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Teaching Problem Solving Skills For Making Teenagers Thinking Visible

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Abstract: *The skills that pupils need for their career and the growing discrepancy between them and what is being taught/tested in schools is a pressing issue of education in the world, especially the one in the Romanian system of education.*
A good question is how can these teachers develop these skills to teenagers who matter most to the unlikely future of human development? Often, educators are not aware of the type of education needed to promote teenagers who think critically, communicate effectively, collaborate to achieve learning goals, solve problems other than traditional-disciplinary ones that are in contradiction with the achievement of some high scores on tests, which, in most cases, did not incorporate rigorous performance criteria. This article focuses on the results obtained in a 12-month research on the level of competence development to solve problems for students through a modular program.The program "Teenagers today, citizen tomorrow", has developed around the idea of interdisciplinary teaching, focusing on the individual development of the ability to solve common problems of everyday life other than mathematical problems. This is important to form innovating citizens, to develop their concrete thinking, visible for active involvement in the life of the community they live in.
Keywords: *problem solving, visible thinking; experimental module; teenagers needs; active citizen.*

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I. INTRODUCTION

An extremely important issue stemming from this learning approach is the way in which academic content is taught, being to a large extent a process of information transfer based on simple memorization, during which students have little opportunity to ask questions or find out what interests them. Ken Robinson [1] says this curiosity is often undermined "canceled by the school". There is also plenty of evidence from the author that too many students, even of prestigious universities, who do not understand at all or almost all of the conceptual foundations of the sciences or mathematics they have studied for some years. They have learned the facts, but do not understand the ideas behind them.

For various reasons, education institutions are deeply conservative, especially in the case of compulsory education. The education system behaves as the main task of preserving and transferring the capital of knowledge to the next generation, as if they were traditions that we rely on infinitely, Ed. Hirsch [2] inventing a term that defines them as "cultural training" .

Dyer, Gregersen, and Christensen [3], the bestselling author of "The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators" talk about a student's journey to school and creativity. "Look at the four-year-olds, always asking questions and wanting to know how things work. When I'm about six and a half, I do not ask questions because she quickly learns that teachers value more accurate answers than provocative questions. High school students rarely show creativity. Once they grow up and integrate into corporate structures, they no longer have any curiosity in them. 80% of executives spend less than 20% of time formulating new ideas. This, of course, does not work for companies like Apple or Google. "

The school curriculum is over-referenced, with no applications for the student to be guided about the use of the lessons learned. The subjects taught in school are not useful in themselves, but it matters most to know how to apply them to new situations or new problems. In fact, it is important for students to learn the necessary skills, enriching their experience in solving problems whose complexity grows progressively and develops their self-confidence to continuously address the existing challenges. The emphasis should be on discovering learning through the test, failure, interest in the learning process, combining the structure and freedom of expression of students by using the more interdisciplinary content.

Critical thinking and creative thinking are important components of competence to solve problems ., [4]. Creative thinking is a cognitive activity that leads to finding solutions to a new problem. Critical Thinking accompanies creative thinking and is used to evaluate possible solutions. The evaluation will focus on stages to understand and solve problematic situations.

The problem-solving competence is personal and directed, therefore the process of solving the process can be influenced by subjective goals[5]. Individual knowledge and problem-solving skills help the individual determine the difficulties the situation faces. However, this stage is affected by motivational and affective factors such as beliefs, self-confidence, perceptions of others' interests in solving the problem[6].

Visible Thinking is a flexible and systematic concept for a conceptual framework that aims primarily at developing the superior processes of adolescent thinking, in relation to different content, beyond the monodisciplinary content, with links to the real life challenges. As effective methods for the development of visible thinking, Ron Ritchhart[7] recalls the the See-think-wonder method, the Zoom in method, the Think-puzzle-explore method, the Chalk Talk method , the 3-2-1 Bridge method, the Compass Points method, The explanation game method.

II. PROBLEM STATEMENT

This module "Teenagers today, citizen tomorrow" provides examples of ways that learning for visible thinking, in relationship with citizen content. In order to develop adolescents' superior thinking skills, it is necessary to adapt the teaching methods to highlight the potential of each of them to get involved in active life by finding solutions to solving everyday problems. As this desideratum is not a simple one, the use of visible thinking is important. The Think-puzzle-explore method, the Chalk Talk method , the 3-2-1 Bridge method, the Compass Points method, The explanation game method have been used in the context of module activities to develop the superior thinking skills of adolescents. In a world where functional illiteracy is a major problem of all education systems in the world, the activities of this module can be seen as a good example that can be adapted to the needs of today's development society.

III. PURPOSE OF THE STUDY

The aim of the study is to demonstrate that routines of visible thinking such as Think-puzzle-explore, Chalk Talk, 3-2-1 Bridge, Compass Points, The explanation game can be a good context to develop skills for the 21 century,like problem solving skills, especially in school system.

In order to achieve our goal we have used the following research hypotheses:

The hypothesis 1: Subjects from the experimental group 1, who will follow the"Teenager s today, citizen tomorrow" program activities, will have statistically higher results at the practical problem solving test than the subjects in the control group.

The hypothesis 2: Subjects from the experimental group 1 who will follow the activities within the framework of the "Teenagers today, citizen tomorrow program will have statistically significantly higher results in the posttest than the pretest test.

The hypothesis 3: Subjects from the pedagogical group who will follow the activities within the "Teenagers today, citizen tomorrow" program will have statistically significant results in the posttest test rather than the pretest test.

IV. METHODOLOGY

The research tool used for the initial data before the adolescents' participation in the module activities and after participating in the module activities was Problem solving inventory (PSI)–Heppner and Peterson P.S.I., organized around 5 sections: actively participates in teamwork, seeks and distributes information, communicates with teammates, thinks critically and creatively, team processes.

The experimental effect is measured by comparing the post observations with those prior to the experimental change. This type of quasi-experimental design is similar to real intra-group pre-posttest experiments. However, there are two important differences. The disadvantage of this design is that the maturation effect may occur, other long-term changes may occur in the environment. In this case, the dependent variable changes over time regardless of the experimental change. Detecting these changes can be done by conducting as many pretest and posttest investigations as possible. It is very important that the dependent variable be consistent over time and relatively isolated from the existence of other experimental factors.

For the analysis of the quantitative data obtained in the experimental research, the SPSS (Statistical Package for Social Sciences) version 20 was used. The statistical hypothesis testing was performed using the Kolmogorov-Smirnov or Shapiro-Wilk test, the Mann-Whitney U test, the Wilcoxon test, Anova Multiple Measures, post-hoc tests, t test for independent samples, ANOVA multiple measures, Mauchly's Test of Sphericity, Bonferonni post hoc tests.

In our study we included a number of 85 teenagers from highschools, 28 students from an economical high school-experimental group and 28 pupils- control group,29 subjects from pedagogical highschool all enrolled in high school, grade XI. The Economic Experimental Group participated in 10 activities, the pedagogical group participated in 10 activities, for about 1 hour/per activity, all belonging to the experimental module perspectives. All groups of students (economic experimental group, economic control group,

pedagogical group) were tested before and after the experimental stage, describing the results obtained by referring to the related chapter. In terms of the subject genes, in the experimental group 16 subjects were male and 12 were female, in the economic control group 15 subjects were male and 13 females, in the pedagogical group were 27 female and 1 male. It was not possible to compare the results of the research with the gender variable as the subjects of the research were, in a first stage, tempted to declare distorted statements. To eliminate this risk and to obtain data as close as possible to school reality, it was decided to fill in anonymity way.

In order to establish the internal consistency and to confirm the factors, we analysed the results of the whole panel . Approximately 45 minutes was needed to complete the test.. Cronbach's Alpha for internal consistency reliability was used to check and assess the consistency of the results across items within each part of the test. Internal consistency coefficient is common in educational studies and there is some given criteria to interpret reliability and validity coefficients.

We did not assess the participants who did not present creditability to the examiner or those who were not present in the second session. The participants were examined individually or in small groups, their anonymity being preserved.

V. FINDINGS

In order to initiate any statistical test with respect to assumptions 1, 2 and 3, we need to verify the normal distribution of data. So we have 2 results (pretest-posttest) for each of the groups: the experimental group, the control group, the pedagogical group. For this we apply two steps: one graphic and one statistical one. The graph is present in the histograms of each working group, and the statistical result is based on the Shapiro Wilk and Kolmogorov Smirnov test (Table1, Table2, Table3).

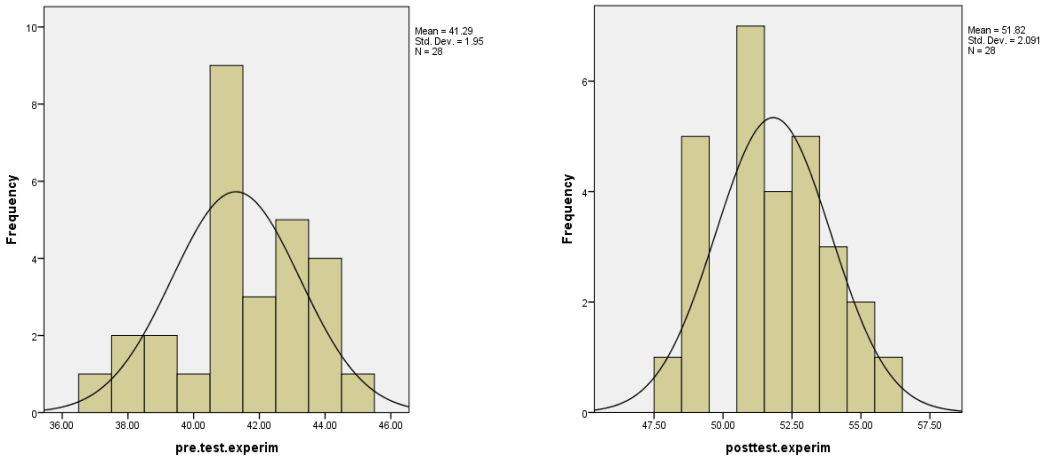

Table 1-Pretest experimental group and posttest experimental group

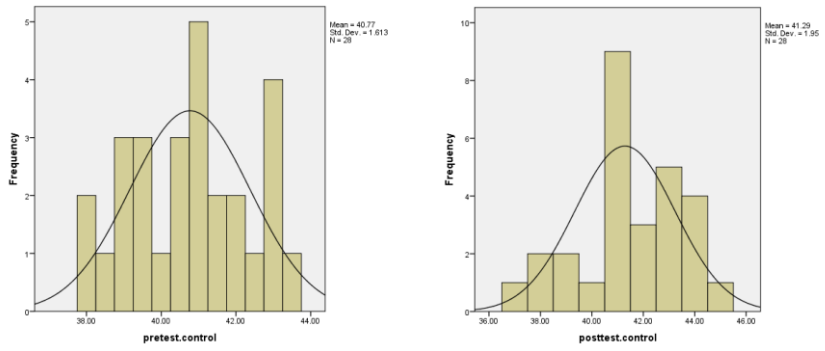

Table 2-Pretest control group and posttest control group

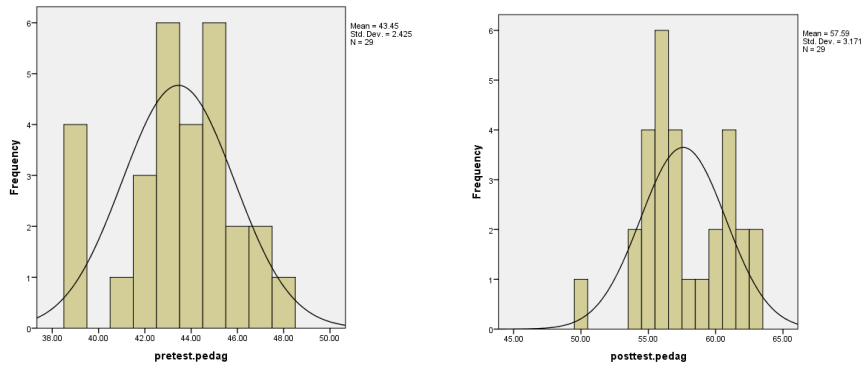

Table 3-Pretest pedagogical group and posttest pedagogical group

From the Table4 Tests of Normality problem solving , we have presented the Kolmogorov-Smirnov and Shapiro-Wilk test results. For the variable to be normally distributed in the population, they must be statistically insignificant. The result of the first test, Kolmogorov Smirnov, for the experimental group, pretest, is 0.132, p = 0.200 and the result for Shapiro Wilk = 0.958, p = 0.310. For the same group, after the intervention, the results obtained in the first test were 0.133, with p = 0.200, Shapiro Wilk = 0.955, p = 0.262. For the control group, the pretest time has the K-S = 0.106, p = 0.200, S-W = 0.955, p = 0.265 and for the posttest test result K-S = 0.132, p = 0.200, S-W = 0.958, p = 0.310. For the pedagogical group, the result for the KS = 0.140 test, p = 0.172, SW = 0.943, p = 0.134 and for the post-intervention the results obtained in the test KS = 0.155, p = 0.083, and the SW = 0180. As all the results obtained for each group, both in the pre-intervention and post-intervention phase, both in the Kolmogorov-Smirnov and Shapiro-Wilk tests are statistically insignificant, it follows that the variables are normally distributed.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pre.test.experim	.132	28	.200*	.958	28	.310
posttest.experim	.133	28	.200*	.955	28	.262
pretest.control	.106	28	.200*	.955	28	.265
posttest.control	.132	28	.200*	.958	28	.310
pretest.pedag	.140	28	.172	.943	28	.134
posttest.pedag	.155	28	.083	.948	28	.180

Table4 Tests of Normality problem solving

The Table5 ANOVA Practical Problem Solving-Descriptive presents the standard averages and deviations to the practical.problem.solving variable for each of the workgroups at both pretest and posttest. So we have the average 41.2857 for the experimental group pretest, average 51.8214 for the experimental posttest group, for the control group we have at the time the mediatest 40.7679 and the posttest media 41.2857, for the pretest media group pretest 43.4643 and after the media intervention 57.6071. As can be seen from the intervening moments, for all three working groups, they have the highest averages, of course significant ones being those that benefited from the activities of the "Students today, citizen tomorrow"program, respectively the experimental group and the pedagogical group.

	Mean	Std. Deviation	N
pre.test.experim	41.2857	1.95044	28
posttest.experim	51.8214	2.09149	28
pretest.control	40.7679	1.61292	28
posttest.control	41.2857	1.95044	28
pretest.pedag	43.4643	2.46805	28
posttest.pedag	57.6071	3.22708	28

Table5 ANOVA Practical Problem Solving-Descriptive

The Table 6 Mauchly's Test of Sphericity probability examines the sphericity condition, one of the conditions for applying the Anova repeat measurement test. Since the result of the Mauchly W = 0.770 test is statistically insignificant, we have fulfilled the condition of sphericity.

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
practic.problem.solving	.770	3.576	14	.073	.667	.772	.200

Table 6 Mauchly's Test of Sphericity probability

The Table7 Tests of In-Subjects Effects is the main table in the output, containing the results of the general F tests. As F = 306.801, p = 0.00, being significant, it results that there are significant differences between the 6 conditions in terms of development problem-solving skills. In order to find out which of these conditions are differences, we will apply post-hoc tests, namely Bonferonni.

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
practic.problem.solving	Sphericity Assumed	6912.079	5	1382.416	306.801	.000
	Greenhouse-Geisser	6912.079	3.334	2073.058	306.801	.000
	Huynh-Feldt	6912.079	3.860	1790.518	306.801	.000
	Lower-bound	6912.079	1.000	6912.079	306.801	.000
Error(practic.problem.solving)	Sphericity Assumed	608.296	135	4.506		
	Greenhouse-Geisser	608.296	90.025	6.757		
	Huynh-Feldt	608.296	104.230	5.836		
	Lower-bound	608.296	27.000	22.529		

Table7 Tests of In-Subjects Effects

The Table8 The Tests of Within-Subjects Contrasts test-contrast presents the results of the contrast tests, these being significant between pretest and posttest for the experimental group (F = 650.699, p = 0.000), and the control group (F = 359.670, p = 0.000), and the test group. Of course there are other differences between the other moments between groups, but the selection is made according to the degree of interest of some data shown in the research). Hence, the assumptions are confirmed.

Source	practic.problem.solving		Type III Sum of Squares	df	Mean Square	F	Sig.
practic. problem.solving	pretest.grup.experim.	vs. posttest.grup.experim	3108.036	1	3108.036	650.699	.000
	posttest grup experim.	vs. pretest.grup.control	3421.080	1	3421.080	609.016	.000
	pretest.grup.control	vs. posttest.grup.control	7.509	1	7.509	1.094	.305
	posttest.grup.controlol	vs. pretest.grup.pedag	132.893	1	132.893	12.856	.001
	pretest.grup.predag.	vs. posttest.grup.pedag.	5600.571	1	5600.571	359.670	.000
Error(practic.problem. solving)	pretest.grup.experm	vs. posttest.grup.experim	128.964	27	4.776		
	posttest.grup.experim	vs. pretest.grup.control	151.670	27	5.617		
	pretest.grup.control	vs. posttest.grup.control	185.241	27	6.861		
	posttest.grup.control	vs. prestest.grup.pedag.	279.107	27	10.337		
	pretest.grup.pedag	vs. posttest.grup.pedag	420.429	27	15.571		

Table8 The Tests of Within-Subjects Contrasts test-contrast

The results of Bonferonni post hoc tests are presented in the Pairwise Comparisons practice problem solving table 8. We notice that there are significant differences between pretest and posttest experimental group Bonferonni t = 25.51, p = 0.000, between pretest experimental group and pretest test group Bonferonni t = 0.0520, p = 0.000, between experiment group pretest and post test group pedagogical Bonferonni t = 26.495, p = 0.000, between posttest test experiment group and pretest test group Bonferonni t = 26.674, p = 0.000, between posttest test group experiment and posttest test group Bonferonnit = 25.51, p = experimental group and pedagogical pretest group Bonferonni = 11.73, p = 0.000, between posttest experimental group and pedagogical test group Bonferonni = 8.32, p = 0.000, between condition pretest control group and posttest test group Bonferonni = 24.67, p = pretest control group and posttest pedagogical group Bonferonni = 27.24, p = 0.000, , between pretest group pretest and post test experimental group Bonferonni = 11.73, p = 0.000, between pedagogical pretest and pedagogical pretest group Bonferonni = 18.958, p = Experimental group Bonferonni = 26.495, p = 0.000, between the pedagogical posttest group and posttest experimental group Bonferonni = 8.325,

p = 0.000, between posttest pedagogical group and pretest test group Bonferonni = 27.274, p = 0.000, between posttest group and posttest group control Bonferonni t = 26.495, p = 0.000, between posttest pedagogical group and pretest group Bonferonni t = 18.958, p = 0.000. There are no significant differences between the control group prestest condition and the posttest group Bonferonnit = 1.04, p = 1000.

As can be seen in Table 9, there are significant differences between the three groups, both in pre-intervention and after intervention. It can also be emphasized that the experimental group, the control group and the pedagogical group at the time of pretest have developed the competence to solve almost equal problems, but in the posttest phase the results no longer show this, but both the posttest of the experimental group and the pedagogical values are much higher than the pretest, which shows us that the activities carried out within the module"Teenagers today, citizen tomorrow" had the expected results, especially in the case of the pedagogical group.

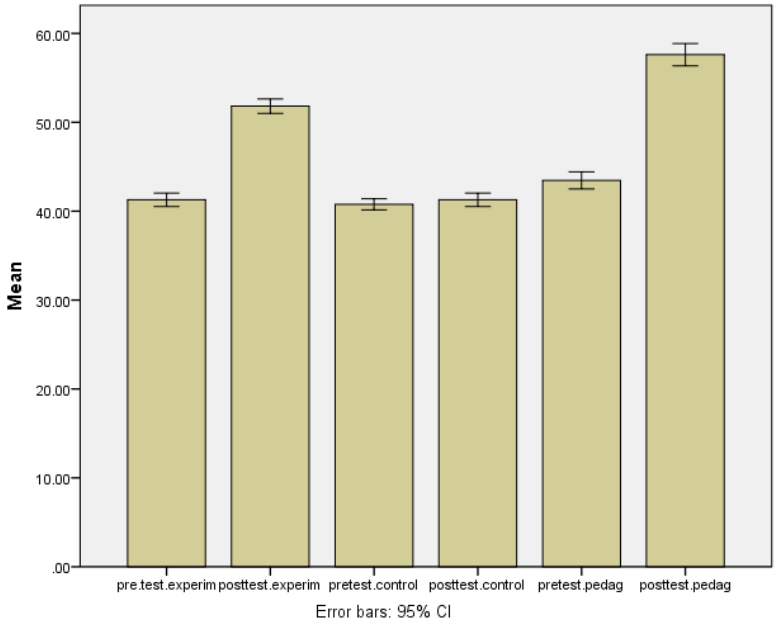

Table 9 Differences between groups (pretest-posttest experimental group, pretest-posttest control group, pretest-posttest pedagogical group).

Knowing that Bonferonni post hoc tests revealed that there are significant differences between pretest and posttest conditions for working groups, it is necessary to calculate the magnitude of the effect. We can calculate the effect size . The results obtained for pretest and posttest experimental sample problem.solving experimental group are as followsr = √ (s) 650.699 / (650.699 + 27), that is, r = 0.96

The results obtained for the pedagogical group between the moments before and after the intervention are r = √ (s) 359,670 / (359,670 + 27), r = 0,93

To verify the effect of the activities on the problem solving skills development, we applied the ANOVA method with repeated measurements. The results indicate that the passage of such a module had a strong effect on the development of practical problem-solving skills in the case of the experimental group, F = 650.699, p <0.001, the effect size r = 0.96, in the pedagogical group, F = 1359.670, p <0.001, the magnitude of the effect r = 0.93, but not a significant development of these skills in the control group (pretest and posttest). If we compare to the results obtained by the control group in the pretest and posttest, F = 1.094, p = 0.305, then we realize that the module has had strong effects on the development of practical problem-solving skills for the participants.

VI. CONCLUSION

As can be deduced from the research results, all three hypotheses have been confirmed, even though the effect of the visible thinking strategies was not the same within the pedagogical experimental group or the economic experimental group. It is important to note that the development and use of these visible thinking routines can be tailored to the individual needs or work potential of the respondents. It can start with lighter activities so that more complex activities can be used as a rising pace. It is very important to mention that teacher training towards visible thinking strategies is a weak point of Romanian education. That's why investing in teacher training is important in organizing these activities for schoolchildren. In this research, the researcher has been trained to develop problem-solving skills and supported with examples of age-level activities.

The most important recommendation relates to the quality of teacher training, the first step towards quality education. Of course, it is easy to understand that the introduction of these categories of modules into the Romanian school curricula should first be tested in pilot programs, then to train teachers to develop competence to solve problems.The teacher training is essential to the development of transversal competencies to create the context of developing practical activities for their students.

Thinking routines form , like an Visible Thinking program [8] can be a good point to begin the motivation of teenagers to get involved in the development of society, by using creative potential and by developing self-confidence because his "goal oriented in that it targets specific types of thinking, gets used over and over again in the classroom,consists of only a few steps, is easy to learn and teach,is easy to support when students are engaged in the routine,can be used across a variety of context,can be used by the group or by the individual".

References

[1]. Azzam, A. M. (2009). *Why creativity now?* A conversation with Sir Ken Robinson. Teaching for the 21st Century, 67, 22-26.
[2]. Hirsch, E.D. Cultural Literacy: *What Every American Needs to Know*(New York: Vintage Books. p. xiv–xv, xvii, 20–21, xiii, 115, 21, 23–2, 1998).
[3]. Dyer, J.H., Gregersen,H.B.,Christensen, C.M, *The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators* (Harvard Business Review Press, Boston, 2011).
[4]. OECDC, 2012 apud Mayer R. E., *Thinking, Problem solving*, Cognition (New York, NY: Freeman, 1992).
[5]. OECD, 2012 apud. Mayer, R. E. & Wittrock, M. C. (2006) Problem Solving. In P. A. Alexander and P. .Winne (Eds.), *Handbook of Educational Psychology* (2nd ed.) (Mahwah, NJ: Lawrence Erlbaum Associates, 2006)
[6]. Mayer, R. E. Cognitive, metacognitive, and motivational aspects of problem solving. *Instructional Science* 26, 49–63, 1998.
[7]. Ritchhart, Ron, et al. *Making thinking visible* (San-Francisco: Jossey-Bass, 2011).
[8]. Cultures of Thinking Project at *Project Zero*, Harvard Graduate School of Education, accessed on July 3, 2018 http://www.pz.harvard.edu/projects/visible-thinking

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