

# IS CREATIVITY CHARACTERISTIC FOR INCOMING TEACHERS OF SCIENCE?

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## Abstract

*Creativity as one of the characteristics is typical for every human and is expressed in many ways. However it isn't developed at the same level by everyone. We are able to determine it and to strengthen it. The components of creativity are newness, novelty and usefulness and we can define it as a creation of new and useful ideas, solutions, or products. For incoming teachers it is very important to be creative. Science teaching provides opportunity to be creative, but the necessity as well. We can expect, that creative teacher will stimulate the pupils to be creative more than a person who isn't very inventive. In this contribution we are focused on finding out the level and the scale of future science teachers' creativity according to results of Figural Form of Torrance Test of Creative Thinking named the Unfinished Figures. It can give us the first view on creative potential of an individual. We can identify students with extraordinary creative abilities and on the other hand, the ones whose abilities are below-average and help them to develop it for that reason. The study sample consisted of 80 second year college students studying natural science, who would like to be science teachers. The divergent thinking abilities, 4 dimensions (fluency, flexibility, originality and elaboration) were tested. According to the results of TTCT we find out, that incoming teachers dispose of figural creativity. Most of them (63.75%) completed all offered unfinished figures. Just 20.0% of them are characterized in high level of flexible creative thinking, 60.0% are in average. The results of originality and elaboration were not satisfying. It is very important to develop incoming teachers' abilities as creativity evidently is.*

**Key words:** *creativity, science teacher, Torrance Test of Creative Thinking (TTCT).*

## Introduction

There are many researchers interested in creativity which is defined and understood in many ways. We can speak about the elite activity (characteristic, ability) of talented people (artists, scientists) which brings unknown and socially valuable results. For every mentally health person there is characteristic a certain level of creativity. E.P.Torrance (2007), American psychologist said, that creativity is a process how to percept problems, gaps and lack in knowledge. Therefore, creativity should expose all thinking parameters, rather than for just a specific pattern, in order to develop wider and more responsive skills, to revisit the ability, and to discover that creative thinking (Hsiao et al, 2004). To be creative it doesn't mean just to choose the way of solving problems, or to mobilize previous experience, but to think of new problems. It is divergent way of thinking which is measured by tests of creativity.

There are six factors of creativity according to J.P.Guilford (1960) and E.P.Torrance (1990, 2000):

1. fluency = ability to create a lot of mental products (words, ideas, pictures, symbols, etc. ). It is the richness of ideas, solutions, it is the resourcefulness. We can speak about verbal, figural, numerous, associative fluency,

2. flexibility = ability to create promptly various, alternate problem solutions, overcome native attitudes. It means to see problem from different point of view, to change the directivity in thinking.
3. originality = ability to create apprehensive, sharp-witted, unexpected, not common products, to find out new combinations, to see different phenomena in new situations,
4. sensitivity = perceptiveness to descry and foresee problem, where other people don't expect it,
5. redefinition = ability to change the meaning and using of the object, to use it in new way,
6. elaboration = ability to do details in solving.

In this article we are interested in the results of SFF TTCT, and that is why the detailed analysis and the results of the first tool are going to be published separately. Figural form of Torrance test of Creative Thinking is one of the tools for identifying creative thinking abilities. Wechsler (2006) analyzed results through Pearson correlations and found out, that there were significant relationships among creative achievements and the creative indicators in TTCT. Jurčova (1984) presents that the technique of incomplete figures (the subtest of TTCT) was used as a part of different psychological tests. The completing of figures is supported by basic idea of the Gestalt – Psychology that incomplete figures make human nervous and tense, what constrained him from completing them the easiest way. The task point out the tendency of structuralization and integration.

The of our study was to find out, whether the incoming science teachers could be characterized as creative people according to usage of measuring tool. We expected, that they should dispose of high level of fluency, flexibility, originality and elaboration.

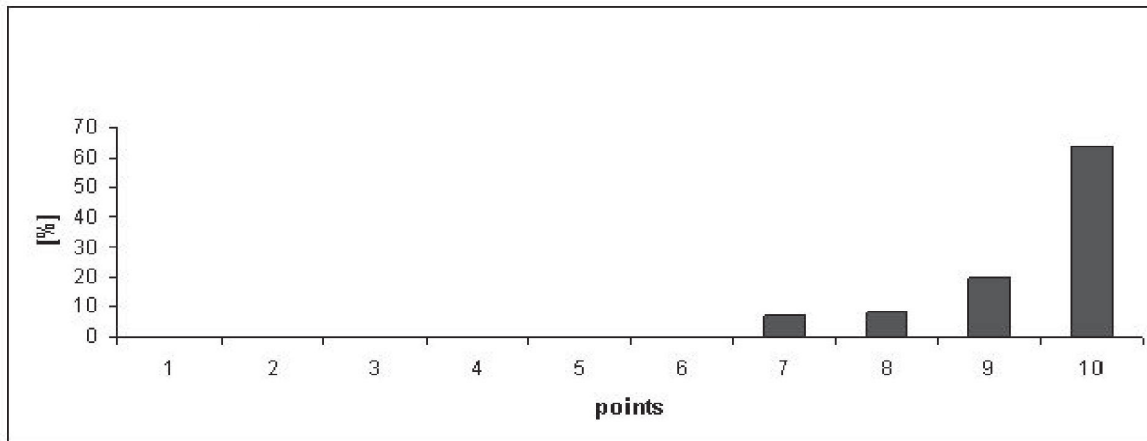
## Methodology of Research

The key question we were interested in was, what level of creativity incoming science teachers dispose of. There exists a lot of different measuring tools for finding out various dimensions of the human creativity (for example Minnesota Test of Creative Thinking, Remote Association Test, E.P.Torrance, 1990). In our research, there was the Koberg scaled questionnaire (Koberg; Bagnall, 1981) of creativity and Subtest of Figural form of Torrance Test of Creative Thinking (SFF TTCT).

The quality of test products could determine, whether creative thinking is typical of incoming science teachers (N=80). The respondents fill in 10 incomplete figures in ten minutes. They should sketch in lines in pictures and draw interesting objects using sketched shapes in way they will be the most interesting, original and complete. They should suggest the title of each one and write it down to the number of the picture. It supplemented the picture and the deeper sense was given to it. There were identified these factors of creative thinking in SFF TTCT: fluency as a number of acceptable answers, flexibility as a number of shifts in thinking, originality as a statistic infrequency of the answers, elaboration as a number of details in pictures.

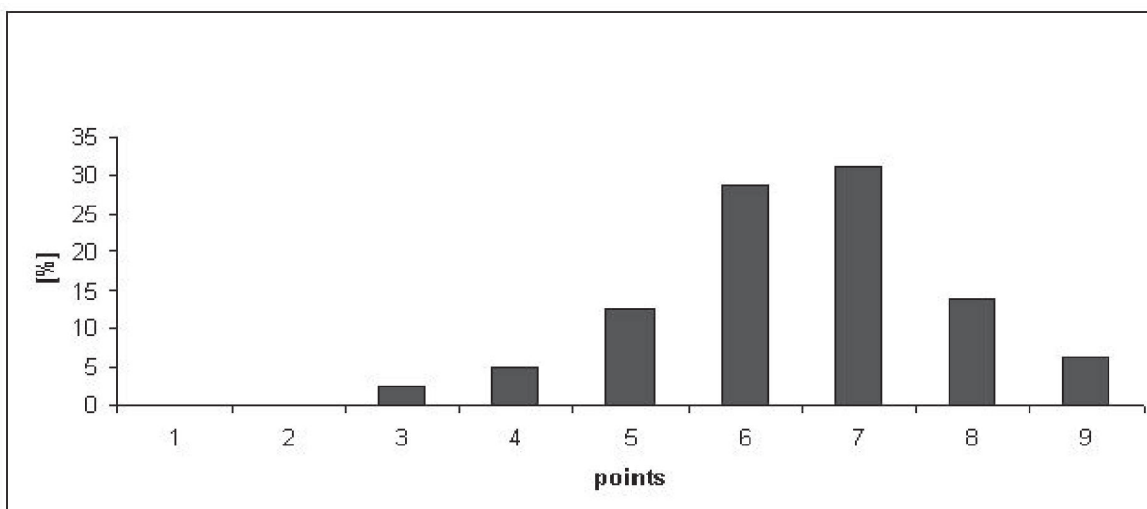
## Results of Research

The fluency is given by the number of the answers, which are acceptable. Ten points are maximum, achieved by 63.75% students of Comenius University in Bratislava at Faculty of Natural Science (Figure 1). Nobody achieved less than 7 points for this factor of creativity.



**Figure 1.** The results of fluency achieved according to the number of respondents (in percents).

The flexibility is appreciated of the products which can be distributed in different categories. Each category is part of a wider complex that can help to sort actual answers. The categories are not the same level of generality, they are dependent on the frequency of proposal appearance. If pictures made by students belonged into 10 different categories, the flexibility is 9 points. If they are put into two categories, its just one point for flexibility. Nine points were achieved by 6.25% students, the figures were mostly put into 8 different categories and than appraised by 7 points (Figure 2).



**Figure 2.** The results for flexibility according to the number of respondents (in percents).

Each product was taken in different category, for example: transport, animals, human body, geometric shape, food and many others. According to the incidence of the motive the points were assigned (more than 5% means 0 points, 3-5% 1 point, 1.26-2.99% 2 points and less or equal than 1.25% means 3 points).

A person should control the tension of unfinished figures and put away the satisfaction of the impulse which makes him to complete the figure. This is the precondition to create an original answer which is not common and ordinary. If the respondent is not able to completely close figures, he will finish figures with obviousness and evidence, without original answer.

Filling the figure No. 9 students reached the average 0.56, the lowest value was found out in figures No. 2, 5, 6, 8 (0.27). The most original solutions appeared in the figure No. 1 (for

three points), the less original answers were found in figure No. 2. No points for originality achieved students whose solution appeared in more than 5% cases and those who didn't complete the figure (Table 1).

**Table 1. Percentage and points for originality (N=80).**

Figure no.	Frequency and percentage of the answers valued by 0-3 points								Average for originality
	0 points		1 point		2 points		3 points		
	f	%	f	%	f	%	f	%	
1	65	10.06	4	6.06	2	5.0	9	18.75	0.44
2	64	9.91	11	16.67	4	10.0	1	2.08	0.27
3	60	9.29	6	9.09	8	20.0	6	12.5	0.5
4	68	10.53	3	4.54	4	10.0	5	10.42	0.32
5	68	10.53	6	9.09	2	5.0	4	8.33	0.27
6	70	10.83	4	6.06	0	0.0	6	12.5	0.27
7	60	9.29	14	21.21	0	0.0	6	12.5	0.4
8	70	10.83	0	0.0	8	20.0	2	4.17	0.27
9	53	8.20	15	22.74	6	15.0	6	12.5	0.56
10	68	10.53	3	4.54	6	15.0	3	6.25	0.3
S	646	100	66	100	40	100	48	100	0.36

Legend: f = frequency, the number of respondents, who achieved points for originality in separated figures 1-10

These results suggest that originality was found out just in few cases. Participants presented typical answers, which could not be considered original, because of the frequency of their distribution. The average of the originality was count as a sum of originality in whole Subtest of Figural form of TTCT which was divided by score for fluency. One of the respondents achieved 1.29 points, 18.75% didn't score. The maximum points for originality were three.

During the completing some figures 27 students (33.25%) got out of the rut and overstep the lines of the linked area. Seven of them did it in two figures and one student in three figures. It demonstrates the ability to see situations behind the barriers which were determined.

**Table 2. The number of students who overstep the figures in Subtest of Figural form of TTCT.**

Figure No.	1	2	3	4	5	6	7	8	9	10
No of students	0	6	4	2	2	3	2	9	4	0

Students didn't solve the task by connecting the figures. This combination is considered the indicator of creative potential, because person who do it in this way, breaks through the structure of testing situation and synthesizes disparate objects to meaningful complex (Jurčova, 1984).

The average of elaboration was counted as a sum of each picture elaboration which was divided by score for fluency. It is faithful indicator, because the students whose score for elaboration in each picture was high, but they didn't complete all figures, were considered. The summing up the elaboration value could be nonadequately evaluate by routine counting. The scoring of evaluation is easier if the title of picture is quoted. It is the basic theme and the details are more identifiable. Maximum that could be achieved was 10 points for elaboration. One student reached 5.6 points and another one 1.8 points, all values were between 1.8 and 5.6 points.

## Conclusion and Discussion

A majority of students (63.75%) completed all ten figures, that is why the score of fluency has limited usage. The less creative person fills in the figure in a short time sketching in one line or curve. Some students produce a lot of original solutions, but don't elaborate any of them. Some produce few ideas, but do them carefully and precisely.

Impulsively, or banal thinking student or „unthinking“ one can be very successful in solving this kind of problem, in most cases he has low score for flexibility, originality and elaboration.

It is our duty to identify creative students, incoming teachers and to develop creativity because it is the precondition preparing creative pupils for life.

Teachers are responsible in developing the potential of pupils. U.S. teachers use the words artistic, curious, imaginative, independent, intelligent/clever, unique/original as creative traits (Runco, Johnson, Bear, 1993). Chinese teachers characteristic were highly associated with intellectual functioning like quick in responding, high intellectual ability, high verbal ability, like/willing to think (Chan & Chan, 1999). It could be very interesting to as study other nationalities teachers“ point of view on the creative and uncreative students“ characteristics.

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