimensions of fluency in subtest 2 ($t(166.4) = -3.159; p = 0.002$) and in elaboration in subtest 1 ($t(254.6) = -3.737; p = 0.000$). Our data agreed with the findings of Kyung-Hee (2005) that five-year-old preschool children score higher in the language and drawing domains of creative thinking ability and creative personality than four-year-old preschool children.

With regard to gender, the data indicated significant differences in the dimensions of originality ($t(273.3) = 2.4; p = 0.02$) and elaboration ($t(283) = -2.4; p = 0.02$) of subtest 1; thus for the third extracted factor. It was found that boys obtained scores significantly higher than girls in ‘originality’, while girls were significantly superior in ‘elaboration’. For the rest of the dimensions and subtests, the differences are not statistically significant. The studies done by Kyung-Hee (2005) shows girls are more creative than boys in the preschool years.
discussion and conclusions

The present study has deepened the understanding of creativity in early childhood, first by carrying out an adequate empirical study in order to find out the internal consistency of the most commonly used creativity test and by examining the internal structure of one of the tests.
The reliability analysis of the TTCT produced a high coefficient (Spearman–Brown = 0.93). This suggests that TTCT is a suitable instrument to evaluate creativity and its dimensions in the early years.

The data proceeding indicated the existence of four differentiated factors within the TTCT. Three of the dimensions evaluated in subtest 3 (parallel lines) constitute the first factor. The second factor would be defined by the three variables of subtest 2 (completing a drawing). A third factor would be made up by the variables of elaboration in subtest 2 and 3. Finally, the last factor would be formed by the whole of subtest 1 (making a drawing). This data indicates that each of the tasks of the TTCT defines a different type of creative behaviour by children. Each of the tasks requires different skills. The originality that is required by the tasks in subtest 2 (where the stimulus that is offered is more varied) is not the same as the originality in subtest 3 (where the stimulus is the same for each item). This data would support that obtained by Perkins (2000), who states that all persons are creative and the manifestation of creativity depends greatly upon the type of task to realizing.

Finally, it is apparent that there are significant differences in creativity according to the age and gender of participants. The data indicates that pupils of six and seven years old obtain scores higher than those reached by five-year-olds.

The differences related to gender, are significant only for the subtest 1 of the test (dimensions of originality and elaboration): boys scoring higher than girls in originality but girls scoring higher than boys in elaboration.

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references


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