Journal of Innovation in Psychology, Education and Didactics	Vol. 20, No. 1 2016	73 - 84

DIDACTIC ASPECTS IN THE DEVELOPMENT OF TEACHING STUDENTS' CREATIVITY THROUGH TECHNOLOGICAL EDUCATION

Luminița BIBIRE [a]*, Adriana VRABIE [b], Luminița BOCA [c], Pedro MUNOZ [d], Teona CODREANU [e]

[a] "Vasile Alecsandri" University of Bacău, Bacău, Romania,

[b] "Octavian Voicu" Secondary School, Bacău, Romania,

[c] Secondary School no. 10, Bacău, Romania,

[d] University Autónoma de Chile, Chile, South America,

[e] "Vasile Alecsandri" National College, Bacău, Romania

Abstract

This paper aims at motivating teachers of Technological Education to apply the active – creative learning instructional strategies in technological education. As a case study we have chosen the Module "The development of the built environment" with the topic "The City" for grade 6, the module "Technologies of communication and transport" - "Transport Networks" for grade 7 and the module "Professional fields" - "The nature of professional different geographical areas", "Labor market evolution" for grade 8.

Key words*:* case study, creativity, students, technological education

Developing creativity in Technological Education lessons. The research hypothesis

Modern methodology operates changes which deal with exploiting and increasing the formative potential of the educational methods in use, in order to enhance the heuristic and active - participatory character, having in mind the student's ability to think, act and create. Activation of instruction provides the psychological basis of modern didactics which designs the shift from a teacher centered approach to active learning which stimulates student reasoning, their effective

* Professor, Ph.D.
E-mail address: lbibire@ub.ro

involvement in building up abilities, skills, knowledge, assets and encourages creative attitude (Dumitriu, 2014; Farrell, Rushby, 2016; Koh, Chai, Hong, Tsai, 2015).

The hypothesis of this experiment relies on the most important acquisitions of contemporary psychology and pedagogy certifying that a person able to en roll on a new existential course forms a student who thinks, strives for personal reflection, does mental search to rediscover the truth, using their maximum creative potential available (Koksal, Yaman, Saka, 2016; Murdock, 2003).

The starting point of this work was the assumption that Technological Education is part of subjects that educate and develop students' creativity and if the appropriate teaching strategies are masterfully chosen, they lead to the effective assimilation of the taught knowledge and this subject becomes the students' favorite one. Of course, the previously mentioned assumption is fully consistent with the views of many experts who claim that any individual can be taught creative abilities, which later in life will help them choose from the large number of domains and subdomains (science, art, technology) the one which will assign a higher value to their creative abilities (Impedovo and Malik, 2016; Oliver, Simpson, 2006; Putwain, Nicholson, Edwards, 2015). This career option usually takes place during adolescence and is prepared and preceded by the school option. In both cases, the student will take into account several factors, creativity included. Ideally students choose the field where they have a high level of creativity. Technological Education offers many options of knowledge, exploration and search and, therefore, it requires the nurturing of creativity within this subject (Edwards, Nuttall, 2015).

The hypothesis of the improvement of the instructional process in Technological Education and the creative approach when designing teaching activities were verified by the experiment reported in this paper (Dumitriu, 2011; Lupu and Dumitriu, 2013).

The target population for this study included 15 secondary school students enrolled in the 8^{th} class in formal schooling. The experiment was conducted during teaching and learning in different types of lessons of Technological Education classes. The fact that the experiment was conducted in a small secondary school made it impossible to form a numerous experimental group which could meet the requirements of a complex pedagogical experiment (homogeneity, representativeness, number) in order to ensure valid statistical results.

We have chosen this group of students mainly because over the years of study, during the educational process, there were identified two groups of students: one group of subjects predisposed to take up creativity opportunities in their formal schooling and another group

with low achievers in terms of creative thinking abilities but who wanted to be as creative as their colleagues in the first group.

The experiment was conducted in a regular classroom environment without influencing the specialized training of students, in accordance with the curriculum and without neglecting the proper acquiring of knowledge and skills.

Having in mind a pertinent analysis there were searched ways to measure the learning environment at the beginning of the experiment with the one at the end of the experiment, by observing, evaluating results and comparing them with each other.

We focused on achieving formal schooling objectives, but this time through developing creative thinking components: fluency, flexibility, originality and elaboration. Throughout the experiment the students were monitored not to overwork and instead to achieve significant and durable learning outcomes through their active-creative engagement. The working hypothesis was confirmed by the fact that the instruction conducted in the conditions of the experiment led to the formation of positive attitudes towards the educational process in general and towards Technological Education as a subject in particular. The students participating in the experiment were encouraged to participate in competitions and were popularized, considering that education and creativity can be done through creative thinking and doing as well.

Methodology

Research Tools

The research tools were: observation, questionnaire, tests, experiment, the analysis of the results of the activity.

a) Observation

Data collection was included in ’observation grids’ of the pedagogical events and on the subjects and later on, these data have been processed, analyzed and interpreted. It must be emphasized that the data collected through observation were not only on pedagogical events and subjects, but also on the students’ reactions and behavior, the active-creative teaching strategies used and the psycho-pedagogical conditions in which these strategies lead to the improvement of students' achievement. The adaptability of students in the conditions of the experiment was also taken into account.

b) Questionnaire

The questionnaires were designed to meet the objectives of the experiment: some questionnaires were designed to collect the students' opinion regarding creativity and others were with close – ended questions (subjects had to choose only one correct variant as the correct answer). To assess the level of creativity, the following symbols have been used: + good; - Weak; → medium; ↓ average to weak; ↑ average to good.

c) Tests

They were used to measure the quantity and quality of knowledge, abilities, skills, the level of the capacity for engaging in creative thinking and doing, before and after the formative stage of the pedagogical experiment and also during progress stage (active – creative strategies).

d) **Experiment**

The formative psycho – pedagogical experiment was the main method of investigation. structure of the experiment which led the research includes: Initial test of creativity; Formative Test (after the introduction of the "progress factor": the use of active - creative strategies in teaching); Final test of creativity. The initial test's main objective was to identify the level of creativity when starting the pedagogical experiment. Taking into account the indicators of creativity: fluency, flexibility, originality and elaboration, we identified five peaks and four low creative subjects in the group of students described as heterogeneous. The next stage, the **formative stage** of the experiment, was the implementation of active-creative strategies in classes of Technological Education, grade 7 and the formative test for "Communications Technologies". The teaching methods were based on methods such as: "I know - I want to know - I learned", The Technique of Dials, SINELG (The interactive scoring for efficient reading and thinking), Brainstorming, Venn Diagram, and other methods to stimulate creativity.

e) The Analysis of the results of the activity

In order to assess the level of theoretical and practical training of students in terms of individual characteristics and specific requirements for Technological Education we took into account reports, drawings, notebooks, portfolios.

Results

For the purposes of the experiment, the initial test was completed with the segregation of the observed group of 15 subjects into two groups: a group of 9 creative subjects and a less creative

group of 6 students - Table 1. The basic idea was to keep track of the development of creativity compared with the initial creative possibilities in the context of active-learning strategies.

Table 1. *The results of the initial test*

No.	Student's Name	Flexibility	Fluidity	Originality	Elaboration
1.	A. P.	→	↑	↓	→
2.	A. C.	+	+	↑	↑
3.	B. I.	+	+	+	+
4.	B. L.	+	↑	↑	↑
5.	B. A.	→	→	→	↓
6.	C. F.	+	↑	↑	↑
7.	C. P. M.	+	↑	+	↑
8.	C. A. M.	+	+	+	+
9.	C. A. V.	→	→	↑	↑
10.	C. V.	→	→	↓	→
11.	C. G.	↑	↑	→	→
12.	C. D.	→	↑	↑	→
13.	H. I.	-	-	-	-
14.	P. P.	↑	→↑	↑	→
15.	R. A.	-	-	-	-

Delimitation of the two groups, the highly creative and the low creative is better illustrated in the histogram in Diagram 1. Looking at the results in Table 1 and Diagram 1, we identified the existence of a group of highly creative students which includes the following subjects: C. A .M., B. A. M., A. C., H. P. and a group of students with a low creative potential which includes subjects: H. I. and R. A..

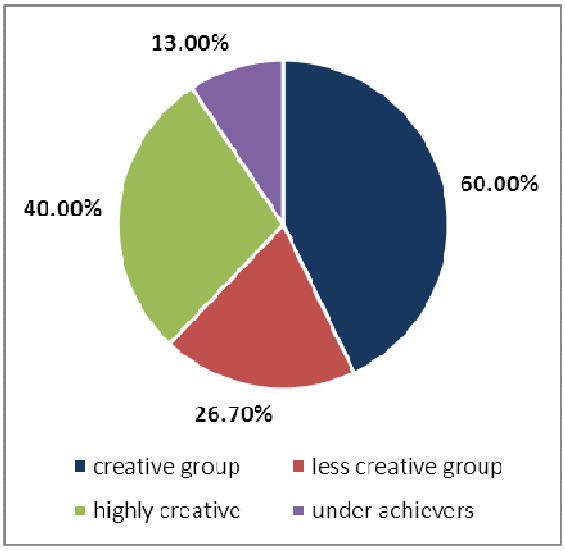


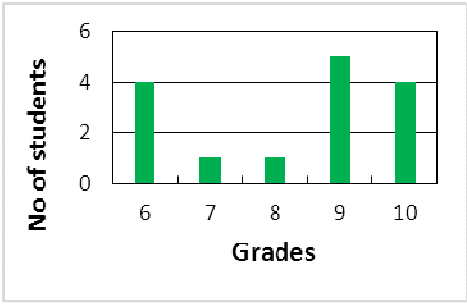
Diagram 1. *The graphic representation of the results of the initial test*

Following the analysis of the Formative test results, we can say that:

- The class will continue to be heterogeneous regarding the level of knowledge gained from implementing active – creative strategies.
- Grades from 9 to 10 which are in the majority indicate a class with students with a very good intellectual potential; grades below average or very poor ones are not the case, as you can see in Table 2, Histogram 1.
- According to Table 3 and Figure 1 we can say that Group A which consists of more creative subjects has a higher level of knowledge compared to the subjects in Group B.

Table 2. Results after the formative test

CLASS	No. of students	GRADES					Class Average Grade
		6	7	8	9	10	
VII	15	4	1	1	5	4	8,26



Histogram 1. Distribution of grades after progress test

Table 3. Group Grades

GROUP	No. of students	GRADES					Group Average grade
		6	7	8	9	10	
A	9	0	0	0	5	4	9,44
B	6	4	1	1	0	0	6,50

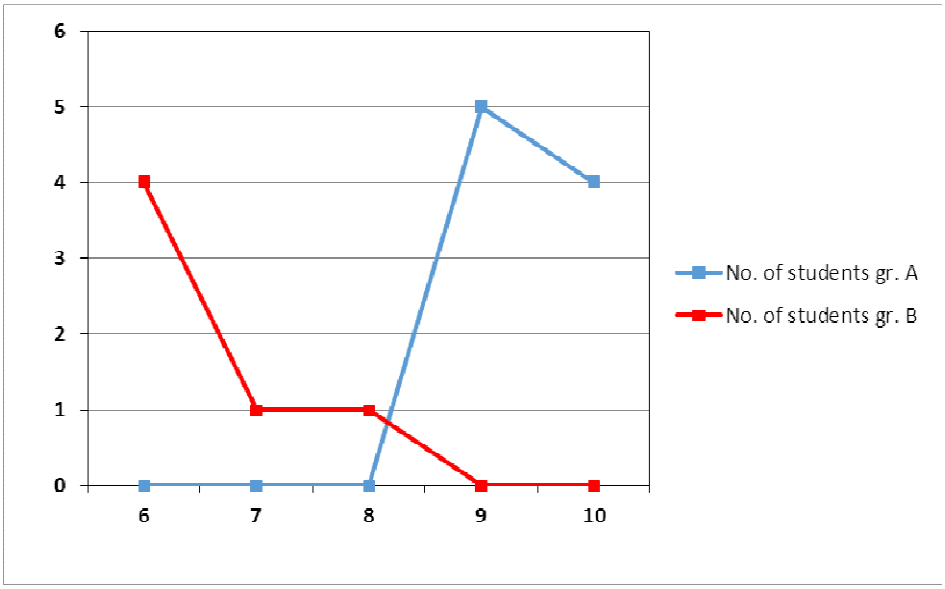


Figure 1. Distribution of group grades

The scoring in the marking scale was carried out according to the following criteria:

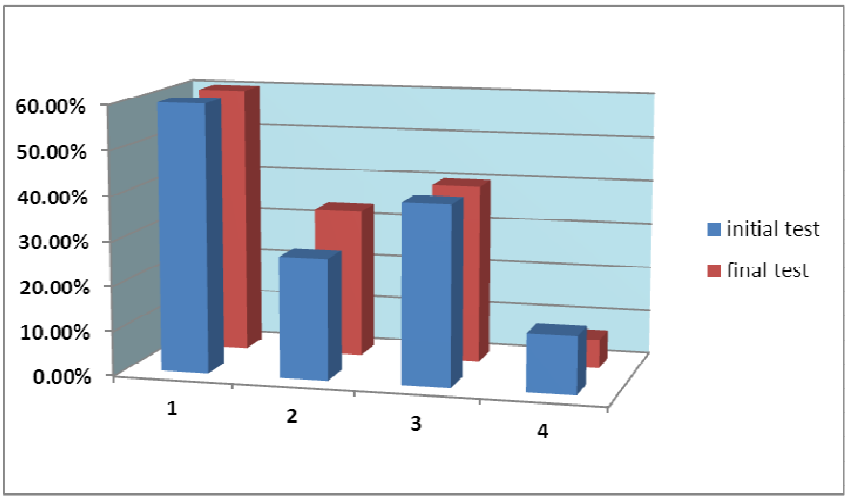
- The items were scored differently depending on the creative potential of everyone (for example, the last two items that appeal specifically to the students' creativity were scored more points).
- The score for each item was given according to its complexity and difficulty as well.
- The accuracy of expression.

It should be mentioned that other students could give other correct answers that were marked as well.

The tables below graphically illustrate the results and comparisons between tests.

Table 4. *Comparative results: initial test – final test*

Results		
Group of students	Initial Test	Final Test
Creative	60 %	60 %
Creative peaks	27 %	33.3 %
Less creative	40 %	40 %
Underachievers	13 %	6,5 %



Histogram 2. Comparative results of the initial and final test

1 - creative group; 2 - ”creative peaks” group; 3 - less creative group; 4 – underachievers

Table 5. Comparative results of formative test and final test

average grade	Formative Test	Final Test
class average grade	8,26	8,47
creative group average grade	9,44	9,53
less creative group average grade	6,50	6,75

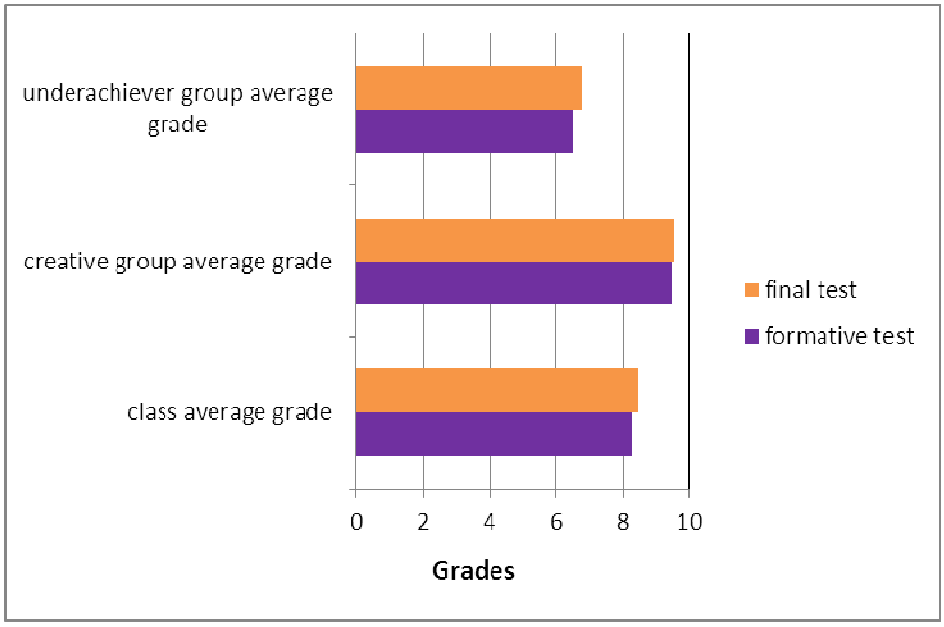


Figure 2. Comparative results of formative test and final test

During the research it was insisted on those variables of the lesson, which could be modified to achieve the desired purpose. Along with effective traditional methods which were adapted to the requirements of the modern school, there were discussed specific ways to develop creativity placing the students of grade 7 in authentic learning context, in a coherent and consistent environment to develop all mental processes required for complex learning experiences in order to confirm the hypothesis formulated in the initial stage of the survey.

There was a real gain in the students' theoretical knowledge, especially in action, but this was matched by positive changes throughout the entire personality in the emotional, motivational, attitudinal and relational spheres, this way increasing the opportunities to adapt to an open society in a rapidly changing world. Also, by knowing the characteristics of these strategies and creatively applying them we may reconsider the status of the teacher, through knowledge and understanding of pupils from entirely new, unexpected perspectives which offer the opportunity

to discover the interests, the difficulties and the problems they face. It was found that by applying active-creative strategies the atmosphere in the classroom changes into a motivating, communicative, enthusiastic and free expression atmosphere. The students were not accustomed to this atmosphere and loved it even more; they were very curious to see what new methods tailored to their needs will be used. The teacher was a moderator, sometimes just a consultant, organizer, partner in the educational act. The reconsideration of information from purpose to means of building skills, abilities and behavior was a real asset. Getting accustomed with active - creative strategies, understanding and applying them proved to be very effective for teachers when dealing with shy students or low-performing ones; it helped them motivate their students and encourage them to socialize more.

Encouraging students to express their opinions, to discuss them with others and find joint solutions to problems contribute to effective and durable learning as cooperative learning maximizes the intellectual potential of the students, helping them to understand, communicate effectively, become creative and innovative.

Conclusions

The comparative analysis of the findings of the two groups of different creative level, has identified the following conclusions:

- the fact that the creative subjects group has worked primarily based on originality in a fast paced working environment is materialized in improving the grades of the highly creative students from 9 to 10;

- the fact that the group which includes subjects with low creative potential is reflected in low levels of originality and mental activity and the slow pace of work of the subjects during the educational process; during teaching activities, one of the two students previously identified as low creative was “recovered", the only remaining student being R. A.

- creative and less creative groups’ answers in the tests were similar.

The analysis of the results of the three tests led to the following conclusions:

- the confirmation of the hypothesis that the introduction of the active – participative strategies in the educational process determines the development of creativity; the results of the final test show an increase in the creative potential of the students with a higher percentage in creative peaks and the lowering of the less creative with 50%;

- for positive results, motivation and increased student engagement together with creative learning are vital; this is why teachers should focus on motivating students for active – creative engagement.

Following the completion of the experiment, the results clearly define the following conclusions:

- the proposed educational goals can be achieved with greater efficiency by using a new approach to content with a higher persistence of cognitive and psychomotor capacities;
- involving students in methods of creative work led to the development of creative thinking in terms of originality, noticing at the same time the emergence of a creative motivation of the students for knowledge and self-awareness which helped develop the students' personality traits specific to creative people: self-confidence, independence in thinking, sensitivity to problems.

The results of the experiment support the improvement of the teaching environment based on active participatory learning, the following being outlined:

- the creative ability of students is favoured by maintaining a permissive climate, mental freedom and dialogue through a democratic governance of teaching, thus offering students freedom of thought and action;
- supportive of the development of creative capacity of students are those forms of organization of educational process which enable discovery learning with an emphasis on practical activities which make students work independently, elevating students' learning beyond knowledge acquisition.

Despite some drawbacks of some methods (time consuming, many resource materials, sometimes difficult to implement due to students' age or sometimes creating disruption in class, they are methodological solutions that may generate increased student engagement and effective participation of students in discovering and assigning new meanings to acquired knowledge.

References

Bibire, L.& Ureche, C. (2015). *Didactica specialităţii - Discipline tehnice – Modulul I* [Didactics of speciality- Technical Disciplines - Module I]. Bacău: Alma Mater.

Cojocariu, V.M. (2007). *Fundamentele pedagogiei. Teoria și metodologia curriculum-lui. Texte și pretexte* [Foundations of Pedagogy. Theory and methodology of curriculum. Texts and pretexts]. București: V&I Integral.

Dumitriu, C. (2014). *Teoria şi metodologia instruirii. Teoria şi metodologia evaluării* [Theory and methodology of training. Theory and methodology of assessment]. Bacău: Alma Mater.

Dumitriu, C. (2011). *Metodologia cercetării pedagogice* [Methodology of pedagogical research]. Bacău: Alma Mater.

Edwards, S. & Nuttall, J. (2015). Teachers, technologies and the concept of integration. *Asia-Pacific Journal of Teacher Education*, *43*(5), 375-377.

Farrell, T., & Rushby, N. (2016). Assessment and learning technologies: An overview British. *Journal of Educational Technology*, *47*(1), 106–120.

Impedovo, M.A. & Malik, S.K. (2016). Becoming a Reflective In-service Teacher: Role of Research Attitude. *Australian Journal of Teacher Education*, *41* (1), 100-112.

Koh, J.H.L., Chai, C.S., Hong, H.Y., & Tsai, C.C. (2015). A survey to examine teachers' perceptions of design dispositions, lesson design practices, and their relationships with technological pedagogical content knowledge (TPACK). *Asia-Pacific Journal of Teacher Education, 43*(5), 378-391.

Koksal, M.S., Yaman, S., & Saka, Y. (2016). Analysis of Turkish Prospective Science Teachers' Perceptions on Technology in Education. *Australian Journal of Teacher Education, 41*(1), 22-41.

Lupu, C., & Dumitriu, C. (2013) *Rolul practicii pedagogice în formarea iniţială* [The role of pedagogical practice in initial training]. Bacău: Alma Mater.

Murdock, M.C. (2003). The effects of teaching programmes intended to stimulate creativity: a disciplinary view. *Scandinavian Journal of Educational Research*, *47*(3), 339–357.

Oliver, J. S., & Simpson, R.D. (2006). Influences of attitude toward science, achievement motivation, and science self concept on achievement in science: A longitudinal study. *Science Education*, *72*(2), 143–155.

Putwain, D.W., Nicholson, L.J., & Edwards, J.L. (2015). Hard to reach and hard to teach: supporting the self-regulation of learning in an alternative provision secondary school. *Educational Studies*, 41(5), 1-18.

Ordinul Ministrului Educaţiei, Cercetării şi Inovării (2009). *Ordin privind aprobarea programelor școlare pentru disciplinele de studiu din învățământul preuniversitar secundar inferior, ciclul gimnazial, care se aplică începând cu anul școlar 2009-2010*, Bucuresti: Monitorul Oficial al Romaniei, Partea I, nr.761 bis.

Consiliul Naţional pentru Curriculum (1999). Curriculum naţional, programe şcolare pentru clasele a V-a – a VIII-a, *Aria Curriculară: Tehnologii, EducaţieTehnologică*, Bucureşti.