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CREATIVITY DEVELOPMENT HOW? TRADITIONAL METHODS OR INFORMATION?

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Abstract:
One of the most important components of the process of teaching and learning is studying and developing students'creativity. The goal of the research is to compare the development of creativity of 5-8 grade students (10-15 years old) in the traditional way and by means of information technology. The authors' method is to Following the development of students taking part in the research (altogether n=300) aided by traditional methods (n=150 students) and aided by information technology methods (n=150) for foury ears within the framework of a longitudinal research. Another method is the comparison of two different development methods and one control group (n = 150). Those taking part in the traditional development programme used fun task sheets on paper, while the IT based development programme used digital facilites. The changes were nearly identical in both groups regarding the five dimensions (self-advocacy, dominance, curiosity – interest, genuineness – creativity, energy). The information technology method resulted bigger changes in four areas (nonconformity, complexity, impatience, playfulness) and the traditional method in two areas (risk-taking, perseverance). Both methods were proved to be efficient in development of creativity, but components of creativity changed in different ways.

Keywords: creativity, skills development, traditional methods

1. Introduction

The present essay compares the results of two, comprehensive and longitudinal (students in grades 5-8, between 2006-2010) studies of development of creativity. One of the studies was conducted withtraditional development facilities (paper-based, playful) alongside the development of learning strategies whereas the other was based on information technology alongside with the development of cognitive skills.

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According to Balogh and Co. (1994) the components of creativity may be grouped in four: cognitive factors (problem-solving, association, analogies, transformations, divergent thinking, representation) affective factors (motivational effects, emotional needs, personality traits), psycho-motoric factors (consciousness, perceptivity, individual growth, bodily/brain functions), social components (interpersonal relationships, communication,socialization, norms, gratification)

According to Tóth (2000), the characteristics of a creative child (curiosity, independence, flexibility, endurance, originality, wide range of interests, sense of humour, inquisitiveness, high level of energy, sensitivity, impatience and vivid fantasy) are the ones that indicate the complexity and elaborateness of creativity.

J. P. Guilford (1950, 1967) described creativity as a part of intelligence, which is a cognitive process and is connected to divergent thinking, transformation and re-definition. (Gyarmathy, 2006, pp. 53).

Guilford indicated the essence of creativity in divergent thinking and described it accordingly as general sensitivity to problems, fluency, flexibility, originality, redefinition and elaboration (Tóth, 2000, pp.234.).

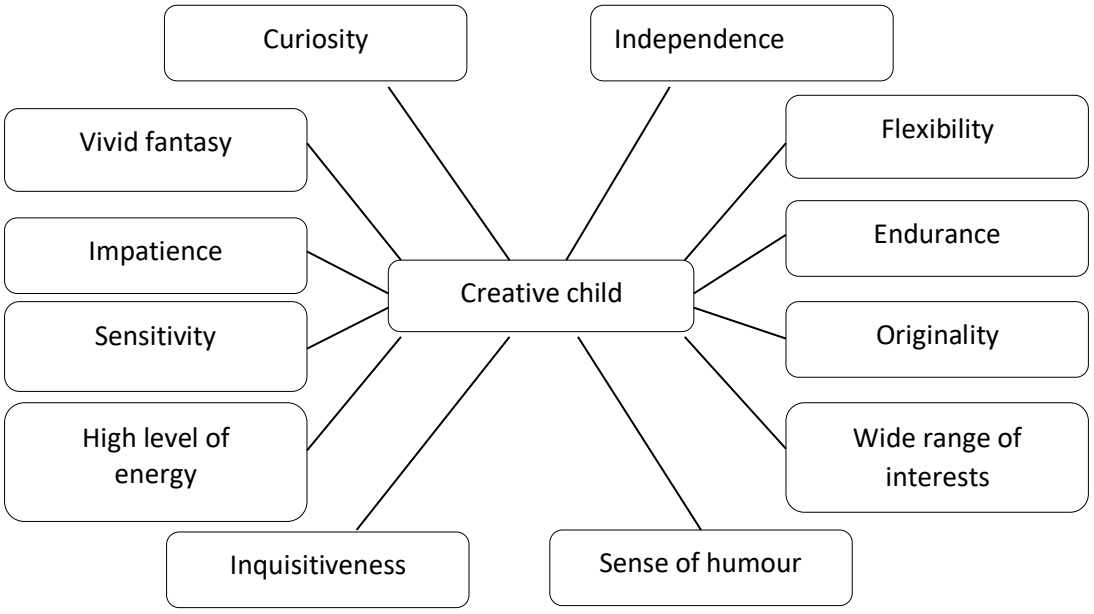

Figure 1: The characteristics of the creative child (Tóth, 2000 based on)

Figure 1 presents the 12 characteristics of the creative child which indicate thecomplexity and elaborateness of creativity. The development of the personality of the creative child depends on many factors, such as family, teachers, peers and environment.

One of the most important factors is the influence of the family and its impact on socialization. The security and background provided by the parents assist these. The motivating effect of the family ensures the proper autonomy, independence for the child and the development of their personality. Teachers play and prominent role in the establishment and development of creativity because their emphatic and understanding attitude is very important. It might occur – which the teacher needs to pay attention to -

that the behaviour of the creative student may be nonconform or they might disturb the teaching process with their behavioural problems. When studying the influence of peers, it was concluded that peers accept and tolerate their creative peer with difficulty. With regard to creativity, there is no difference in terms of socio-cultural background, but its development is encouraged by the more supporting environment (Torrance, 1963; Landau, 1974; Arasteh és Arasteh, 1976; Amabile, 1983; Gyarmathy, 2006).

1.2 Creativity with age

Creativity changes with age andits growth might be predicted until the age of 40, after that it gradually decreases with time. Both in artistic and scientific fields, productivity is connected to age (Dávid, 2000). At the same time, individual deviations may be observed as in the case of Thomas Mann who published more works in his 70s (Sternberg and Lubart, im.,1991.).

According to Arieti (1976), the young (between 20-30) create intensively and spontaneously whereas the members of the older generations (40 or over) create something new in several steps (Simonton, 1975).

1.3 Connection between creativity and school performance

Researchers of the American Institute IPAR (quoted in Moya Tyson (1972)) studied the connection between creativity and intelligence. They concluded that a high level of creativity does not directly result in an IQ over 120. Thus, creativity requires a suitable level of intelligence but after attaining a certain level, the factors of personality and motivation become more important (Tyson, 1972).

In the view of Mc Nemar és Guilford, creativity may be more varied in the case of a high intelligence while in the case of a low intelligence, creativity may be also less varied, with less deviation (Kálmánchey, 1978., quoted in Dávid, 2000).

The development of creativity has interior (self-actualization, self-knowledge, tolerance, abilityof bearance) and exterior (created by the educational environment: encouragement of independent activity, playfulness, spontaneity, search for ideas, democratic atmosphere) components as well. There are several techniques to develop creativity, such as the application of problem-solving techniques, brainstorming, synectics, (the use of analogies), playful activities that encourage curiosity, tasks that foster independence, etc. (Inántsy-Pap and Juhász, 2011).

2. Results of the study

2.1 Objectives

The purpose of this study is to compare the results of developing creativity by traditional and information technologyfacilities. Within the framework of a longitudinal study, the results of trackingof the development of students (altogether n=300) developed by traditional (n=150) and information technology (n=150) facilities over four academic years were compared. The development took place in the case of the students participating in the development by traditional facilities (see later: traditional) in a paper-based, playful

form whereas in the case of the information technology -based development (see later: information technology) it was realized with IT facilities.

2.2 Sample

The study sample consisted of 450 students (224 male, 226 female) in the senior section of elementary school. In the case of the two methods (traditional and information technology development) as far as the study sample is concerned, nearly the same number of students participated in the development: 150 students in the traditional group, 150 in the information technology group and the control group, respectively.At the time of the input measurement, the students were in the 5th grade (aged 10-11) while at the end of the study they were in the 8th grade (aged 14-15).

The students came from different schools therefore sampling might be considered wide range but not representative. In a PTA meeting, parents were briefed about the study and subsequently we asked for their written permission for their child to be able to participate in the study. Data relating tothe students were encrypted and treated confidentially in adherence with the principles of data protection and individual rights. This age group was chosen because students in senior elementary school already possess the information technology skills that are necessary to use information technology gadgets and facilities.

2.3 Methodology

During the course of the four-year–long longitudinal study, data were recorded on five occasions in all three groups. The first test was conducted in September of grade 5, the further four tests were carried out in May of grades 5, 6, 7, and 8.

In the traditional group, the learning motivation and orientation, style, attitude and creativity of the students were measured. In the information technology group, attention, memory, thinking, learning motivation and orientation, creativity, attitude to information technology and the intelligence of the students were tested.The students in the study were continually observed by their teachers. The opportunity for consultation with the teachers and the students was continual during the course of the study.

In the case of the traditional method, development took place by differentiated development. Its programme package in relation to general subjects (mathematics, Hungarian, history) was developed by the subject teachers and us. The development took place in one lesson per week(by teachers of the school) in accordance with the lesson plans provided by us. During the development, playful, paper-based tools were applied. In the case of the information technology group, development was connected to development blocks of subjects: mathematics, history, Hungarian, natural science (in grades 7 and 8, geography, biology, physics). The complex exercisesapplied during the development were compiled by partly with the help of us and partly that of the subject teachers (mathematics, history, Hungarian, natural science). The development took place in an IT room, in one extra lesson in weekly recurrence.In the schools involved in the study, students participated in differentiated development based on the input test in the study group.

Learning arrangement, in some cases, differentiation, was carried out based on the results. During differentiation, alongside the teacher's explanation and independent learning, games, group work, cooperative learning, programmed learning assisted by computers and, in some cases, the education package were applied. The formation of the groups during groupwork was in all cases determined by the content objective of differentiation, thus the students worked in heterogenous or homogenous groups based on their abilities and pace of progress. Computer-based games of development also have an important motivational role, they were usually used at the beginning of the lessons, before complex exercises.The complex exercises improved attention, memory, thinking and creativity with the help of an information technology facility. During programmed education, the application of multimedia, interactive tools, educational and user's packages as well as the versatile use of the internet assisted development.

In the case of the control group, no development took place within the framework of extra lessons.

2.3.1 Tools

There are several methods to measure creativity: the creativity test by Torrance (Torrance, 1966, 1974); the creativity spare time activity questionnaire (Tóth, 1996); the creativity estimation scale (TCES) by Tóth (Tóth, 2004; Tóth and Király, 2006). In order to examine the characteristics of creativity, we chose the creativity estimation scale (TCES) by Toth (see Appendix 1)

The reliability indicators of the test can be found in the article 'A new method to define creativity: the creativity estimation scale (TCES) by Toth' by László Tóth, Zoltán Király (2006): (Magyar Pedagógia, 106. (4), 292–295).

The questionnaire examines the creative characteristics of the students' personalities in 12 dimensions. We get a broader picture about the components of students' creativity based on the answers given to 72 questions.

Dimensions: complexity preference (COM), playfulness (PLA) curiosity (CUR), impatience (IMP) cognitive independence (COG), assertiveness (ASE), originality (ORI), nonconformity (NON), energy (VIT), dominance (DOM), endurance (END) and risk-taking (RIS).The meaning of the dimensions is as follows:

- Complexity preference (COM): Creative people attempt to absorb novel, unusual stimuli. They are not usually satisfied with simple games or problems. In most cases, they are interested in complex ones which they usually interpret as a challenge, a problem to be solved.
- Curiosity (CUR): Curiosity, the desire for new information is one of the significant qualities of creativity, the manifestation of the exploratory motive which is fundamentally present in humans. It is also one of the fundamental starting points of creative ideas.
- Cognitive independence (COG): If you take the road less travelled, they very often have to abandon the assistance of external clues. Furthermore, following external clues may be a disadvantage, as it might hinder the appearance of creative thoughts and novel solutions.

- Originality (ORI): Originality is the oldest identified and most recognizable quality of creativity, the ability of stepping away from conventions. Its essence is that the individual finds a new solution in a given context or problem situation which solves the situation in an adequate way and relatively more effectively and which others have not even thought of. Originality is always socially embedded, and its starting point can be interpreted in relation to it.
- Energy (ENE): The preparation and invention of a novel solution does not come about easily. Therefore, a kind of extra motivation is also required for it to be able to deal with the arising cognitive (and social) hinderances that may come up in the meantime more easily. Energy is prominent and positivepattern of behaviour, thus it can inspire an imitation pattern in others.
- Endurance (END): The episodes of creative problem - solving and ones leaping away from a given context come about in the individual only from time to time. Endurance is the ability that enables the problem-solving individual to remain on the grounds of reality but also in the vicinity of the problem.
- Playfulness (PLA): A partial distance from theproblem, the reconstruction of situations from a new point of view are enabled by the playful attitude and behaviour. Endurance with playfulness ensures the continuity of the creative problem-solving process which will help to lead the individual to a phase of development.
- Impatience (IMP): Creative individuals are characterised by impatience which is a manifestation of intrinsic motivation.This personality trait is mostly characteristic after the appearance of the idea and during the phase of development.
- Assertiveness (ASE): The birth of creative thoughts does not necessarily lead to a creative performance as the individual needs to break through the social barrier that surrounds them (see:conformity) In order todo that, the individual has to own and represent their own but unusual idea or point of view (in compliance with social expectations).
- Nonconformity (NON): Conform behaviour enables the individual to be a recognized member of their social environment. That is why society rewards conformity and at the same time hinders the appearance of unusual, new things (ideas, behaviour, etc.) .
- Dominance (DOM): Making the others accept a novel idea usually requires - depending on the pressure of conformity on the part of the environment - extra effort. The pursuit of dominance is not a substantial part of creativity, but it only serves the social legitimation of the creative product.
- Risk-taking (RIS): Acknowledgingall novelties or new ideas inherently include the possibility of failure as well. From the point of view of the individual, this means balancing between two opposing motives (self-actualization and adherence to social norms) That means that the individual always has to take a certain amount of risk during the process of creative problem - solving. (Tóth and Király, 2006, 292–295. o.).

2.4 Results

Multi-aspect variance analysis (VA) was applied to examine the effect of the consecutive five measurements, the belonging to the traditional, information technology or the control group and that of sex on the creativity scores. During the variance analysis, the dependent variants were the characteristics of creativity while the independent ones were the measurements (five measurements in terms of time) and the method (traditional, information technology and control)

A variance analysis (Type III) was conducted: dependent variable: nonconformity, independent variables: group, time (this latter one is a factor within the individual). Time proved to be significant ($F=35.004$, $p<0.001$, eta square=0.073) and the time and method interaction ($F=25.443$, $p<0.001$, eta square= 0.102).

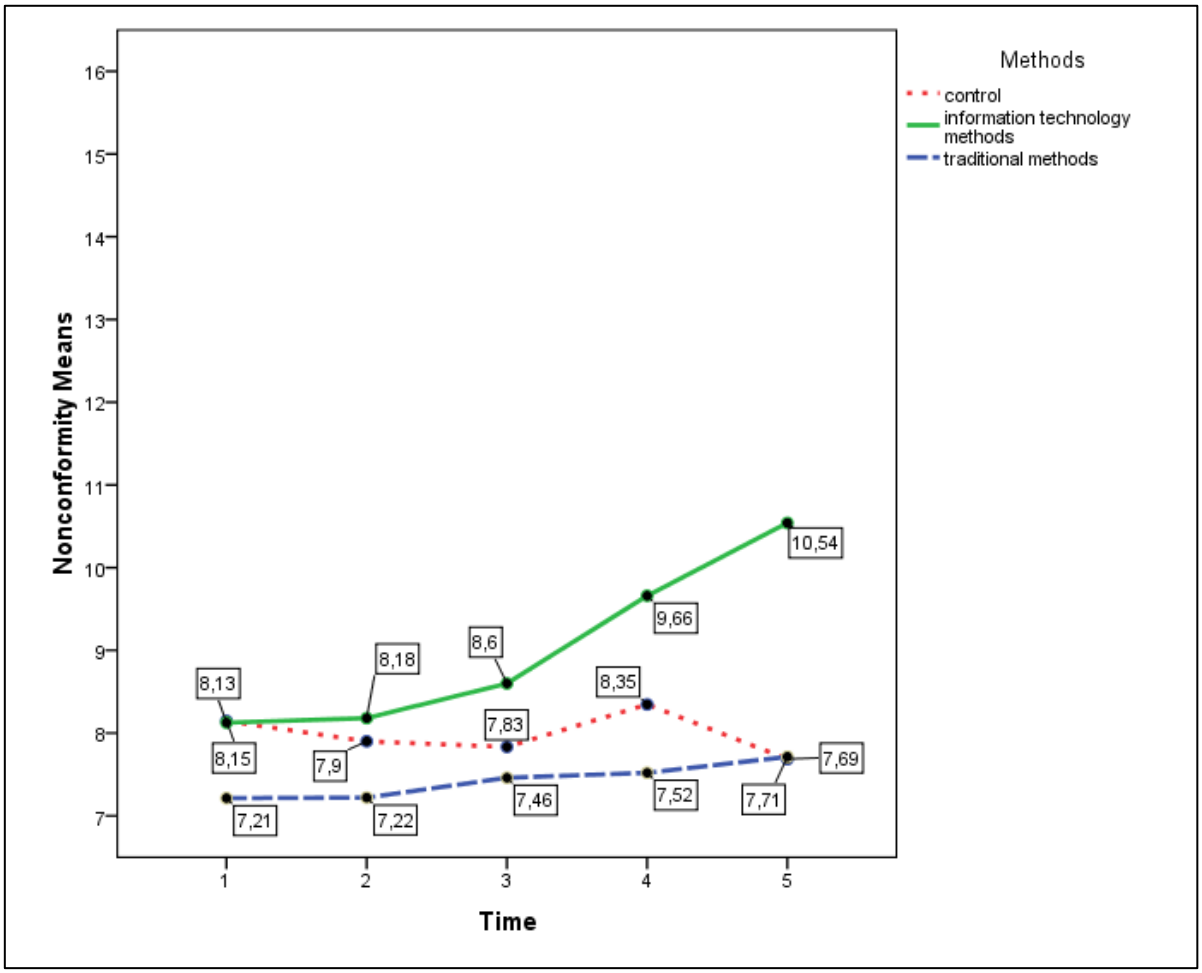

Figure 2: The change of the averages of nonconformity in the traditional, information technology and control group

The change of the averages of nonconformity can be observed in Figure 2 in the traditional, information technology group in terms of time (number of measurements). It may be observed that the two graphs differ the most at the time of the third measurement, in the case of the information technology group the line is steeper: agreater change has taken place in the nonconformity of the students.

A variance analysis (Type III) was conducted: dependent variable: complexity-preference, independent variables: group, time (this latter one is a factor within the individual)

Time proved to be significant (F=102.24, p<0.001, eta square=0.186) and the time and method interaction (F=37.868, p<0.001, eta square= 0.145).

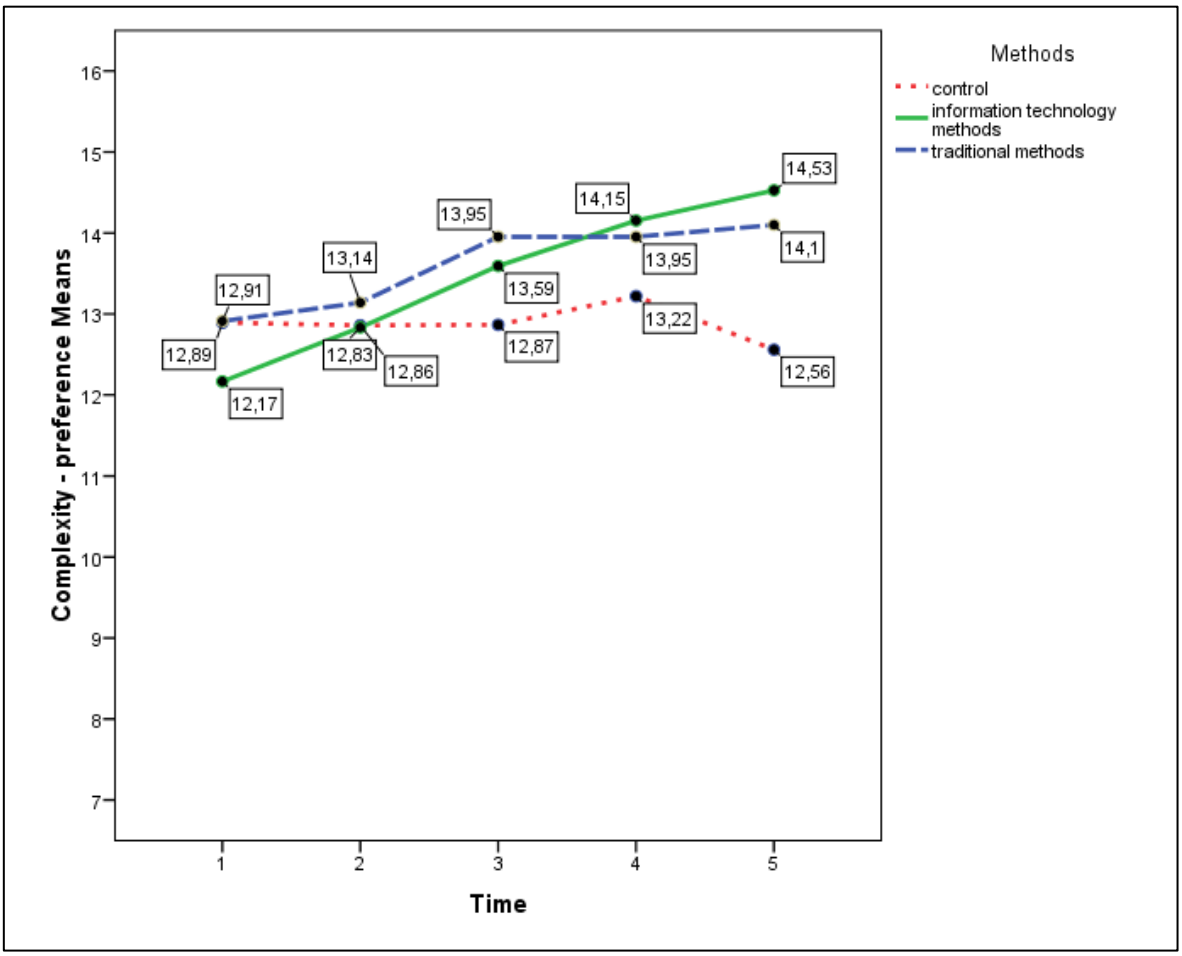

Figure 3: The change of the averages of complexity and preference in the traditional, information technology and control group

The change of the averages of complexity can be observed in Figure 3 in the traditional, information technology group in terms of time (number of measurements). An intensive change may be observed in the case of the traditional group between the second and the third measurement after which the results of the students stagnate. In the case of the information technology group the line is continuously rising, its steepness is nearly identical until the fourth measurement, between the fourth and the fifth one it slightly decreases. The change of the control group is not significant, it decreases slightly by the end of the fifth measurement.

A variance analysis (Type III) was conducted: dependent variable: risk-taking, independent variables: group, time (this latter one is a factor within the individual)

Time proved to be significant (F=35.198), p<0.001, eta square = 0.073) and the time x method interaction (F=13.441 p<0.001, eta square =0.057).

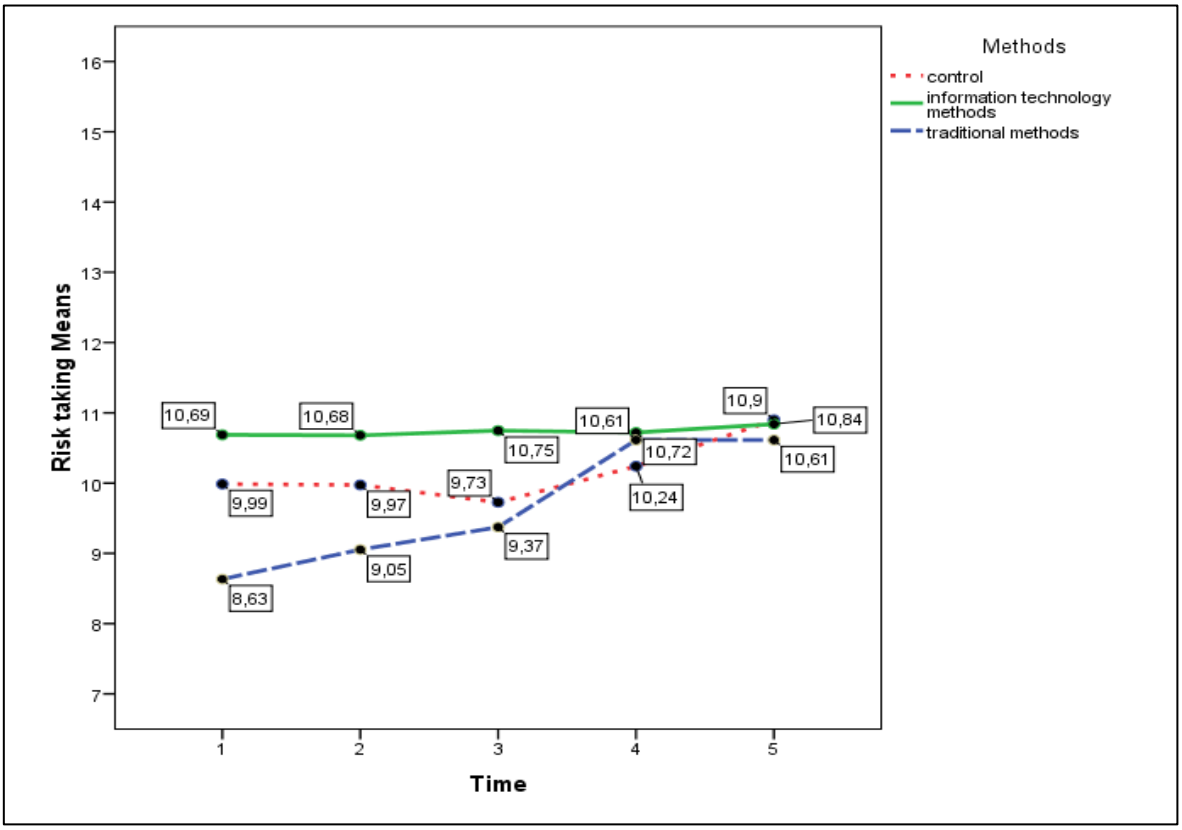

Figure 4: The change of the averages of risk taking in the information technology and control group

The change of the averages of risk taking in Figure 4 in the case of the traditional group it slightly and steadily increases between the first and the third measurements. Between the third and the fourth one an intensive rise can be observed. Then, between the fourth and the fifth, it stagnates.In the case of the information technology group the line is practically flat between the first and the fourth measurement, then a slight increase may be observed between the forth and the fifth ones. In the case of the control group, it is almost unchanged until the third measurement whereas there is a more intensive growth between the third and the fourth one.

A variance analysis (Type III) was conducted: dependent variable: independent thinking, independent variables: group, time (this latter one is a factor within the individual)

Time proved to be significant ($F=104.308$), $p<0.001$, eta square = 0.189) and the time x method interaction ($F=26.364$, $p<0.001$, eta square= 0.106).

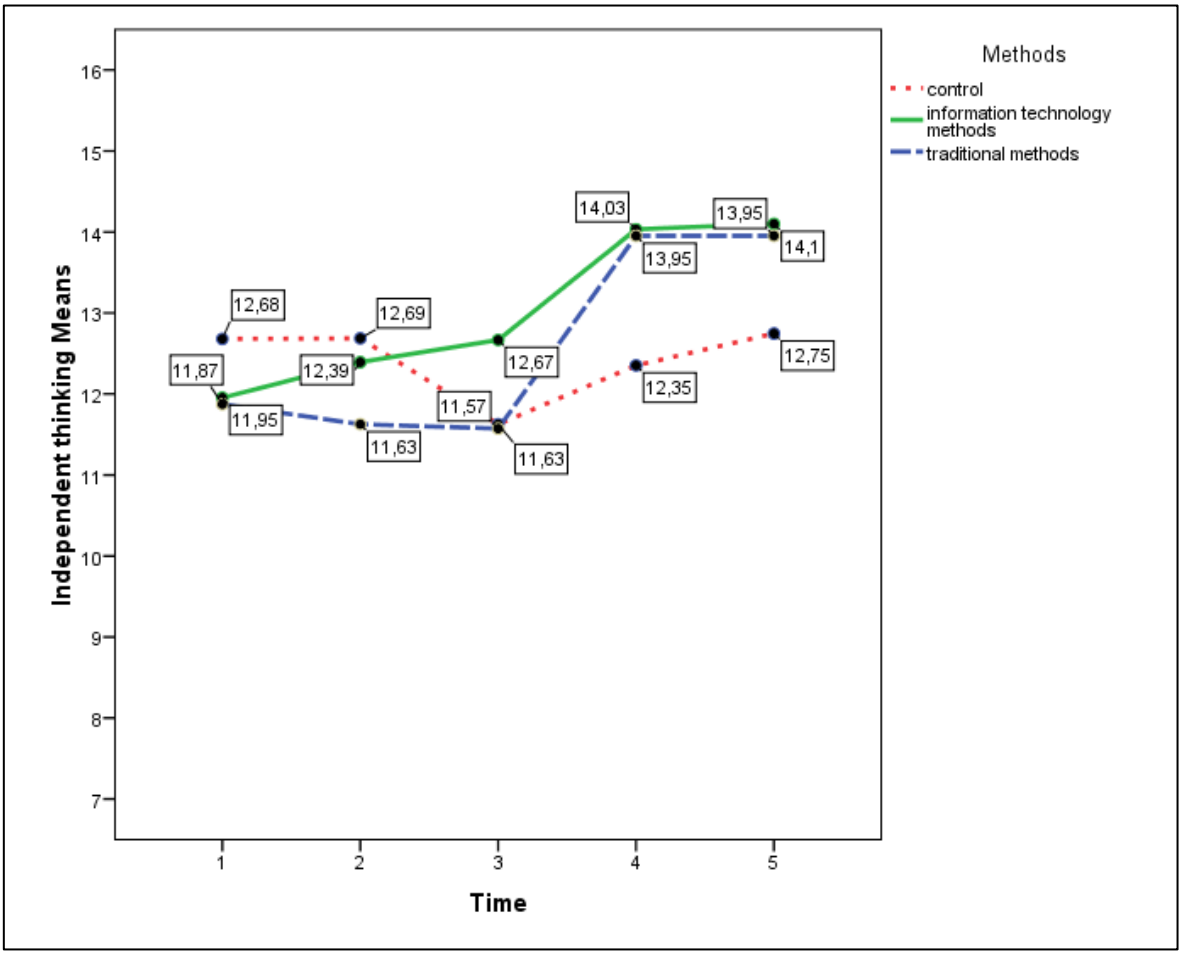

Figure 5: The change of the averages of independent thinking in the information technology and control group

In the case of independent thinking (Figure 5) in the traditional group the averages stagnate between the first and the third measurements then a strong increase may be observed between the third and the fourth one. In the case of the information technology method, a light increase may be observed between the first and the third measurement, the rise of the averages is more intensive between the fourth and the fifth ones (the graph is steeper in the case of the traditional group). In the case of the control group, the change is not steady: first a decrease may be observed between the second and the third measurement, then there is a slight increase.

A variance analysis (Type III) was conducted: dependent variable: impatience, independent variables: group, time (this latter one is a factor within the individual)

Time proved to be significant ($F=203.861$), $p<0.001$, eta square = 0.313) and the time x method interaction ($F=21.478$, $p<0.001$, eta square= 0.88).

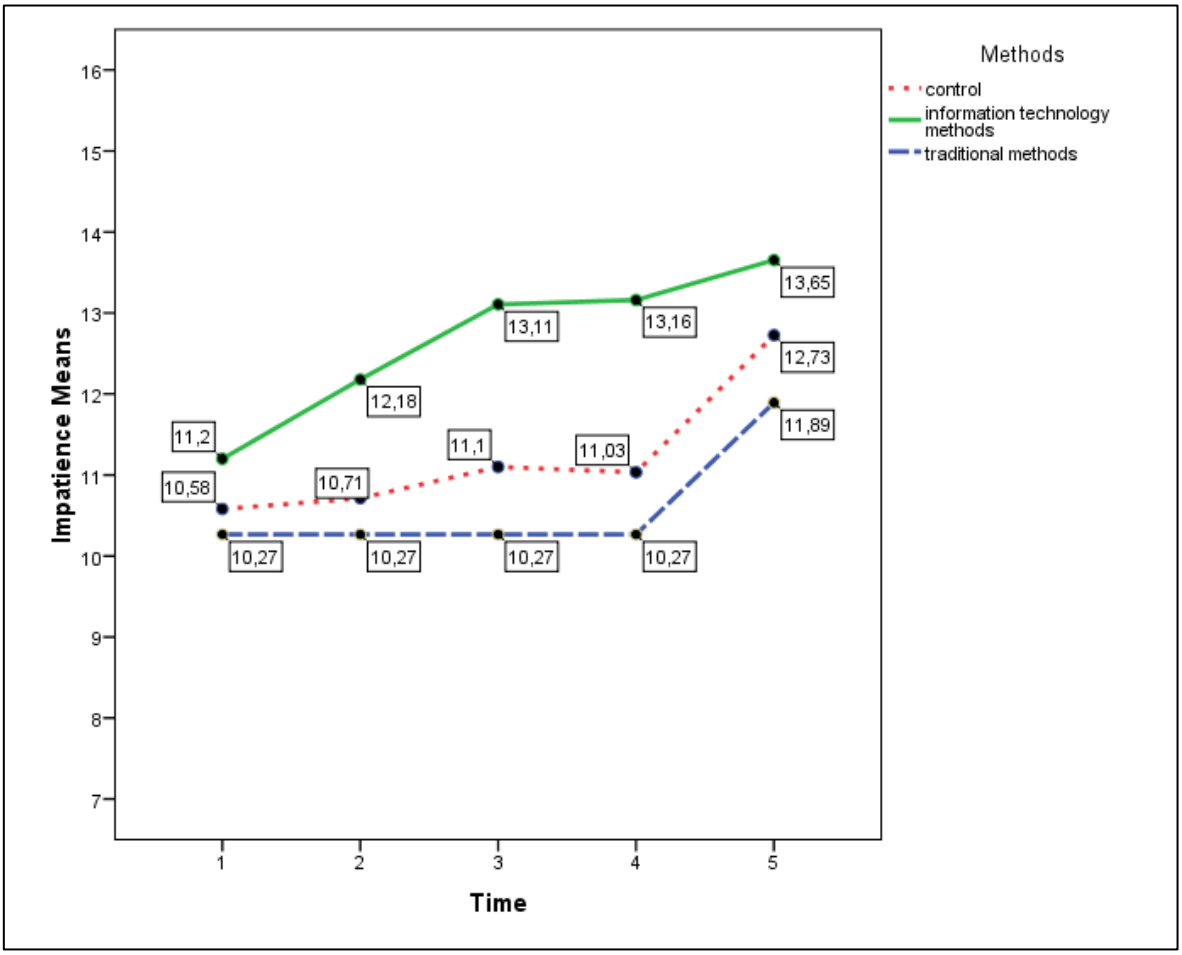

Figure 6: The change of the averages of impatience
in the traditional, information technology and control group

In the case of impatience (Figure 6) there is an intensive rise between the fourth and the fifth measurement in the traditional group. In the case of the information technology group,the impatience of students continuously increases until the third measurement, then it almost stagnates and between the fourth and the fifth measurement it slightly increases again.In the case of the control group, the change is not steady between the first and the fourth measurement and there is an intensive increase between the fourth and the fifth measurement.

A variance analysis (Type III) was conducted: dependent variable: assertiveness, independent variables: group, time (this latter one is a factor within the individual). Time proved to be significant ($F=199.419$), $p<0.001$, eta square=0.308) and the time x method interaction ($F=2,636$, $p<0.05$, eta square= 0.012).

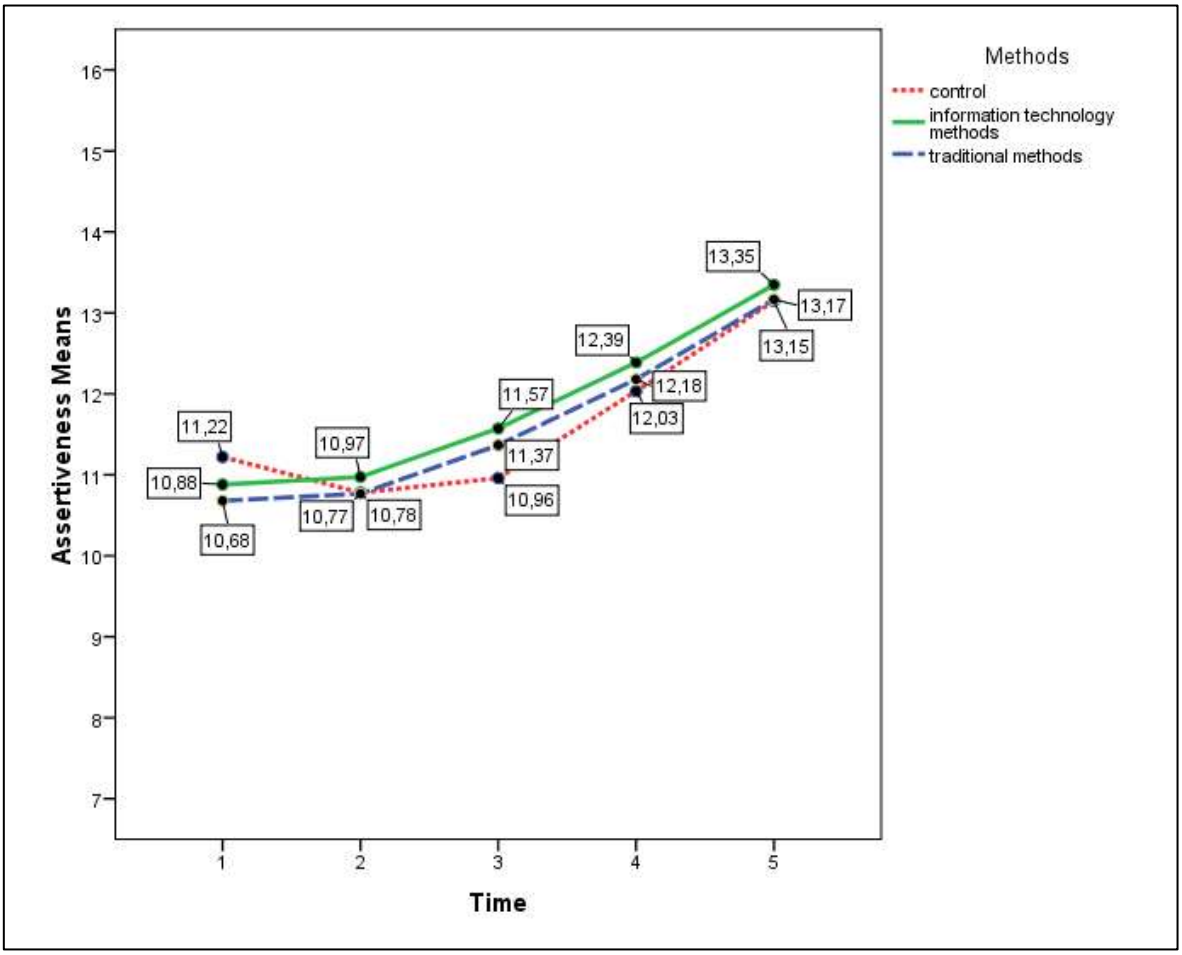

Figure 7: The change of the averages of assertiveness
in the traditional, information technology and control group

In the case ofassertiveness (Figure 7) it can be observed that the steepness of the graphs and that of the averages change nearly the same way and a slight increase can be experienced from the second measurement. In the case of the control group, there is a decrease between the first and the second measurement, stagnation between the second and the third and a rise between the third and fifth measurement.

A variance analysis (Type III) was conducted: dependent variable: dominance, independent variables: group, time (this latter one is a factor within the individual).

Time proved to be significant ($F=114.273$, $p<0.001$, eta square=0.204) and the time x method interaction ($F=7.56$, $p<0.001$, eta square= 0.033).

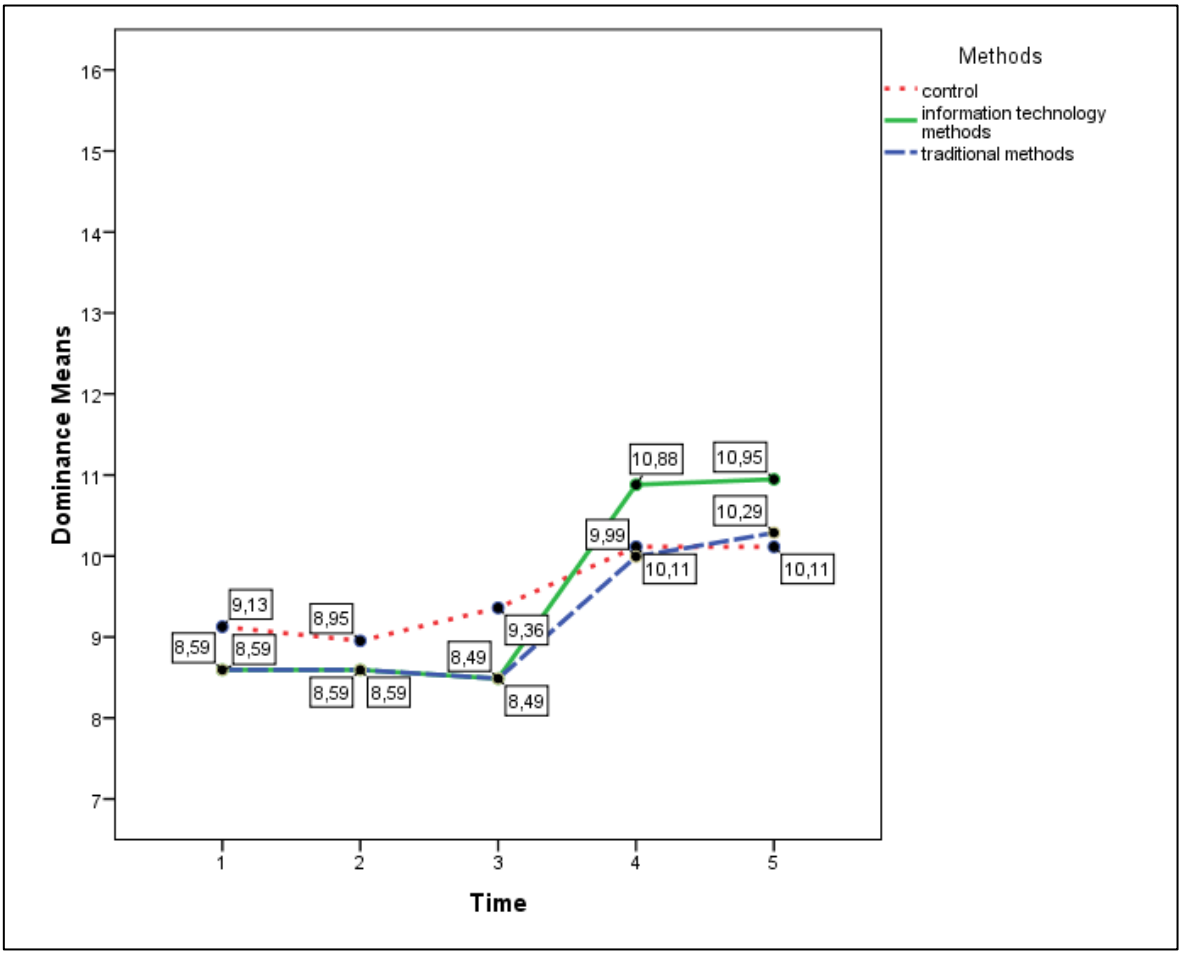

Figure 8: The change of the averages of dominance
in the traditional, information technology and control group

In the case of dominance (Figure 8) it may be observed that there is a bigger difference between the two methods (traditional, information technology) at the third and the fourth measurement where the development is more intensive in the case of the information technology and a greater change between the third and fourth measurement. In the case of the traditional group, the graph is steeper between the fourth and fifth measurement. In the case of the control group, the degree of the change is unsteady, there is a slight increase between the second and the fourth measurement and then a decrease may be observed until the fifth measurement.

A variance analysis (Type III) was conducted: dependent variable: curiosity-interest, independent variables: group, time (this latter one is a factor within the individual).

Time proved to be significant ($F=22.76$, $p<0.001$, eta square=0.048) and the time x method interaction ($F=68.673$, $p<0.001$, eta square= 0.235).

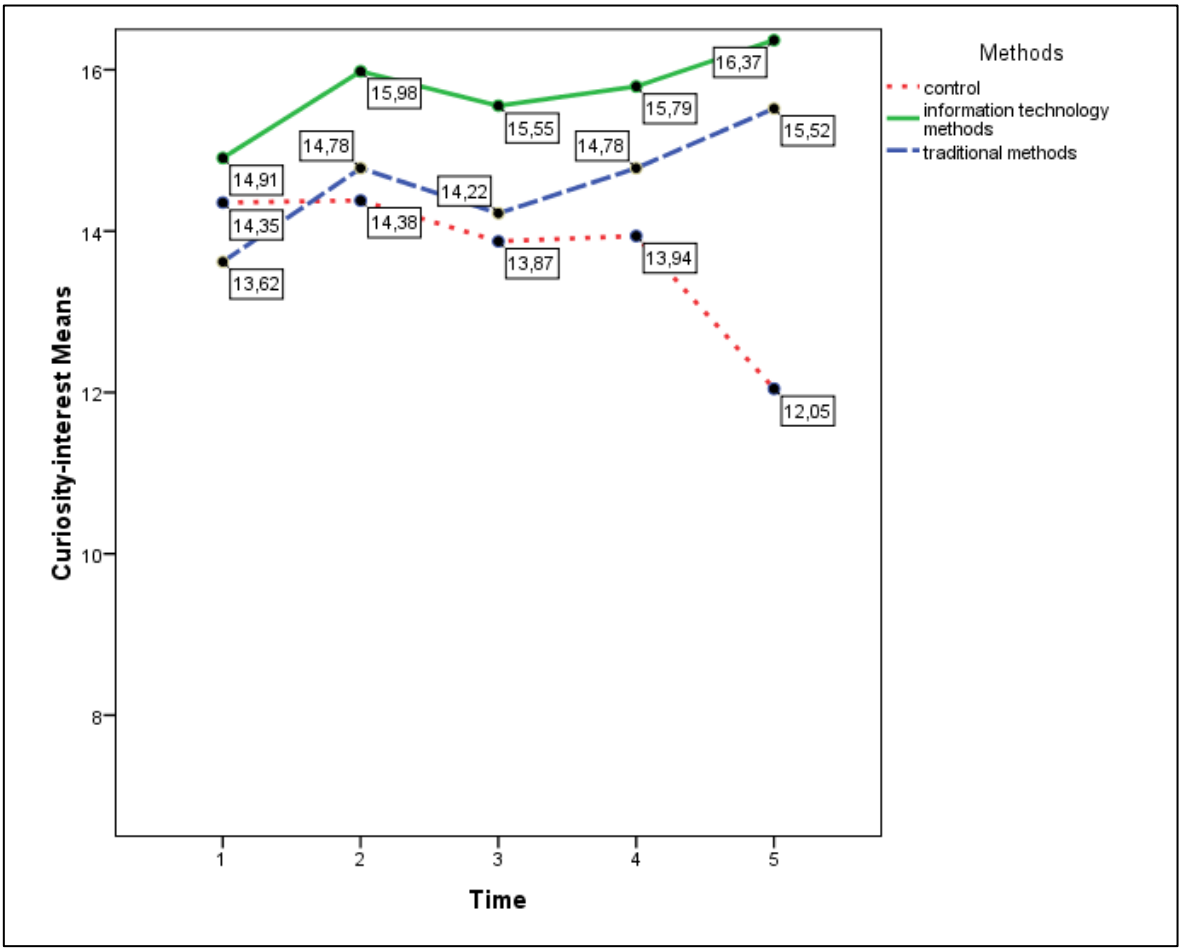

Figure 9: The change of the averages of curiosity and interest in the traditional, information technology and control group

In the case of curiosity (Figure 9) the average of the students, the steepness and fall of the graphs change in a similar fashion until the third measurement. After that, in the caseof the traditional facilities, the graph indicates a steady and greater change than the information technology one. In the case of the control group, the change occurs between the fourth and fifth measurement which indicates a strong decrease.

A variance analysis (Type III) was conducted: dependent variable: energy independent variables: group, time (this latter one is a factor within the individual).

Time proved to be significant ($F=20.823$), $p<0.001$, eta square=0.045) and the time x method interaction ($F=10.174$, $p<0.001$, eta square= 0.044).

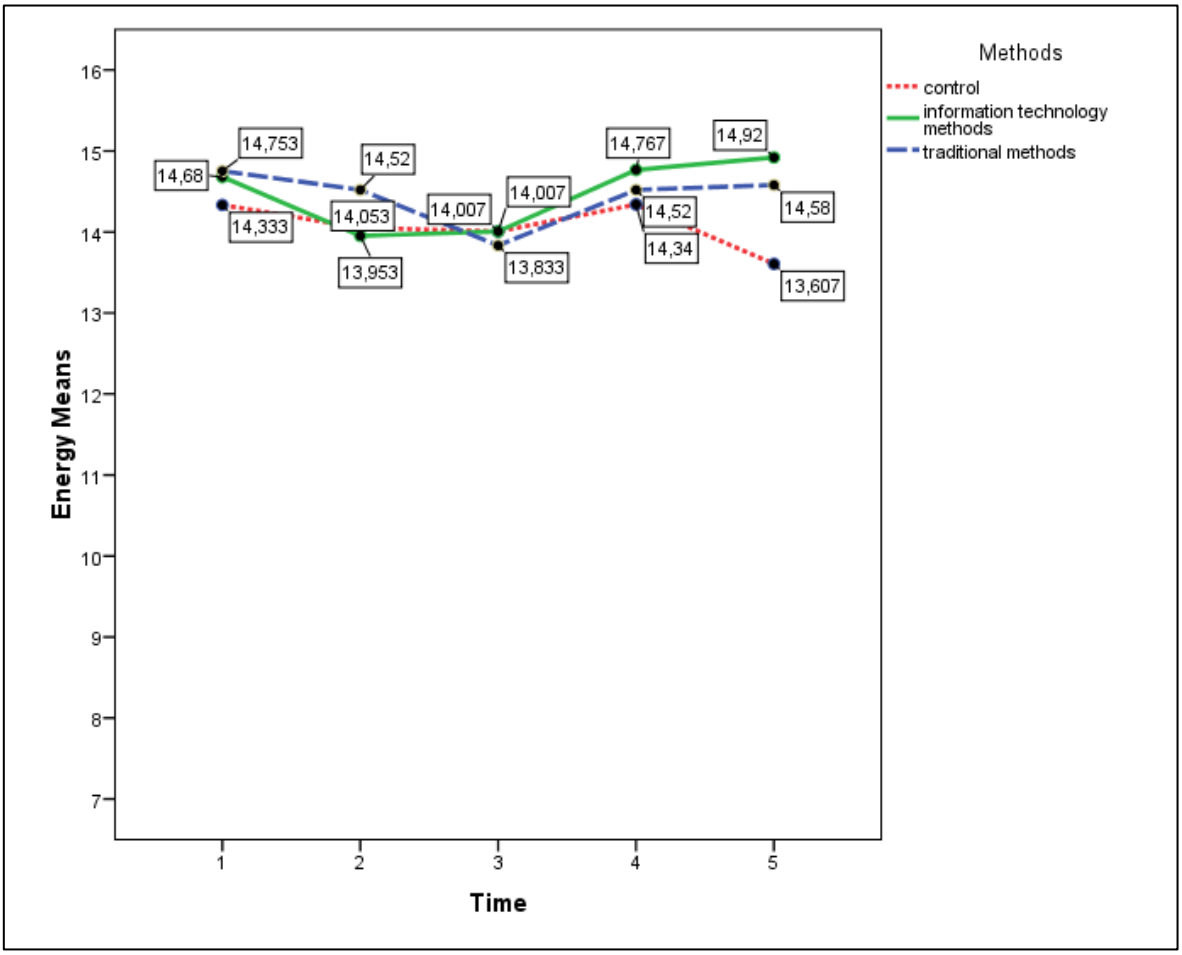

Figure 10: The change of the averages of energy
in the traditional, information technology and control group

In the case of energy (Figure 10) it may be observed that until the second measurement, the averages decrease in both methods, to a greater degree in the information technology one. Between the second and the third measurement the decrease is greater in the case of the traditional method whereas the information technology one hardly changes. The change in the steepness of the graph is nearly identical between the third and the fourth measurement in the case of these two methods. In the case of the control group a more intensive decrease may be observed between the last two measurements.

A variance analysis (Type III) was conducted: dependent variable: originality-wit independent variables: group, time (this latter one is a factor within the individual)

Time proved to be significant ($F=14.113$), $p<0.001$, eta square=0.031) and the time x method x not interaction ($F=18.22$, $p<0.001$, eta square= 0.075).

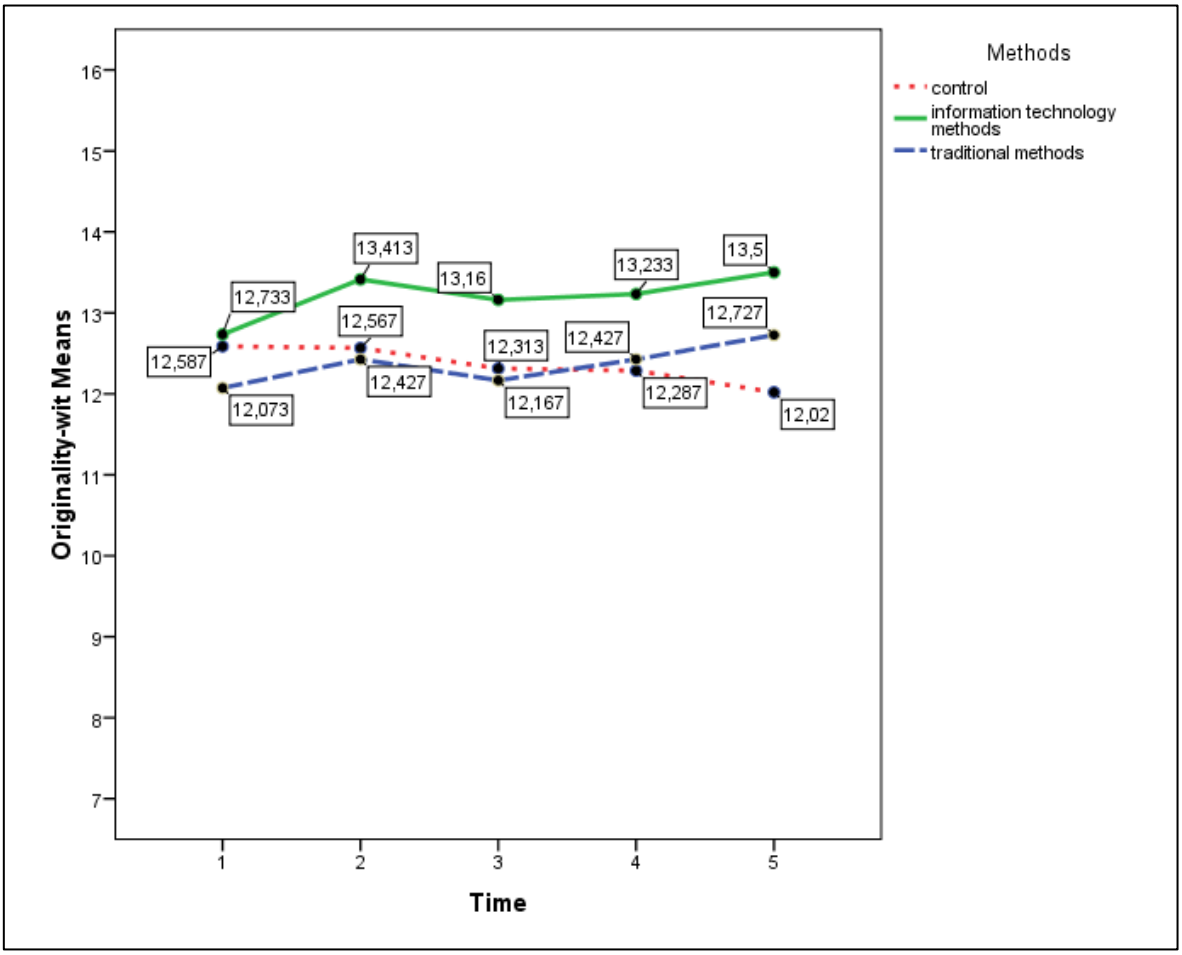

Figure 11: The change of the averages of originality-wit in the traditional, information technology and control group

In the case of originality-wit (Figure 11) we can observe that the changes of the averages of both methods (traditional, information technology), the steepness of the graph changes at a nearly identical level, there is no real difference. In the case of the control group, the tendency is gradually decreasing.

A variance analysis (Type III) was conducted: dependent variable: endurance, independent variables: group, time (this latter one is a factor within the individual).

Time proved to be significant ($F=20.197$), $p<0.001$, eta square=0.043) and the time x method interaction ($F=19,855$, $p<0.001$, eta square= 0.082).

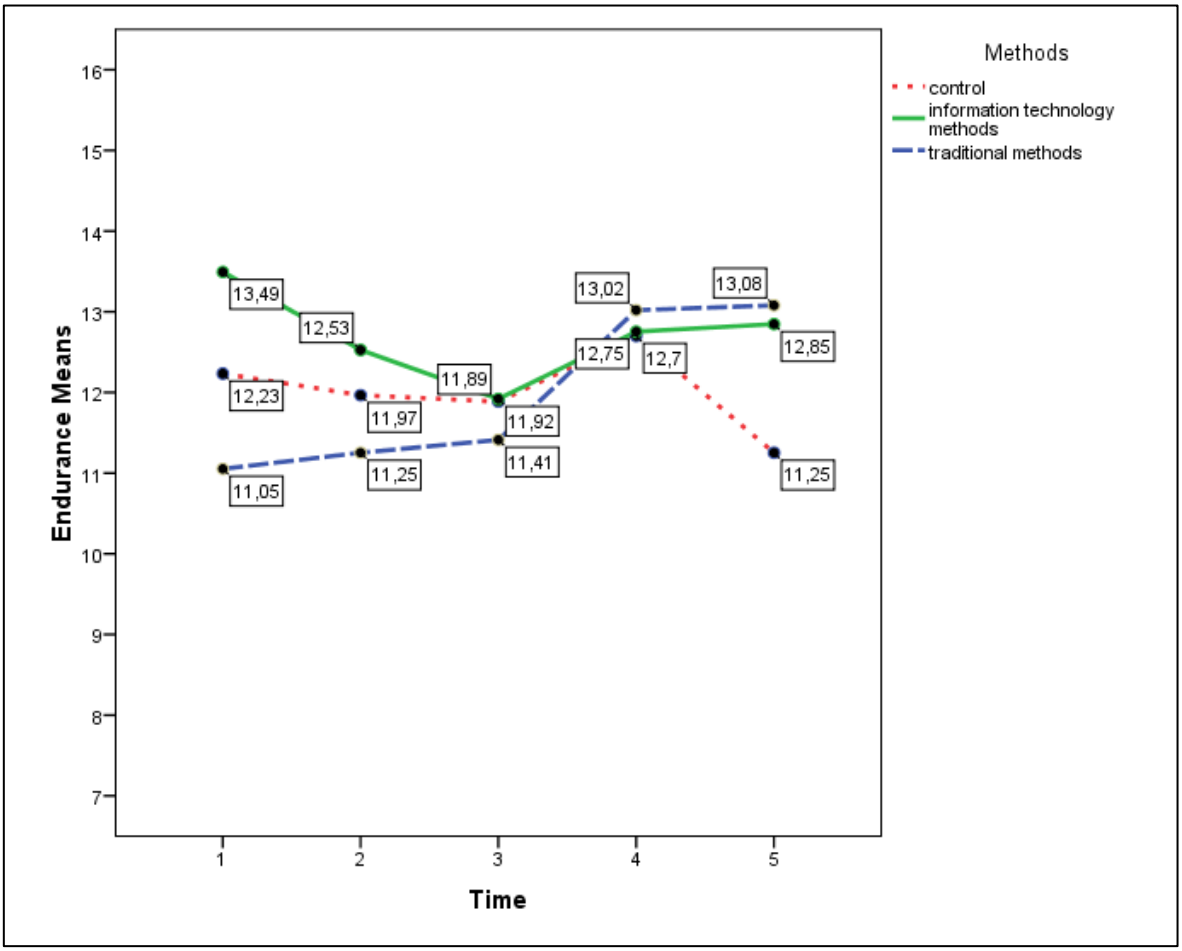

Figure12: The change of the averages of endurance
in the traditional, information technology and control group

In the case of endurance (Figure 12) it can be observed that in the case of the traditional method there is a increase in the change of the averages until the third measurement.At the information technology group, there is an intensive decrease. There is an increase in the case of both methods between the third and fourth measurement, butit is of greater degree inthe traditional method. The steepness of the graphs is nearly the same degree between the fourth and the fifth measurement. In the case of the control group, there is an increase between the third and fourth, whereas an intensive decrease between the fourth and fifth measurement.

A variance analysis (Type III) was conducted: dependent variable: playfulness - humour independent variables: group, time (this latter one is a factor within the individual)

Time proved to be significant ($F=9.49$), $p<0.001$, eta square=0.021) and the time x method interaction ($F=24.294$, $p<0.001$, eta square= 0.098).

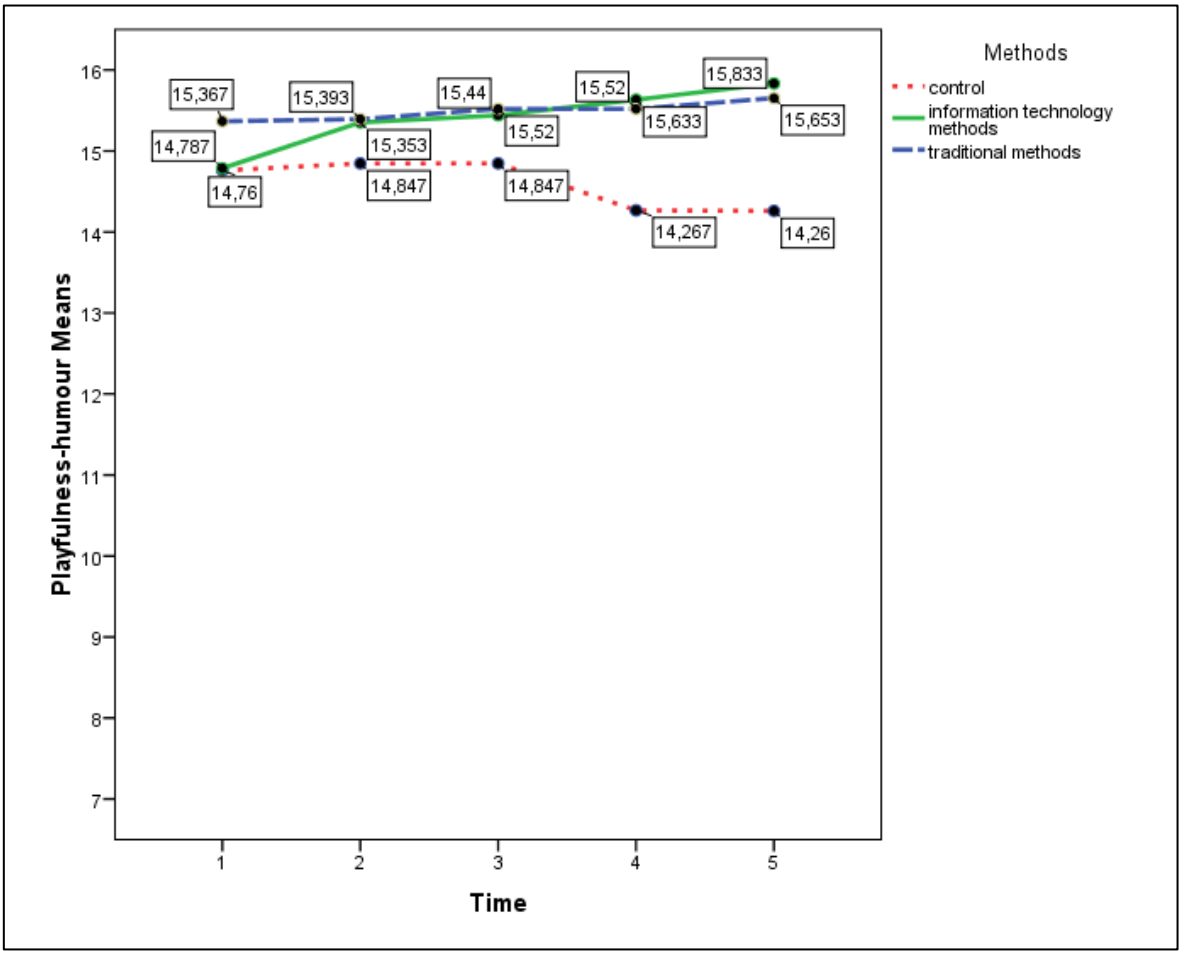

Figure 13: The change of the averages of playfulness - humour in the traditional, information technology and control group

In the case of playfulness-humour (Figure 13) we can observe that until the second measurement the information technology method shows an increase while the traditional hardly changes. Between the second and the third measurement, it hardly changes in the case of both methods. From the third measurement a smaller increase can be observed in the case of the information technology method than in that of the traditional one. In the case of the control group the decrease of the averages is significant between the third and the fourth measurement and then they stagnate.

3. Discussion

Based on the results of the study, it can be clearly stated that the creativity of the children was developed by both methods.

When it comes to the traditional and information technology methods, the efficiency of the development is nearly the same in the case of 5 motives of creativity out of the 12 ones. There was not a significant difference in assertiveness, dominance, curiosity-interest, originality-wit and energy.

In the case of non-conformity, the information technology group indicated a greater change from the third (in May of Grade 6) measurement.

In the case of complexity-preference, the information technology group indicated a steadier, more intensive development during the course of the study. The effect in the case of the traditional method was fluctuating, students developed mostly in Grade 6. There is an interaction between time and method and a significant difference ($p<0,05$).

In the field of risk-taking, the traditional method indicated a greater efficiency. Until the end of Grade 7, a continuous development can be observed, the most intensive period in in Grade 7. In the case of the information technology method, only a very slight change can be seen. There is an interaction between time and method and a significant difference ($p<0,05$).

In the case of independent thinking, students developed quite differently between the measurements. In the case of the traditional method, there is a minimal decrease until the end og Grade 6 whereas in the information technology group we can observe a slight increase. In Grade 7, there is an intensive increase in the case of both methods, which is greater in the case of the traditional one. In Grade 8, almost no change occurred in the case of neither methods. There is an interaction between time and method and a significant difference ($p<0,05$).

In the case of impatience, almost no change can be observed in the case of the traditional method until the end of Grade 7. In Grade 8, there is an intensive increase. In the case of the information technology method, there is an increase in Grades 5 and 6, a stagnation in Grade 7 and a slight increase in Grade 8. By the end of the study, there had been a greater change in the case of the information technology method. There is an interaction between time and method and a significant difference ($p<0,05$).

In the case of endurance, the traditional method proved to be more efficient. There is an increase until the end of Grade 7, after that there is stagnation. In the case of the information technology method, a decrease may be observed until the end of Grade 6, then an increase until the end of Grade 7 and it stagnates in grade 8. There is an interaction between time and method and a significant difference ($p<0,05$).

In the case of playfulness-humour, there was a neglectable change in the traditional group during the course of the study. In the information technology group, an intensive increase can be observed in Grade 5 and a slight increase in in Grade 7 and 8. There is an interaction between time and method and a significant difference ($p<0,05$).

By having analysed the result of the control group, it can be stated that the degree of positive changes is smaller compared to the other methods (traditional, information technology).

4. Summary

The observance of creativity, its measurement and development are more and more significant fields in pedagogy and psychology. In reality, it refers to a way of thinking (divergent thinking) whose help we can utilize to solve the problems we face with new types of approaches. Our knowledge, experience and observations play a role in it. Nowadays more and more exercises aimed at developing creativity are practised in

schools and several outstanding experts (Csikszentmihályi, 1996; Kaufman és Strenberg, 2006) profess their efficiency.

In our study we introduce the results of two, independent and longitudinal which lasted 4 years. The aim of the study was to compare the results of creativity development with traditional and information technology facilities in the senior section of elementary school. Our study was conducted with the creativity estimation scale (TCES) by Tóth and Király (2006., Magyar Pedagógia, 106. (4), 292–295).

Our study seeks the answer to the question if we can find differences between the efficiency of the traditional and information technology methods within the framework of several development methods. The base of our aim was determined by this proposition. In the case of both groups, a positive change or development can be observed. The 5 areas of creativity (assertiveness, dominance, curiosity-interest, originality-wit and energy) changed in a nearly similar fashion, the information technology method changed four areas (nonconformity, complexity, impatience, playfulness) while the traditional method changed two (risk-taking, endurance) to a greater degree. In the case of independent thinking, the information technology method proved to be more efficient until Grade 6, but in Grade 7, the group using the traditional method indicated a more intensive performance.

We also considered it important that the opportunities of developing creativity are available to the teachers who took part in the study as their task of developing the creativity and flexible thinking of students in educational work is extremely important. During the course of our study, we strove to help teachers with a lot of exercises and also prove to them the possibilities of usefulness and versatile development of this area and the fact that it makes sense to include thought- provoking exercises regularly in school education.

One of the most significant practical benefit of the study is that two methods of development were compared which confirmed that there are versatile and efficient possibilities and treasure troves to develop students' creativity which can be applied according to the aim to be achieved.

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Appendix 1

A. Creativity estimation scale (TCES)

1. My school conduct has always been impeccable.
A B C D E

2. I like complicated problems and situations that are difficult to solve.
A B C D E

3. I would like to experience living on an uninhabited tropical island alone for a month.
A B C D E

4. Most of the time I do not understand school material completely without a detailed explanation by the teacher.
A B C D E

5. I am usually able to refrain from interrupting lengthy monologues of others to urge them even if I find it boring.
A B C D E

6. I would rather give something upif I perceive having to overcome resistance from too many people.
A B C D E

7. In a company, I am usually the opinion leader.
A B C D E

8. I like examining, experimenting with and looking up things.
A B C D E

9. I can always get myself together if necessary.
A B C D E

10. I usually do not rack my brains how an object could be utilized beside the what it is made for.
A B C D E

11. I would rather have late-night study sessions than perform weakly when being tested.
A B C D E

12. When it comes to playing, I do not need encouragement although I am not a little child any more.
A B C D E

13. I have had may conflicts with my teachers due to my behaviour.
A B C D E

14. I would rather have a simple job that does not require dividing my attention.
A B C D E

15. I would not put all my money on a gamble that could win me a fortune, but I could also lose everything.
A B C D E

16. I do not need advice when planning my tasks.
A B C D E

17. I get upset when I have to explain the same thing multiple times to someone by the time they understand it.
A B C D E

18. I always pursue my own goals even if this results in conflicts with others.
A B C D E

19. I am not a bossy type.
A B C D E

20. I am not particularly interested in the causes of things.
A B C D E

21. I usually become tired soon, I need a lot of rest.
A B C D E

22. I have conceived jokes many times on my own.
A B C D E

23. I often do not feel like doing my homework, I would rather copy it from someone.
A B C D E

24. I think playing games is a waste of time. I would rather deal with important things.
A B C D E

25. I do as I am expected in all situations.
A B C D E

26. I would rather regard complicated situations as a challenge than something to be avoided.
A B C D E

27. I would like to try parachuting.
A B C D E

28. I often ask for advice.
A B C D E

29. I relatively tolerate it well if I am doomed to inaction due to an illness or accident.
A B C D E

30. In most cases, I do not say a word if somebody jumps the queue because avoiding conflicts is more important to me.
A B C D E

31. I would do well in a profession where I would have influence, 'power' and the right to control others.
A B C D E

32. Research would suit me.
A B C D E

33. I manage with little rest.
A B C D E

34. I am often let down by my imagination in the very moment I should come up with something new.
A B C D E

35. I learn with great dedication and perseverance.
A B C D E

36. I am always available for a little fun.
A B C D E

37. I have often been told off because I wanted something different that the others.
A B C D E

38. I find it too difficult to consider multiple points of views at the same time.
A B C D E

39. I would not dare to do bungee jumping from a high bridge.
A B C D E

40. I manage to deal with my tasks on my own.
A B C D E

41. I believe I am less patient, compared to others.
A B C D E

42. I do what I consider the right thing to do even if I might be frowned upon.
A B C D E

43. I do not consider myself to be a leader.
A B C D E

44. During my studies, I have not come across a topic yet that would interest me so much that I would continue learning about it beyond the compulsory lessons.
A B C D E

45. I often realize that I do not achieve something just because I get exhausted sooner that I should.
A B C D E

46. I have often found solutions to problems that nobody had not even thought of before.
A B C D E

47. I do not feel the strength to continue studying for many years to come.
A B C D E

48. Nowadays I do not feel the need to sit down to play on my own or with others from time to time.
A B C D E

49. In company, I tend to conform.
A B C D E

50. I find pleasure in dealing with complicated and novel problems.
A B C D E

51. I have often purposefully travelled on buses or trams without a ticket.
A B C D E

52. I usually ask for other people's opinions to learn if what I think is right.
A B C D E

53. I can remain calm even if I have to stand in a long queue.
A B C D E

54. I am rarely the winner in arguments.
A B C D E

55. If there are more of us, what I want is what usually happens.
A B C D E

56. I am attracted to the unknown.
A B C D E

57. I can learn for a long time continuously without getting tired.
A B C D E

58. I am not inventive enough.
A B C D E

59. I do not stop learning until I have finished my homework.
A B C D E

60. I like board games.
A B C D E

61. I am somehow always the odd man out.
A B C D E

62. Complicated problems somehow always confuse me.
A B C D E

63. I never went to school completely unprepared trusting that I might not be tested that day.
A B C D E

64. I can fully comprehend the learning material all by myself I do not need to discuss it with someone.
A B C D E

65. I can't stand waiting.
A B C D E

66. I insist on getting my own way, even with force.
A B C D E

67. I usually avoid being the leader.

A B C D E

68. There is no subject that would interest me so much that it would make me browse in books or search the internet for hours.
A B C D E

69. I often feel I do not have enough energy for a task.
A B C D E

70. Once in a while, I have more ideas and they come to my mind more quickly than to most of my classmates.
A B C D E

71. I only spend as much time learning as minimally necessary.
A B C D E

72. I used to like playing very much but I no longer long for it.
A B C D E

Source: 'A new method to define creativity: the creativity estimation scale (TCES) by Toth' by László Tóth, Zoltán Király (2006): (Magyar Pedagógia, 106. (4), 292–295).