

APPLYING OF STRATEGIES OF CRITICAL AND CREATIVE THINKING BY TEACHERS ACCORDING TO THE TEACHING SUBJECT AND DEGREE OF EDUCATION

^aJANA DUCHOVIČOVÁ, ^bLÍVIA FENYVESIOVÁ

*Constantine the Philosopher University, Faculty of Education,
Department of Pedagogy, Dražovská 4,
Post code: 949 74, Nitra, Slovakia
Email: ^ajduchovicova@ukf.sk, ^blfenyvesiova@ukf.sk*

This work was supported by the Slovak Research and Development Agency under the contract No. APVV-15-0368.

Abstract: The study presents the results of our research dealing with teaching strategies that develop critical and creative thinking of pupils. The subject of our study is the correlation level between the application of strategies developing the critical and creative thinking by teachers and the subjects they teach. The analysis of dependence of particular strategies pointed out the fact that teachers of natural sciences, social sciences, languages, as well as educational and artistic subjects use strategies developing critical and creative thinking with the same frequency, and there does not exist any difference in their application according to particular groups of teaching subjects. We identified a statistically significant difference only in two teaching strategies.

Keywords: critical thinking, creative thinking, teaching strategies.

1 Introduction

The ability to think in a critical and creative way represents one of the key abilities of people for effective and meaningful life in the 21st century. The excessive usage of technologies in our environment, informative explosion and quickly spread information require individuals who are able to select information, assess and solve problems, find and judge possible alternatives, make correct decisions and offer their own ideas. It is possible to develop these skills and they represent a challenge for the current school system and its form of the teaching process. The changes in the contents and processes of education are indispensable so that teachers can carry out cognitively oriented teaching and apply such teaching strategies that develop reflective, critical and creative thinking of pupils. The work was developed as part of research project solution VEGA No. 1/0098/17 Individual Conception and Strategy of Education within the Context of Teacher's Professional Development.

2 Theoretical and Empirical Starting Points

It is indispensable to look at the concept of critical thinking in a complex way within the context of development of critical thinking by means of education. Until now there does not exist any overtly accepted definition that would define critical and creative thinking to the full extent. For the needs of assessing learning results of pupils there was approved a definition that was published in the so called Delphi Report (Facione, 1990) Critical thinking is: *intentional, regulated thinking based on the consistent consideration of evidence, concepts, methods, criteria and correlations, focused on the interpretation, analysis, assessment and drawing of conclusions.*

Critical thinking is perceived as a more dimensional concept. The core of critical thinking consists of two dimensions (Ennis, 1985; Facione, 1990; Paul, 1992; Halpern, 2014, Bailin et al., 1999):

1. specific categories of cognitive competences: interpretation, analysis, assessment, assuming, explaining, and self-regulation;
2. dimension of personal predispositions.

The cognitive dimension of critical thinking is formed by mental processes like analysis, synthesis, and assessment which are denoted as higher cognitive processes. Halpern (1997) understands critical thinking as *“the use of those cognitive skills or strategies that increase the probability of a desirable outcome”*. Critical thinking is a mental process and on its basis individuals are able to judge arguments and new information, to draw conclusions and create their own opinions. Thinking at the highest level, the critical and creative thinking, allows us to gain individual freedom (Limbach,

Waugh, 2010). Erwin (2002) made a list of cognitive competences of critical thinking, including there:

- the competence to identify key ideas and assumptions in the argument,
- the competence to recognize important correlations,
- the competence to interpret data correctly,
- the competence to draw logical conclusions from accessible information,
- the competence to differentiate between facts and assumptions,
- the competence to assess the reliability of evidence mentioned to support the statements and credibility of authority,
- the competence to re-evaluate our own convictions,
- effective decision making and problem solving. (In Pascarella, Terenzini, 2005).

The affective level of critical thinking is created by personal predispositions, attitudes of individuals to information, their interest and motivation to solve tasks and problems. A very important part is represented by the so called “intellectual curiosity” and openness to new horizons (Paul, 1992). Also Watson and Glaser (2012) mention the close relationships between the cognitive and affective level of critical thinking. According to them, critical thinking contains attitudes to information, knowledge, as well as valid assumptions, abstractions, generalizations and abilities that could be used at work. In addition to the cognitive and affective levels of critical thinking, Kosturková (2016, p. 15) describes also the performing dimension whose essence is created by the abilities of individuals to use different methods for better orientation in manifold types of information, such as creating of conceptual maps, Venn Diagram, recurrent graphical organization, etc.

As aforementioned, in the educational -formational process it is possible to have a direct impact on the ability to think critically (Paul, 1992; Nelson, 1994; Halpern, 2014; Bailin et al., 1999). However, the development of critical and creative thinking in the conditions of Slovak school system seems to be an unexplored area. There exist only few research works that document the state of critical thinking of pupils and their teachers. There are hardly any research works and data about the preparation of teachers in the course of their pre-graduate formation from the point of view of applying strategies for development of critical thinking. Current measurements and analyses, dealing with the state of critical and creative thinking of pupils of the secondary education, emphasize the unsatisfactory results. According to the results of PISA 2012, 2015, the level of their literacy in reading, mathematics and natural sciences has been below the average of other countries of OECD for long time. Kosturková (2016) was interested in finding out the state of critical thinking of students at Slovak secondary grammar schools. The research sample was formed by 365 students of secondary schools and her diagnostic tool was the W-GCTA test of critical thinking. The general achieved mean level of gross score was 40,41 points out of the total number of 80 points, and pupils achieved the lowest mean score in the subtest for judging and the highest score in the subtest for recognizing assumptions. To a certain degree, these results reflect the insufficient attention paid to the development of critical thinking of pupils. At the same time, these results emphasize the need for the development of critical and creative thinking of teachers and also the subsequent need for creative application of adaptive teaching strategies by teachers of primary schools, secondary schools and universities. International measurements Tallis (2008) pointed out the fact that the structured approach to teaching is dominant in Slovakia when compared to the approach focused on pupils and extensive teaching. The frequency of applying this extensive teaching type with dominant individual and creative activities of pupils (debate, argumentation, project work, production of products for others, essay writing) was identified as the lowest one out of all three evaluated types of teaching. Many other research works confirm that teachers develop higher cognitive abilities of pupils to a very limited extent (Zelina

1990, Portík, 2001, Šušáková, 2017). Kosturková (2016) assesses the state of critical thinking of Slovak teachers as unsatisfactory. Compared to the sample of British teachers, our teachers obtained a relatively low mean gross score (41,15 points out of 80 possible points) in the W-GCTA test (Watson-Glaser test of critical thinking). Our research was based on the fact that the level of critical thinking of teachers subsequently determines the application of teaching.

3 Method and Methodology

Our formulation of the research problem is focused on the aims of the research project No. APVV-15-0368, Practice in the centre of specialized didactics, specialized didactics in the Centre of practical preparation. Its aim was to identify the key adaptive strategies applying the cognitively oriented approach to the development of pupils' critical and creative thinking by teachers.

Research subject

The correlation level between the application of strategies for development of critical and creative thinking by teachers and the subjects these teachers teach.

Research problem

A statistical significance of the correlation between the application of strategies for development of critical and creative thinking by teachers and the group of subjects they teach.

In the assessment we pay our attention to the frequency of applying specific identified strategies of critical and creative thinking by teachers in terms of factor division of strategies and also according to particular items belonging to the given strategies (Duchovičová, Tomšík, 2017, 2018). The frequency of their application is based on the self-reflective analysis by teachers of particular groups of subjects (natural sciences, informatics and mathematics, social sciences and mother tongue, artistic education and educational subjects, foreign languages).

Research sample

Our research sample was formed by $N = 125$ randomly selected teachers (teachers fulfilling the requirement for the position of training teachers) working at primary schools ($n = 67$) and secondary schools ($n = 58$) in Slovakia. The average age of respondents was $M = 45,58$ years with the standard deviation $SD = 9,71$ years (min = 25; max = 65), and the average length of teaching practice was 20,61 years. Out of the total number of participants in the research there were $N = 16$ male respondents and $N = 107$ female respondents ($n = 2$ non-categorized). The division according to the teaching subjects is the following one: teachers of natural sciences, informatics and mathematics ($n = 38$); teachers of social sciences and mother language ($n = 32$); teachers of artistic education and educational subjects ($n = 16$) and teachers of foreign languages ($n = 39$).

Research methods

In the collection of research data we used the questionnaire "Strategies of critical and creative thinking in teaching" (Duchovičová, et al. 2017). The questionnaire is designed for teachers and training teachers. By means of this questionnaire it is possible to identify the key didactic strategies for development of critical and creative thinking of pupils that are used by teachers. The research tool consists of two two-dimensional parts one one-dimensional part. For the purposes of our research, we selected the first part focused on the frequency of using particular strategies in teaching for development of critical and creative thinking of students. This part has 41 items and they are divided into six following subscales (the reliability of particular subscales for specific dimensions is expressed with the Cronbach's coefficient α):

- Strategies for development of self-regulation (9 items; $\alpha=0,824$; $\alpha=0,844$),

- Strategies for development of systematic and interpretative skills (10 items; $\alpha=0,785$; $\alpha=0,800$),
- Argumentation strategies (6 items; $\alpha=0,803$; $\alpha=0,760$),
- Strategies for drawing conclusions and problems solutions (8 items; $\alpha=0,673$; $\alpha=0,608$),
- Strategies for development of assessment (5 items; $\alpha=0,522$; $\alpha=0,586$),
- Strategies for development of reading skills (4 items; $\alpha=0,737$; $\alpha=0,643$).

The reliability of the complete tool expressed with the Cronbach's coefficient is $\alpha=0,935$.

The inner consistency and validity of the questionnaire was verified with the factor analysis (Duchovičová, Tomšík, 2017). Taking into account the unequal number of items in the particular subscales of the questionnaire, the score of respondents' answers can achieve different levels. Higher score represents a higher level of the factor analysed in the subscale. All items are formulated as declarative sentences that require answers according to the five-degree scale of Likert type (1-5).

The research data were processed by means of the programme Microsoft Excel and statistical programmes IBM SPSS (ver. 22) and STATA (ver. 9). For the description of the research data, we used methods of descriptive statistics, namely: the number, mean, the mean of items (the summary score was divided with the given number of items in the factor), the standard deviation. In order to find out the differences in the studied variables between the research groups, we used the Kruskal-Wallis test/Mann-Whitney U test. We compared the data from the particular groups of teachers divided according to their teaching subject by means of the variation analysis ANOVA (Tomšík, 2016; 2017).

Design

The collection of data was carried out within the period of April, May and June 2017. The administration of the tool took approximately 30 minutes. The tool was in the print form and it was completed by teachers. During the months of July and August 2017 we analysed the obtained data and published information about the factor analysis of the tool. Partial data from the research of strategies of critical and creative thinking applied by teachers are published continually.

4 Results and discussion

The aim of the research was to find out what relationship is between the application of strategies of critical and creative thinking by teachers according to the subjects they teach. The results of the analysis of applying a specific strategy according to the type of subject are mentioned in the table 1.

As it is evident from our findings, teachers include and apply particular strategies developing critical and creative thinking of pupils in particular subjects in a comparable way. We identified a statistically significant difference only in the strategy *Creating space for presenting different views, attitudes and cultural differences among learners*. This strategy was more frequently applied by teachers of social and educational subjects. Another statistically significant difference was found out in the strategy *Using of discussion as a space for exploration of learners own feelings, remarks and opinions* that was much more often used by teachers of foreign languages and natural sciences. In the final overall assessment we did not find any significant differences in the application of particular strategies in teaching by teachers of specific groups of subjects.

We mention the results of the frequency in application of particular strategies according to the factors consisting of the given items in the graph 1. The division of frequencies of application of strategies according to the factors of critical thinking is stated in the table 2.

Table 1. Descriptive statistics of research data - application of strategy by teachers from the particular group of subjects

		N	Mean	Std. Deviation	Std. Error
A2. Use of contradictions and conflicts, guidance to argumentation	natural sciences	37	4,30	1,127	,185
	social sciences	32	4,16	,987	,175
	languages	39	4,38	,815	,130
	artistic education	16	4,13	1,088	,272
	<i>Total</i>	<i>124</i>	<i>4,27</i>	<i>,989</i>	<i>,089</i>
A3. Using role plays	natural sciences	37	3,43	1,237	,203
	social sciences	31	3,39	1,334	,240
	languages	39	3,56	1,046	,168
	artistic education	16	3,13	1,147	,287
	<i>Total</i>	<i>123</i>	<i>3,42</i>	<i>1,187</i>	<i>,107</i>
A4. Leading learners to identify key and relevant facts and ideas in the curriculum	natural sciences	37	4,68	,784	,129
	social sciences	31	5,00	,856	,154
	languages	38	5,03	,944	,153
	artistic education	15	4,73	,884	,228
	<i>Total</i>	<i>121</i>	<i>4,88</i>	<i>,871</i>	<i>,079</i>
A5. Structuring of the subject curriculum based on defined goals according to specific taxonomies (Bloom, Simpson, Harrow, Krathwohl, Tollinger...)	natural sciences	37	3,57	1,444	,237
	social sciences	32	3,94	,914	,162
	languages	38	3,55	1,655	,269
	artistic education	16	3,56	1,365	,341
	<i>Total</i>	<i>123</i>	<i>3,66</i>	<i>1,384</i>	<i>,125</i>
A6. Using various sources (other than a textbook)	natural sciences	37	4,95	,941	,155
	social sciences	32	5,09	,818	,145
	languages	39	5,13	,732	,117
	artistic education	16	4,94	1,124	,281
	<i>Total</i>	<i>124</i>	<i>5,04</i>	<i>,869</i>	<i>,078</i>
A7. Using debate in lessons (requiring analysis and arguments)	natural sciences	37	4,76	,895	,147
	social sciences	31	5,13	1,056	,190
	languages	39	4,92	,900	,144
	artistic education	15	4,60	,986	,254
	<i>Total</i>	<i>122</i>	<i>4,89</i>	<i>,955</i>	<i>,086</i>
A8. Learners guidance to graphic design of the subject matter (conceptual maps, handout, table, graphic representations)	natural sciences	37	3,89	1,390	,229
	social sciences	32	4,44	1,076	,190
	languages	39	4,44	1,273	,204
	artistic education	16	3,94	1,389	,347
	<i>Total</i>	<i>124</i>	<i>4,21</i>	<i>1,290</i>	<i>,116</i>
A9. Leading learners towards identification of the differences between fact and opinion	natural sciences	37	3,92	1,038	,171
	social sciences	32	3,84	1,167	,206
	languages	39	4,23	1,063	,170
	artistic education	16	3,69	,946	,237
	<i>Total</i>	<i>124</i>	<i>3,97</i>	<i>1,074</i>	<i>,096</i>
A10. Leading learners towards drawing conclusions and generalization	natural sciences	36	4,50	1,183	,197
	social sciences	32	4,63	1,040	,184
	languages	39	4,64	1,013	,162
	artistic education	16	4,50	1,265	,316
	<i>Total</i>	<i>123</i>	<i>4,58</i>	<i>1,094</i>	<i>,099</i>
A11. Use of digital study materials, programmes and applications	natural sciences	37	4,16	1,365	,224
	social sciences	32	4,25	1,078	,191
	languages	39	4,62	1,091	,175
	artistic education	16	3,88	1,310	,328
	<i>Total</i>	<i>124</i>	<i>4,29</i>	<i>1,215</i>	<i>,109</i>
A12. Guidance toward formulation of questions that support thinking (question types like: What is the essence of it? What does it mean? Why is it happening? What if? etc.)	natural sciences	36	4,72	1,210	,202
	social sciences	32	4,97	1,177	,208
	languages	39	5,13	,864	,138
	artistic education	16	4,75	1,483	,371
	<i>Total</i>	<i>123</i>	<i>4,92</i>	<i>1,142</i>	<i>,103</i>
A13. Creating space for presenting learners ideas, their presentation and improvement	natural sciences	37	4,59	,985	,162
	social sciences	32	4,59	,911	,161
	languages	39	4,36	,932	,149
	artistic education	16	4,19	1,047	,262
	<i>Total</i>	<i>124</i>	<i>4,47</i>	<i>,958</i>	<i>,086</i>
A14. Guidance of learners towards identification, naming of problems	natural sciences	37	4,49	,989	,163
	social sciences	32	4,69	,859	,152
	languages	39	4,26	,880	,141
	artistic education	16	4,50	1,033	,258
	<i>Total</i>	<i>124</i>	<i>4,47</i>	<i>,932</i>	<i>,084</i>
A15. Asking questions to repeat already learnt by heart subject matter	natural sciences	37	4,49	1,017	,167
	social sciences	32	4,66	1,125	,199
	languages	39	4,72	,944	,151
	artistic education	16	4,44	1,209	,302
	<i>Total</i>	<i>124</i>	<i>4,60</i>	<i>1,043</i>	<i>,094</i>
A16. Managing learners to assess the credibility of the	natural sciences	37	4,11	1,197	,197

resource, leading to argumentation	social sciences	32	4,16	1,221	,216
	languages	39	4,26	1,141	,183
	artistic education	16	4,13	1,500	,375
	<i>Total</i>	<i>124</i>	<i>4,17</i>	<i>1,215</i>	<i>,109</i>
A17.Respect for interdisciplinary relationships	natural sciences	37	4,32	1,082	,178
	social sciences	32	4,69	,965	,171
	languages	39	4,33	,898	,144
	artistic education	16	4,31	1,195	,299
	<i>Total</i>	<i>124</i>	<i>4,42</i>	<i>1,013</i>	<i>,091</i>
A18.Guiding pupils to identify the cause and effect	natural sciences	37	3,95	1,153	,190
	social sciences	32	4,59	1,043	,184
	languages	39	4,28	,972	,156
	artistic education	16	4,13	1,408	,352
	<i>Total</i>	<i>124</i>	<i>4,24</i>	<i>1,122</i>	<i>,101</i>
A19.Using techniques for remembering	natural sciences	37	4,59	,927	,152
	social sciences	32	4,66	1,125	,199
	languages	39	4,44	,968	,155
	artistic education	16	4,50	1,461	,365
	<i>Total</i>	<i>124</i>	<i>4,55</i>	<i>1,062</i>	<i>,095</i>
A20.Using graphical representations for presentation of the curriculum (conceptual maps, handout, table, graphic representations)	natural sciences	37	4,16	1,214	,200
	social sciences	32	4,78	,832	,147
	languages	39	4,44	1,046	,168
	artistic education	16	4,13	1,258	,315
	<i>Total</i>	<i>124</i>	<i>4,40</i>	<i>1,096</i>	<i>,098</i>
A21.Leadng learners to work with text and to create their own notes	natural sciences	37	4,30	1,244	,205
	social sciences	32	4,66	1,181	,209
	languages	39	4,41	,966	,155
	artistic education	16	4,19	1,167	,292
	<i>Total</i>	<i>124</i>	<i>4,41</i>	<i>1,133</i>	<i>,102</i>
A22.Creation of presentations and supporting learning materials for learners	natural sciences	37	4,43	1,068	,176
	social sciences	32	4,47	,761	,135
	languages	39	4,51	1,073	,172
	artistic education	16	4,25	1,065	,266
	<i>Total</i>	<i>124</i>	<i>4,44</i>	<i>,990</i>	<i>,089</i>
A23.Solution of problems and drafting conclusions	natural sciences	37	3,95	1,177	,194
	social sciences	32	4,34	,937	,166
	languages	39	4,10	1,095	,175
	artistic education	16	4,00	1,095	,274
	<i>Total</i>	<i>124</i>	<i>4,10</i>	<i>1,081</i>	<i>,097</i>
A24.Leadng learners toward deduction, specification (drawing on specific examples from general theories)	natural sciences	36	4,17	1,183	,197
	social sciences	32	4,38	,976	,172
	languages	39	4,18	1,073	,172
	artistic education	16	4,50	1,095	,274
	<i>Total</i>	<i>123</i>	<i>4,27</i>	<i>1,079</i>	<i>,097</i>
A25.Using project assignments	natural sciences	36	3,61	,994	,166
	social sciences	32	3,72	,888	,157
	languages	38	3,97	,885	,144
	artistic education	16	3,88	,806	,202
	<i>Total</i>	<i>122</i>	<i>3,79</i>	<i>,911</i>	<i>,082</i>
A26.Using procedures for understanding	natural sciences	36	4,39	,994	,166
	social sciences	31	4,26	1,154	,207
	languages	38	4,58	1,081	,175
	artistic education	16	4,31	1,138	,285
	<i>Total</i>	<i>121</i>	<i>4,40</i>	<i>1,077</i>	<i>,098</i>
A27.Leadng to summarize and interpret the curriculum (say the learning content in own words)	natural sciences	37	4,92	1,038	,171
	social sciences	32	5,25	,762	,135
	languages	39	4,97	,873	,140
	artistic education	16	5,00	1,211	,303
	<i>Total</i>	<i>124</i>	<i>5,03</i>	<i>,945</i>	<i>,085</i>
A28.Preference of cognitively more challenging tasks (tasks with analysis, evaluation, creativity) with one right solution	natural sciences	37	4,00	1,225	,201
	social sciences	32	4,09	,856	,151
	languages	38	3,95	1,012	,164
	artistic education	16	4,00	1,211	,303
	<i>Total</i>	<i>123</i>	<i>4,01</i>	<i>1,060</i>	<i>,096</i>
A29.Leadng to application of the subject matter in unusual situations and tasks	natural sciences	37	3,62	1,010	,166
	social sciences	32	3,78	,832	,147
	languages	39	3,44	,852	,136
	artistic education	16	3,69	1,195	,299
	<i>Total</i>	<i>124</i>	<i>3,61</i>	<i>,943</i>	<i>,085</i>
A30.Preference of tasks with multiple correct solutions	natural sciences	37	3,70	1,392	,229
	social sciences	32	3,44	1,216	,215
	languages	38	3,58	1,222	,198
	artistic education	16	3,50	1,414	,354
	<i>Total</i>	<i>123</i>	<i>3,57</i>	<i>1,287</i>	<i>,116</i>
A31.Using categorization (division -sorting based on a certain criterion)	natural sciences	35	3,26	1,268	,214
	social sciences	31	3,68	,748	,134
	languages	39	3,72	1,191	,191
	artistic education	16	3,25	1,065	,266
	<i>Total</i>	<i>121</i>	<i>3,51</i>	<i>1,111</i>	<i>,101</i>
A32. Preference of tasks aimed at innovation and	natural sciences	37	4,38	1,233	,203
	social sciences	32	4,19	,965	,171

improvement of assignments and solutions	languages	39	4,38	,847	,136
	artistic education	16	4,13	1,258	,315
	<i>Total</i>	<i>124</i>	<i>4,30</i>	<i>1,051</i>	<i>,094</i>
A33.Guiding learners towards creation of original ideas, solutions and products	natural sciences	37	4,11	1,242	,204
	social sciences	32	4,56	,840	,148
	languages	39	4,23	,986	,158
	artistic education	16	4,00	1,506	,376
	<i>Total</i>	<i>124</i>	<i>4,25</i>	<i>1,116</i>	<i>,100</i>
A34.Using associations (initial ideas associated with a certain term, phenomenon)	natural sciences	37	4,62	1,037	,170
	social sciences	32	4,56	,948	,168
	languages	39	4,77	1,038	,166
	artistic education	16	4,69	1,014	,254
	<i>Total</i>	<i>124</i>	<i>4,66</i>	<i>1,003</i>	<i>,090</i>
A35.Creating space for self-presentation, presentation of a learner's own solutions	natural sciences	37	4,43	1,094	,180
	social sciences	32	4,28	1,114	,197
	languages	39	4,62	,847	,136
	artistic education	16	4,31	,793	,198
	<i>Total</i>	<i>124</i>	<i>4,44</i>	<i>,990</i>	<i>,089</i>
A36.Creating space for presenting different views, attitudes and cultural differences among learners	natural sciences	37	4,54	,989	,163
	social sciences	32	5,09	,928	,164
	languages	39	4,72	,916	,147
	artistic education	16	5,13	,806	,202
	<i>Total</i>	<i>124</i>	<i>4,81</i>	<i>,949</i>	<i>,085</i>
A37.Identification and definition of basic terms and their relations by a teacher, creation of notes	natural sciences	36	4,19	1,117	,186
	social sciences	31	4,35	,950	,171
	languages	39	4,23	,959	,154
	artistic education	16	4,25	,931	,233
	<i>Total</i>	<i>122</i>	<i>4,25</i>	<i>,992</i>	<i>,090</i>
A38.Using the discussion as a space for exploration of learners own feelings, remarks and opinions	natural sciences	37	3,89	1,329	,218
	social sciences	32	3,53	1,218	,215
	languages	39	4,05	,826	,132
	artistic education	16	3,19	1,047	,262
	<i>Total</i>	<i>124</i>	<i>3,76</i>	<i>1,150</i>	<i>,103</i>
A39.Using small work groups when teaching	natural sciences	37	3,95	1,129	,186
	social sciences	31	4,03	1,080	,194
	languages	39	3,97	,932	,149
	artistic education	16	3,56	1,031	,258
	<i>Total</i>	<i>123</i>	<i>3,93</i>	<i>1,042</i>	<i>,094</i>
A40.Creating space for learners discovery,curiosity	natural sciences	37	3,76	1,164	,191
	social sciences	32	3,97	1,031	,182
	languages	39	3,85	1,089	,174
	artistic education	16	3,75	1,000	,250
	<i>Total</i>	<i>124</i>	<i>3,84</i>	<i>1,077</i>	<i>,097</i>
A41.Using problem solving teaching	natural sciences	35	3,86	1,478	,250
	social sciences	31	4,32	,871	,156
	languages	39	4,03	1,013	,162
	artistic education	16	3,88	1,408	,352
	<i>Total</i>	<i>121</i>	<i>4,03</i>	<i>1,190</i>	<i>,108</i>
A42.Using similarities and analogies	natural sciences	37	3,84	1,143	,188
	social sciences	32	3,81	,821	,145
	languages	38	3,89	1,060	,172
	artistic education	16	4,19	1,167	,292
	<i>Total</i>	<i>123</i>	<i>3,89</i>	<i>1,039</i>	<i>,094</i>

*Note: N – number; Std. Deviation – standard deviation, Std. Error - standard error

Graph 1 Application of particular strategies for development of critical and creative thinking by teachers of secondary education (more in detail Fenyvesiová et al. 2018)

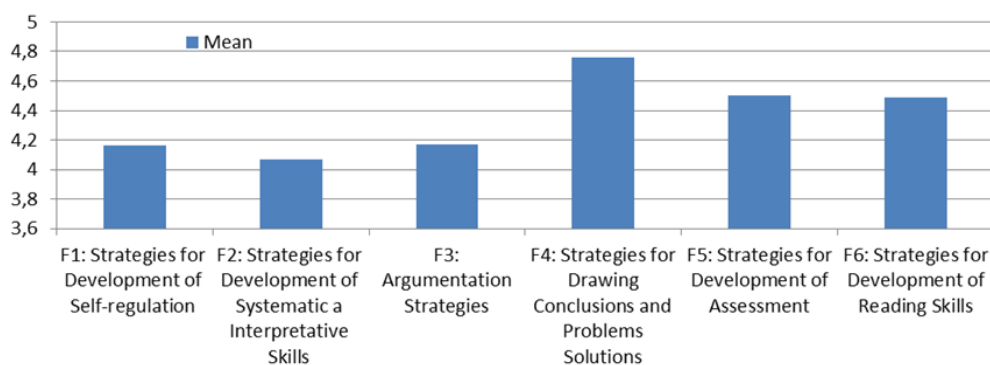


Table 2. Descriptive statistics of research data - application of strategies by teachers of particular group of subjects according to the factors of creative thinking

		N	M	SD	SE	Sig. ANOVA
F1: Strategies for Development of Self-regulation	natural sciences	34	35,3529	6,92769	1,18809	,753
	social sciences	31	36,1613	4,89964	,88000	
	languages	37	36,7027	5,50689	,90533	
	artistic education	16	35,3750	4,85627	1,21407	
	Total	118	35,9915	5,69074	,52388	
F2: Strategies for Development of Systematic a Interpretative Skills	natural sciences	34	38,0882	6,25405	1,07256	,693
	social sciences	29	39,6207	4,85808	,90212	
	languages	37	39,4324	5,83829	,95981	
	artistic education	16	38,5000	6,71317	1,67829	
	Total	116	38,9569	5,82706	,54103	
F3: Argumentation Strategies	natural sciences	37	23,2703	4,81692	,79190	,586
	social sciences	31	23,9355	4,39648	,78963	
	languages	39	24,3077	3,97462	,63645	
	artistic education	16	22,6875	5,12144	1,28036	
	Total	123	23,6911	4,47970	,40392	
F4: Strategies for Drawing Conclusions and Problems Solutions	natural sciences	35	36,1143	5,73827	,96994	,377
	social sciences	31	38,2258	5,18787	,93177	
	languages	39	36,8718	4,89994	,78462	
	artistic education	15	35,8667	6,41278	1,65577	
	Total	120	36,8750	5,42878	,49558	
F5: Strategies for Development of Assessment	natural sciences	37	21,0541	3,61283	,59395	,294
	social sciences	31	22,3871	3,19038	,57301	
	languages	37	22,0811	3,00350	,49377	
	artistic education	15	20,9333	4,36654	1,12744	
	Total	120	21,7000	3,44366	,31436	
F6: Strategies for Development of Reading Skills	natural sciences	37	17,0541	2,94341	,48389	,117
	social sciences	32	18,1563	2,55405	,45150	
	languages	39	17,9744	2,96015	,47400	
	artistic education	16	16,4375	2,63233	,65808	
	Total	124	17,5484	2,84949	,25589	

*Note.: N– number; M– mean; SE– standard error of mean; SD – standard deviation; Sig. ANOVA – statistical significance

Analyses of identifying applied strategies for the development of critical thinking show that teachers of secondary degree of education most frequently apply strategies for drawing conclusions and problems solutions, as well as strategies for development of reading skills and assessment of learners. (Fenyvesiová, et al., 2018). The works by Brečka, Valentová et al., 2017; Čeretková et al., 2017, Horváthová, Reid, et al., 2017 analyse the application of strategies of critical and creative thinking by teachers of particular teaching subjects more in detail. The authors present detailed results of applying strategies from the point of view of several criteria of data division. We were interested to find out if there are any differences in the application of the given strategies from the point of view of groups of subjects taught by teachers of secondary education. We divided the subjects into the following groups: natural sciences (we included there also teachers of mathematics and informatics), social sciences, languages and subjects of artistic education/educational subjects. When analysing the obtained data, we found out that the application of strategies of critical and creative thinking by teachers is not determined by the character of the teaching subject, and therefore the contents of the teaching subject do not influence the application of argumentation strategies, strategies for development for development of systematic and interpretative skills of learners, strategies for development of self-regulation, assessment, drawing conclusions and problems solving, and strategies for development of reading skills. We did not find any statistically significant relationship between the application of strategies by teachers and the type of subject they teach in the secondary degree of education in any of the studied factors of developing critical and creative thinking.

Unsatisfactory results of pupils in particular areas of critical and creative thinking represent a long-term problem in the educational system of the Slovak Republic. Zelina (2011) sees the reason of this situation in the didactic level, i.e. in the methods and strategies applied by teachers and also in the relationship between teachers and their pupils. Within the project APVV-15-0368 we identify the basic and referential orientation in the level of applying strategies of critical and creative thinking by teachers (Duchovičová et al. 2018). We found out that teachers of secondary degree of education most frequently apply strategies for drawing conclusions and problems

solving, as well as strategies for development of reading skills and assessment of learners. We also found out that there do not exist any statistically significant differences in the application of strategies for development of critical and creative thinking by teachers from the point of view of teaching subjects they teach in the secondary degree of education. Teachers of particular groups of subjects apply strategies for development of self-regulation, strategies for development of systematic and interpretative skills, argumentation strategies, strategies for drawing conclusions and problems solving and strategies or development of reading skills with the same frequency. Their application is not determined by the contents and character of the teaching subject. The analysis of the dependance of particular strategies proved the fact that teachers of natural sciences (we included also teachers of mathematics and informatics into this group), social sciences, languages and subjects of artistic education/educational subjects use the given strategies with the same frequency of application. We identified a statistically significant difference only in the strategy *Creating space for presenting different views, attitudes and cultural differences among learners* and *Using the discussion as a space for exploration of learners own feelings, remarks and opinions*.

A new problem for statistical processing of data related to the application of strategies of critical thinking by teachers is their classification according to the degree of education, their inclusion into the process of continual education, or according to their expertness expressed with the length of their pedagogical practice. We consider these results to be relevant for further education of teachers as well as for the orientation of education in the pre-graduate preparation. It is important to focus on these areas more intensively also at the methodical level.

Based on this research, Fenyvesiová, Duchovičová, Tomšík, Grofčíková, 2018 assess the frequency of applying strategies for development of cognitive processes by teachers of secondary education as satisfactory. However, the effectiveness of their application is unsatisfactory and therefore this problematic area still requires to be in the centre of intensive research work.

References

1. Bailin, S., Case, R., Coombs, J.R., Daniels, L. B. 1999. Conceptualizing critical thinking. *Journal of Curriculum Studies*, vol. 31, n. 3, pp. 285–302.
2. Brečka, P., Valentová, M. et al. 2017. *Stratégie kritického a tvorivého myslenia v odborových didaktikách výchovných predmetov*. Nitra : PF UKF, 2017, 162 p. ISBN 978-80-558-1227-4.
3. Čeretková, S. et al. 2017. *Stratégie tvorivého a kritického myslenia v príprave učiteľov prírodovedných predmetov, matematiky a informatiky*. Nitra: UKF, 2017, 160 p. ISBN 978-80-558-1231.
4. Duchovičová et al. 2017. Stratégie kritického a tvorivého myslenia vo vyučovaní. Dotazník pre učiteľov a cvičných učiteľov. In Brečka, P., Valentová, M. 2017. *Stratégie kritického a tvorivého myslenia v odborových didaktikách výchovných predmetov*. Nitra : PF UKF, p.164-17, ISBN 978-80-558-1227-4.
5. Duchovičová et al. 2018. Stratégie rozvíjania kritického myslenia v pregraduálnej príprave učiteľov, 2018. In. *Studia scientifica facultatis Paedagogicae*. ISSN 1336-2232, vol. 17, n. 1 (2018), p. 73-84.
6. Duchovičová, J., Tomšík, R. 2017. Critical and creative thinking strategies in teaching internal consistency of the research tool. DOI 10.18355/PG.2017.6.2.14. In *Slavonic Pedagogical Studies Journal : the scientific educational journal*. ISSN 1339-9055, Vol. 6, no. 2 (2017), p. 375-394.
7. Duchovičová, J., Tomšík, R. 2018. Managerial Competencies of a Teacher in the Context of Learners' Critical Thinking Development: Exploratory Factor Analysis of a Research Tool and the Results of the Research DOI 10.18421/TEM72-15. In *TEM Journal : Technology, Education, Management, Informatics*. ISSN 2217-8309, vol. 7, n. 2 (2018), p. 335-347.
8. Ennis, R.H. 1985. A logical basis for measuring critical thinking skills. *Educational Leadership*, vol. 43, n.2, pp. 44–48
9. Facione, P. A. 1990. *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction*. Reserch Findings and Recommendations. Newark: APA
10. Fenyvesiová, L., Duchovičová, J., Grofčíková, S., Tomšík, R. 2018. Preferencie stratégií rozvíjajúcich kritické myslenie žiakov a budovanie individuálnej stratégie vyučovania učiteľom In *Inovatívne trendy v odborových didaktikách v kontexte požiadaviek praxe*. Nitra: PF UKF, 2018, ISBN 978-80-558-1277-9. p. 517-522.
11. Halpern, D.F. 1997. *Critical Thinking Across the Curriculum: a Brief Edition of Thought and Knowledge*. Mahwah, NJ, USA : Lawrence Erlbaum Associates.
12. Halpern, D.F. 2014. *Trouth and Knowledge. An Introduction to Critical Thinking*. (5 ed.) New York, London: Taylor & Francis,
13. Horváthová, B., Reid, E., Kováčiková, E., Datko, J. 2017. *Teaching Strategies in the Context of Foreign Language Lessons*. Nitra : PF UKF, 2017, 180 p. ISBN 978-80-558-1225-0.
14. Kosturková, M. 2016. *Kritické myslenie v edukačnej praxi na Slovensku*. Prešov : Rokus, 2016.
15. Limbach, B., Waugh, W. 2010. Developing Higher Level Thinking. In *Journal of Instructional Pedagogies*. 2010, Vol. 3,
16. Pascarella, E., Terenzini, P. 2005. *How college affects students*. San Francisco: Jossey Bass *Preparing Teachers around the World* 2003 [online] Educational Testing Service. [cit. 20.11.2014] Available online: http://www.ets.org/Media/Education_Topics/pdf/prepteach.pdf
17. Paul, R.W. 1992. Critical thinking: What, why, and how? *New Directions for Community Colleges*, 77, p. 3–24.
18. Portík, M. 2001. *Od vnímania tvorivému mysleniu žiakov mladšieho školského veku*. Prešov: PU, 131 p., ISBN 80-8068-032-9.
19. Šutáková, V. 2017. Didaktické kompetencie učiteľa v edukačnej praxi. In *Edukácia*. Vol. 32, N.2, p.303-312,
20. Tomšík, R. 2016. *Štatistika v pedagogickom výskume: Aplikácia komparačných a korelačných metód pomocou programu Microsoft Excel*. Nitra: UKF, 2016. 304 p. ISBN 978-80-558-1027-0.
21. Tomšík, R. 2017. *Kvantitatívny výskum v pedagogických vedách: Úvod do metodológie a štatistické spracovanie*. Nitra: UKF, 2017. 500 p.
22. Watson, G., Glaser, E.M. 2012. *Critical Thinking Appraisal: User-Guide and Technical Manual*. UK, USA : Pearson Education, 96p.
23. Zelina, M. 2011. Funkčná gramotnosť žiakov v kontexte školskej reformy. In *Rozvoj funkčnej gramotnosti v kontexte medzinárodných porovnávacích štúdií PISA a PIRLS : Zborník z medzinárodnej vedeckej konferencie*. Bratislava : ŠPÚ, 2011, ISBN 978-80-8118-057-6, p.15-25.
24. Zelina, M., 1990. *Rozhovor vo výchove, poradenstve a na vyučovaní*. Bratislava : Psychodidaktické a didaktické testy š.p., 1990, 241p., ISBN 80-85179-12-1.

Primary Paper Section: A

Secondary Paper Section: AM