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Correlation between Psychomotor Skills and Creativity among Secondary School Students and Future Teachers

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Abstract

The falling level of manual skills of the young generation is one of issues in the 21st century. The existing society asks for creative individuals who can work independently. On the other hand, the manually skilled ones are needed too. The core question of our research was to find out whether the individuals who score high on the test of creativity are at the same time manually skilled. In our opinion, it is important to be creative and manually skilful at once to become successful in these days. To ascertain the relationship between creativity and the level of manual skills, a random sample was selected from children from a secondary school and students of pedagogy.

The presented research deals with research regarding levels of creativity and manual skills at secondary schools, that means in the Czech Republic kids from 10 to 14 years old, and at the faculty of education of teachers-to-be. Readers are acquainted with results of evaluating the students of teaching and the pupils/learners at secondary schools from the point of creative abilities in relation with the level of their manual skills. There was used the Urban's test of creative thinking to test creativity, the level of psychomotor skills was tested using Testing batteries for psychomotor skills, which was made for the research purpose by as. Prof. Honzíkova. Those research results as well as the unique testing battery for psychomotor skills are introduced.

Keywords: manual skills, creative abilities, evaluation of manual skills and creativity, teacher training

Introduction

The aim of modern European society is to have wise and creative individuals. Humans should not be only manually skilful, but should approach various activities in a creative way to be able to form socially valuable products. One of the possibilities how to achieve that status is to start developing children at school through various work activities. Work activities create suitable space for developing creativity in kids as a natural way when they gain practical skills as well as theoretical knowledge. Those may be useful later on in their ordinary lives or future career.

That clarifies that neither a creator nor the process of creating nor the product could be made without manual skills. That was the idea we focused on in our research. After that we describe two basic research tools – Testing batteries for psychomotor skills and the Urban's figural test of creative thinking.

Testing batteries for psychomotor skills (PSM) by Honzíkova

First of all, the testing battery for indicating the level of psychomotor skills should be introduced. The battery of tests was designed to meet the needs of evaluating the level of manual skills.

While forming the test, the author of the set of tests was inspired by Mager's technique where it is recommended to have an aim formulation with three components (Honzíkova, Sojková, 2014): required performance, performance conditions and standard of performance.

Tests were composed to reflect the predominant psychomotor skills of pupils during workshops. As grounding was used the taxonomy of psychomotor aims written by Simpson (1972) who defines seven levels of psychomotor domains: activity perception, activity set, activity simulation, mechanical activity – skill, complex or overt activity, activity adaptation, activity origination.

Regarding the acceptable scope of testing battery, only some of the aims were selected. Namely the complex fulfillment of higher aims would significate a prolongation of testing time and complications during the results evaluation (Honzíkova, Sojková, 2014; Janovec, Honzíkova, 2013).

In case of using the testing battery for a larger transversal research, following criteria must be complied: the testing battery should be practical, tasks should be explicitly given, the performance measuring should be simple, battery should be mobile with no high demands on tools, it should be quiet not to disturb other pupils while testing, the design should be suitable to proceed the test at a school desk in a short period of time (Honzíkova, Sojková, 2014; Janovec, Honzíkova, 2013).

The testing battery of practical tests consists of 13 individual parts – subtests. The subtests can be used also separately while testing various age groups. Each researcher gets the possibility to form his own evaluating scale for certain age group based on measuring the time and exactness of fulfilling the task. The testing battery was carried on a sample of 320 respondents from nursery, primary, secondary and high schools and teachers at internship.

Urban's test of creative abilities – TSD – Z (CREATIVITY TEST)

Figural test of creative thinking – TSD – Z is actually a screening tool to provide a view on creative potential of individuals. It is used as a tool to discover high creativity abilities on the first side and on the other side it highlights under-developed capabilities. There are some advantages in the test e.g. simple

administration and evaluation, large scope of research and financially not very demanding. A possibility to use the test for various age groups also counts between the advantages. The test contents of a sheet for A type and a sheet for B type. The sheet contains figural fragments (semi-circle, dot, wave, right angle, dashed line, small horizontal “u” out of frame) and the task for a respondent is to complete the drawings. Using the presented elements – points are given for every use of fragments, the evaluation considers. The result is based on 14 criteria (Urban, Jellen, Kováč, 2003).

The test is evaluated step by step when the points for each category are written down into a dedicated cell and summed up. Theoretically, the maximal score of TSD – Z is 72 points (Urban *et al.*, 2003).

Unlike other tests, the test also considers qualitative characteristics of creative performance of respondents. The total score provides a general estimation of creative potential which may be compared according to standards received from the researches. It is objective, valid and passes even the criteria of reliability.

The test offers a large scope of use i.e. to make an overview of creative abilities of respondents, to compare individual performances of pupils at the same age, to analyse the impact of the programs for developing creativity, in fields like psychological and educational consulting, special education to detect previously unknown potentials of children with learning and behaviour disabilities, to find extra ordinary creative individuals, the test may be also used by professional advisers as a complementary method, in tenders where creativity is requested, it may be used as a research tool for evolutionary psychology, clinical, professional and educational psychology (Urban *et al.*, 2003).

TSD – Z test corresponds to modern methods of researched regarding creativity which are not focused only on a divergent way of thinking. The test is basically aimed to qualitative, content and elaborative aspects of creativity. (Honzíková, Krotký, 2014; Honzíková, Sojková, 2014; Urban *et al.*, 2003; Urban, 2005)

The first mentioned research tool for evaluating the level of psychomotor skills had to be created for the research purpose as there was no such a tool. Validity of the testing battery was verified by respondents in different age groups. The second research tool – the Urban’s figural test of creativity is a screening tool, which can provide a view of a creative potentiality at the individual. Using both of the testing tools we expected to get the answer to the question whether a manually skilful individual is at the same time a creative person.

Methodology of Research

General background of research

It was clear from the beginning that the research would be time demanding because all the respondents had to pass 13 subtests of the testing batteries for

psychomotor skills and the Urban's test. Therefore the research was planned for a period of two years. During the first stage of the research, similar researches from home and abroad were analysed, the research methodology and tools were prepared. The field research works itself took a year.

Research sample: The research sample consisted of 100 learners from 6th – 9th grade of secondary schools in Pilsen region, 50 students of Teaching programme for 1st–5th grade of secondary school and 50 students of bachelor or master programme of “Technical Education” at West Bohemian University of Pilsen, Czech Republic.

The core question of the research: The core research question was formed as following: are the individuals who score high on the test of creativity at the same time manually skilful?

Hypotheses determination: Considering the basic questions regarding the research, the following hypotheses were determined H1 and H2.

Research time schedule: In the first stage, the “Testing battery for psychomotor skills by Honzíkova” was tested in the field. The second stage was formed from “The test with wire” and “Theoretical test” for pupils of 7th grade. Field testing was carried in a period of two years. All research was conducted between 2012 and 2014.

Research tools: Testing battery for psychomotor skills – by Honzíkova (Honzíkova, Sojková, 2014), Urban's figural test of creative thinking – TSD – Z, non-standardised didactic practical test and test of theoretical knowledge for workshops.

For statistics processing were used: Parametric Student t-test, Pearson's coefficient of correlation and Wilcoxon's test. The research methods used were field testing, tests evaluating and following statistics processing.

Results of Research and data analysis

H1 – Students of Teaching at 1st-5th grade who achieve good results in the test of creativity will also achieve good results in the test of psychomotor skills.

To test the relation between the results of both groups there was used the Pearson's coefficient of correlation. Based on the results from the table 1 when the calculated value of the correlation coefficient was estimated as 0.6216, it is stated that between the results of students of teaching at secondary schools which were achieved in the test of creativity and psychomotor skills there is a mean, significant and important but negative, opposite relation, i.e. the high value results in one test are more likely to correspond to lower results of the other test.

There is significant relation between the results of both tests done by students of teaching at 1st–5th grade, however, the original hypothesis, saying that

students who achieve good results in the creativity test will at the same time achieve good results in the test of psychomotor skills, could not be confirmed. The results tendency goes rather in the opposite direction.

For better imagination of estimated value of the calculated correlation coefficient, the calculation of determination coefficient r_p^2 was made too. In this case $r_p^2 = 0.6216^{2c} = 0.3863$. It is possible to state that the creativity test performance is from 38% influenced negatively, opposite by the performance in the test of psychomotor skills and vice versa. The remaining 62% passes to other, not ascertained factors. Both of the tests also measure other factors in a big scope. This status is noticeable in full: Tab. 1.

Statement that students who highlighted their creativity abilities in the test are at the same time manually skilful is correct only partially, according to the results. There is a mean, significant relation, but it is opposite that means that high values in one test correspond with rather lower values in the other test. It seems more that creativity and manual skills are constructed in tests and measured mostly by using other factors and quantities.

Tab. 1. Correlations of variables

Variable	Correlation (List 1 in Honzíkova1 Urban´s test 1 st , 2 nd gr. Marked correlations are significant for the level of $p < 0.05000$ N = 20 (Full cases missed at ChD)			
	Average	Reference error	Urban test.	PSM test.
Urban test.	29.00000	7.348469	1.00000	-0.621694
PSM test.	6.70000	1.301821	-0.621694	1.00000

H1 was not confirmed. If we strictly take into account the research test results, in majority it does not apply to the respondents that who is creative is at the same time skilful.

H2 – Among responding groups – children of secondary schools, bachelor and master degree students – there are significant differences between their results of the test of creativity.

The Parametric Student t-test was used to test differences between independent samples. Based on the results in table 2, it is possible to estimate on the level of significance $p = 0.05$ that between the groups of students of bachelor and master degree and children of secondary schools there exist statistically significant differences in scores of the creativity test.

According to the calculated average values for both groups, which are set for bachelor students to 37 points, for master degree students to 29 points and for pupils 27 points, it is possible to observe that students of bachelor degree achieved in average completely the best results in the creativity test. They are

followed by students of master degree (29 p.) and children of secondary schools (27 p.). The difference between master degree students and pupils is statistically significant, nevertheless the average score deviation is 2 points only.

These results are displayed in the fig. 2. It is interesting that among the group of students there are extreme and distant values present in large number which have a big impact on the results. It is possible to conclude that regarding respondents – learners of secondary schools – there were presented many extraordinary creative individuals as well as many extremely not creative individuals. Measured according to the Urban's test, the creativity of the research sample was distributed really unevenly.

Tab. 2. Test of averages vs. reference constant

Variable	Test of averages vs. reference constant (value)							
	Average	Standard deviation	N	Standard error	Reference constant	t	SV	p
Urban test. (children)	27.07143	9.063126	56	1.211111	0,00	22.35255	55	0.00001
Urban test. (Bachelor)	37.36366	9.168127	11	2.764294	0,00	13.51652	10	0.00001
Urban test. (Master)	29.00000	7.348469	20	1.643168	0,00	17.64884	19	0.00001

Based on the presented results, the H2 hypothesis should be accepted as there are significant differences recorded between the participating groups of respondents.

Discussion

Two types of testing were used in implementation of the research – Testing battery of psychomotor skills by Honzíkova (Honzíkova, Sojková, 2014) was used to test the level of manual (psychomotor) skills and Urban's figural test of creative thinking was used to detect the level of creativity – therefor the comparison with other published researches was complicated. The main aim was to interconnect the results of the manual skills test with the results of the creativity test as researches in this area is not yet available.

There are no similar researches in other countries which would compare the level of practical skills or level of technical knowledge with the level of creativity at individual respondents. Hence it is impossible to compare the obtained results with the results of researches carried in past 10 years. Regarding the research of practical skills, there are only results of published researches carried on pupils of 1st–5th grade secondary school and high-school students.

There are mostly partial researches with focus on the level of practical skills in certain fields (Krotký, Simbartl, 2016).

Standardised tests to estimate the level of psychomotor skills at school children are not available. If tests are used to indicate the level of psychomotor skills, those are usually specialised on certain profession i.e. medicine (Stefanidis, Korndorffer, Black, 2006; Amabile, 1992). Currently, the testing battery of Janovec and Honzíkóv was created in the Czech Republic to test psychomotor skills of pupils at secondary schools (Janovec, Honzíkóv, 2013). Both of the testing batteries aim to find out the level of manual skills. Janovec (2013) carried out in this mode a test for pupils of 1st-5th grade. The research results were not much different from our research results, but the evaluation process was different.

The results of research on the level of creative abilities are presented in technical literature more often. In the history, testing was usually done with support of Torrance figural test of creative thinking. Large research on almost 1500 respondents was carried in the Czech Republic from 2007 to 2008 by Honzíkóv, Novotný (2012). They utilised for their research not only Torrance figural test of creative thinking to analyse the level of creative thinking, but also Shape folding test for estimating the level of technical imagination. The large and original research was focused on comparison of creative thinking and imagination. In Slovakia, they are familiar with the researches using Torrance test of figural thinking by Jurčová (2009). Recently, Urban's figural test of creative thinking is commonly used as it can be used for various age groups and provides broad scope for testing creative abilities. The results of our research regarding creative abilities using Urban's test were compared with similar research results carried out in Germany (Urban, 2005), Slovak Republic (Lokšová, Lokša, 2001) and Hungary (Kárpti, Gyebnr, 1994). No significant differences were found per individual groups of respondents. Records of testing using the Urban's tests were found in other European countries too (Portugal, Spain, Poland) as well as in further destinations such as i.e. South Africa, Philippines, China, Nigeria, India, Indonesia. Those tests were done by various groups of respondents, from children to seniors. However, none of those researches is dedicated to relation between creativity and psychomotor skills.

Aim was to find out the relation between creativity and manual skills. First question was about the respondents who achieve high score in the creativity test whether they can earn many points in the test of manual skills too. In a simplified way, is a creative individual at the same time skilful? The results of testing demonstrated that i.e. students of education who achieved good results in the creativity test did not get good results in the psychomotor test, but contrary – their results were rather under average. Also children of secondary schools who scored well in the creativity test did not succeed much in the manual test. It is

definitely necessary to think about the content of education in our society. It is assumed that every creative man should implement his ideas in a presentable form to prove his creativity abilities. Human race does not require individuals who only have some ideas, rather than the ones who can implement them not only on top level but also in their ordinary lives.

Conclusions

Psychomotor skills may be developed and improved besides other ways by training. On the other hand, the big question is to what extent is creativity inborn and to what extent can we develop it. Investigations show a strong correlation between creativity and intelligence (Jauk, Benedek, Dunst, Neubauer, 2013).

As already mentioned, one of the targets of our society is to raise and form creative individuals, though, how can a teacher help to promote more creativity in his learners? The specific research (meta-analysis) of 70 programs for developing creativity proved a certain increase of creative power of the observed individuals (Scott, Leritz, Mumford, 2004). To develop creativity effectively, the teacher has to focus on all the three components (Amabile, 1998):

- expertise (technical and technological skills and knowledge),
- creative-thinking (especially developing skills, working with imagination and visualisation),
- motivation.

In the modern industrial society we can see a higher demand for creative talent and a creative power of individuals more than their manual skills (Krotký, Korytář, Simbartl, 2016). The transformation is in relation to the development of robotics and the availability of technology. The lessons at secondary schools reflect these trends and children create PC models or work with computer-controlled machines among other things. In our part of the research (H1), it was not proved that there is any correlation between creativity and psychomotor skills of students at the faculty of education – future teachers. The question is whether any relation does not exist during another interval of human development or whether the research was not affected by other factors. According to Honzíková, the performance of an individual is during the psychomotor test constant or does not vary significantly even when it is repeated on another place in another time, while the level of creativity exposure may be different every time. The main negative factors which affect the creative performance are namely lack of time (Brady, Austen, 2012) or depressive, colourless, unhygienic, and monotonous working environment (Alimardani, Soheili, 2014). Following investigations should be carried in the field of creative products. The principal question is the way of measuring and classifying the levels of creative performance from the product. Functional creativity presents a shift to creative products with “useful social purpose” or also efficiency (Cropley, Kaufman, Cropley, 2011; Reis, Renzuli, 2004; Mastracci, 2012).

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