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**The Role of Interactive Methods
for Stimulating Creativity in Shaping the Thinking
of Students in the Public Education System**

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Abstract

The main purpose of the paper is to investigate the role of interactive methods of stimulating creativity in the formation of students' thinking in the public education system. In order to achieve the main purpose of the research, a quantitative approach was used, from a methodological perspective, by using a questionnaire-based survey on a sample of thirty subjects, students in the public education system in Romania. The results of the research are in agreement with some previous research on the role of methods of stimulating creativity in the development of students' thinking, highlighting the particularities of applying these methods in the case of the public education system in Romania. The research carried out has pronounced applicative valences at the level of management of the public education system by highlighting some innovative elements that can be transposed into policy formulations and strategic options specific to institutions in this field.

Keywords: creativity, innovator, methods, thinking, public education.

1. Introduction

Creativity is a complex process, which engages the entire personality of the student, to be developed in different ways, both in the educational process and in extracurricular activities. In the educational process, creativity tends to stimulate deep learning, understanding of concepts, and their application in real-world situations. (Shernoff, 2024; Keirsanszki et al., 2024). School, defined by attributes such as accessibility, creativity, flexibility, and continuity, represents the main factor that can contribute decisively to the valorisation of students' potential creativity, to the stimulation of their creative inclinations, and to the education of creativity (Amabile, 1997) . The role of school in stimulating students' creativity has been

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emphasised by numerous previous studies, since the early stages of childhood (Feldman & Benjamin, 2006).

Creativity, being the main dimension of contemporary man, must constitute a central issue of the school (Craft, 2005). In order to develop students' creative abilities, teachers must first of all know the features of creative behaviour, which refer to: the level of general intelligence; divergent thinking; fluency of thought; receptivity to problems; spirit of observation; creative imagination; originality; combinatorial ability; perseverance, initiative; nonconformism in ideas. Creativity tends to become an expression of individuality, one rather socially and culturally directed with effects on the evolution of society and even its survival (Gardner et al., 2001; Craft, 2005; Claxton, 2005).

By educating the intellect and intellectual processes (imagination, thinking, memory), creativity is educated. Among the elements that ensure the constructive role of education in stimulating and developing creativity and, implicitly, promoting creativity pedagogy, two are the most important. First, the emphasis in instructional-educational activities on promoting collaborative didactic relationships, on ensuring a psycho-social climate favourable to good collaboration, on stimulating students' efforts, their desire to make their own contributions to introducing the new, to be original, inventive, and creative. Second, the promotion of heuristic education, which lays the foundations for the formation of independent and creative thinking of students and puts into action the spontaneity and initiative of students, their entire intellectual, affective, and motivational potential (Landau, 1979).

The adaptation of creative methods to the teaching of school subjects is considered one of the main directions of innovation in the educational process due to the fact that they represent the most direct and operational ways of consciously training and practicing creativity (Sternberg, 2003).

Active and interactive methods have multiple formative values that contribute to the development of critical thinking (Blyznyuk & Kachak, 2024), to the development of creativity (Al Ghozali et al., 2024), actively involve students in learning, putting them in a position to think critically, to make logical connections, to produce their own ideas and argued opinions, to communicate them to others, to synthesise/essentialise information, are based on independent learning and through cooperation, students learn to respect the opinions of their peers.

By using interactive methods, one tries to actively involve the child in the instructional-educational process, thus increasing his interest, which leads to a better and easier assimilation of the information that is intended to be transmitted. Interactivity develops students' abilities to work together, which is important for life and for their future professional activity (Wang et al., 2024). Group work allows the division of tasks and responsibilities into parts that are much easier to achieve, the time to solve problems is most often shorter in the case of group work than when trying to find solutions on their own. The child thus learns early on that a healthy and beneficial society is one in which not only he feels good, but also the one next to him, that only through collaboration can effective solutions be found and only through communication can problems be solved (Bocoş & Chiş, 2012).

Considering the state of knowledge, revealed by previous studies and research, in the research presented in this paper we had the following research objectives:

- synthesising the main results of previous studies and their limits regarding the relationship between interactive methods and creativity;
- revealing the particularities of using interactive methods in the educational process;
- studying the role that interactive methods play in stimulating the creativity of students in the primary cycle of the public education system in Romania;
- knowing the students' opinion on potentially implementable elements that can facilitate and optimise the use of interactive methods in educational processes.

In order to achieve the research objectives and by reporting on the results of previous studies published in the specialised literature, in this paper we set out to answer the following research questions:

- What are the most frequently used interactive methods online, within the primary cycle in the public education system in Romania?
- What are the effects of these methods in the educational process and in stimulating students' creativity?
- What are the actions/instruments whose applicability should be initiated/extended to improve the use of interactive methods in the context of online education?

Through modern methods, the student first learns how to learn, what type of intelligence he has and how he can use it for his own benefit and that of others. In order to develop creativity, specialists have developed various techniques that allow students with average intelligence to achieve results close to those of creative people.

2. Literature Review

Although creativity has been linked to education and learning since the beginning of research in the field, the relationship between them has been, in the understanding of Feldman and Benjamin (2006), discontinuous and irregular. In the same direction, Long et al. (2022) consider that the literature in the field remains inconsistent in its results. There are authors in the specialised literature who have shown that the learning process is facilitated by the amplification of creativity in the classroom (Beghetto & Plucker, 2006).

Ryhammar and Brodin (1999) considered that there were four directions of approach regarding research in the field of creativity and education: one based on personality, the second based on cognition, a third that aimed to evaluate specific programs to stimulate creativity at the individual and group level and a last approach, from a psycho-sociological perspective and systems theory. As a result of the development of the last approach, the psycho-sociological one, the development of creativity has become a central element of the educational process (Jesson, 2012).

Hernández-Torrano and Ibrayeva (2020) concluded, following a bibliometric analysis, that research on creativity and education is interdisciplinary in nature and is confined to the field of educational sciences and several fields of study in psychology. Furthermore, Long et al. (2022) considered that the assessment of creativity in educational processes was transferred from teachers and educators to

psychologists in the second half of the last century. Considering the topic of creativity in education as an emerging one, especially after the year 2000, Hernández-Torrano and Ibrayeva (2020) noted four major themes addressed in this field in the last 45 years: teaching and learning creativity, psycho-educational aspects of creativity, the role of creative processes within contemporary organisations, and the way in which affective and cognitive processes influence creativity.

From a methodological perspective, research on creativity in educational contexts has included a multitude of approaches, methods, and levels of addressing the researched problem (Plucker & Callahan, 2014). Some of the previous studies conducted, based on systematic reviews of the literature, seem to indicate that teachers value creativity and believe that schools should be involved in cultivating students' creativity (Mullet et al., 2016; Bereczki & Kárpáti, 2018). Collard and Looney (2014) even showed that, in order to cultivate creativity in education, schools must support teachers in adopting and integrating methods of stimulating creativity in the educational process. Kaplan (2019) believes that creativity itself must become a part of the design of educational processes. Other studies, especially meta-analyses, have revealed that creativity at the individual level tends to explain academic performance (Gajda et al., 2017). However, some of these previous studies also address the issue of factors that constrain creativity in the educational process (Cachia et al., 2010; Bereczki & Kárpáti, 2018).

Modern methods tend to approach scientific research methods as closely as possible, engaging students in direct investigation and research of phenomena. The use of interactive methods in teaching results in increased motivation for learning and self-confidence (Mattmann, 2017; Aliriad et al., 2024), contributes to the formation of a positive attitude towards the subjects studied in school and ensures the conditions for the formation of children's ability to interact and communicate, preparing them better for social activity (Bocoş, 2003).

Through interactive group methods, students exercise their ability to select, combine, learn things they need as a schoolchild and later, as an adult. Modern methods make the student responsible, make him an active member in his education and training process. Modern methods emphasise the development of the student's imagination (Al Ghozali et al., 2024), on his ability to formulate and support opinions, but also to work in a team. The student has an active role in the instructional-educational process, not just to receive information (Boden, 1994).

Creativity techniques can be used in all educational subjects: language, mathematics, history, geography, music and art education, practical skills, etc. In general, they can be embodied in: compositions, original solutions, solutions to exercises and problems, practical works, and other points of view regarding more or less common contexts.

To find new ideas, the most common methods used are: brainstorming (Obafemi, 2024), brainwriting (Atmowardoyo & Patak, 2024), starburst, clusters, quadrant method, question lists, suggestion boxes.

To solve some situations, many methods could be used: the Vann-Euler diagram, the diamond, the cube method, the double log, and others. Another classification of

creativity techniques, interesting from a practical point of view, divides them into: individual creativity techniques, group creativity techniques. From this point of view, the most fruitful are group creativity techniques. Arguments in Favor of their use would be: group activity stimulates the creation of ideas, some people's ideas are generated or enriched by the ideas of others; more is obtained than the sum of all students' ideas.

The development of critical thinking can be achieved using brainstorming, the 6 thinking hats method (Karmakar & Chattopadhyay, 2024), the diamond method, the cube, the idea tree, role-playing (Birhan et al., 2021). This stimulates integrated learning, which is beneficial because it links one discipline to the others, ensures a global vision of the objectives, a certain understanding of the child considered as a whole, and also maximum coordination in different stages of the learning process.

Thus, teaching and learning are seen from a holistic perspective, reflecting the real world that is interactive. Such means, teaching strategies create the affective and intellectual climate conducive to the independent, original, and, at the same time, verbal skills development.

3. Methodology

The research presented in this paper is a pilot study on the role of interactive methods for stimulating creativity in shaping the thinking of students in the public education system. The research approach was quantitative using data from a questionnaire survey of a sample of 30 students. Descriptive statistics were performed on the data from the questionnaire and the results were interpreted.

The sample chosen for this research work is represented by the group of 30 students, 18 girls, and 12 boys, from the third grade of Grigorie Ghica General School in Bucharest. The analysis was carried out by designing, implementing, monitoring and evaluating the learning effects following the application of interactive methods in teaching activities carried out in the offline versus online-synchronous environment. Teaching activities were held according to the schedule, but the group of 30 students was grouped into two series of 15 students each, who physically participated in the courses (offline), while the other series participated virtually in the courses (online).

Every 2 weeks, these series were rotated. Students in the online series worked asynchronously, after the end of the courses, on the Google-Classroom platform to post, check, and correct their homework.

During this period, classroom practice showed that an assessment through interactive methods in the online environment is not relevant due to the lack of authenticity of the manner of solving the evaluation test (here, it should be emphasised that the interventions of adults present in the student's learning space and various other situations related to technology: connection, devices, etc.) influenced the test result.

For the accuracy of the research, the interpretation of the results, and the conclusions, we considered it appropriate to address a questionnaire to students to express their personal opinions regarding the application of interactive methods in

teaching activities carried out in the online environment, emphasising the conditions and effects of learning, especially in the Romanian Language and Literature discipline, from each individual's perspective.

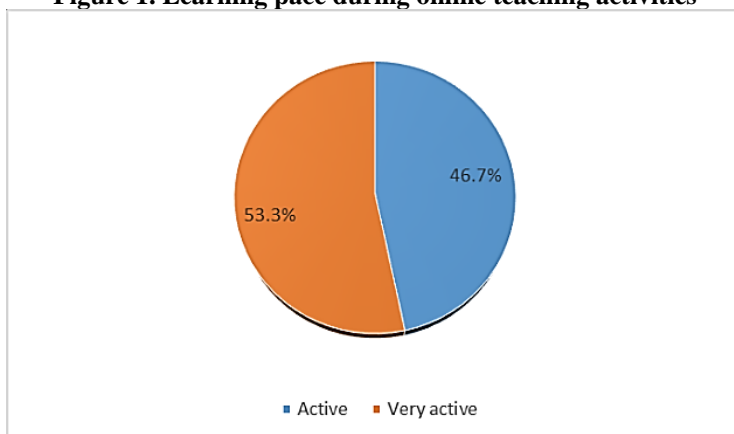
The questionnaire used to conduct the research on the role of methods included 12 questions grouped into three categories: two questions regarding the type of school attended and age, both of which serve to validate the research context; one question regarding the age of the students; seven questions regarding the particularities of using interactive methods and their role in stimulating students' creativity, and one question regarding recommendations and proposals for activating Romanian Language and Literature classes that take place online.

4. Analysis and Results Interpretation

The first three questions in the questionnaire concerned the type of school attended by the students, the grade they graduated from and the student's age during the school year in which they were surveyed. Of these, the first two questions served to validate the research context, as all the responding students were enrolled in a public school in the third grade. For the third question, regarding the age reached during the school year, 83.3% of students stated that they had reached 10 years of age at the time of completing the form, or more precisely 25 students out of a total of 30.

For the fourth question, regarding the learning pace during online learning activities, a certain equality is observed in Figure 1, with the dominance of the "very active" (53.3%) versus the "active" (46.7%) pace. However, it is interesting to note that no student considered an inactive learning pace when conducting online classes.

Figure 1. Learning pace during online teaching activities

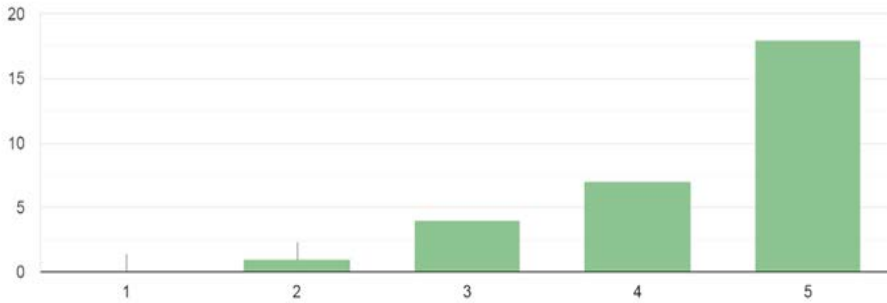


Source: own calculations.

On the fifth question, regarding the use of interactive methods applied to the learning process in the online scenario, a percentage of 83.3% (25 students) placed the importance of applying interactive methods on the Likert scale in "4-agree" and

"5-strongly agree" and it is noteworthy that no student considered "1-strongly disagree" in this regard. The students' answers to this question are shown in Figure 2.

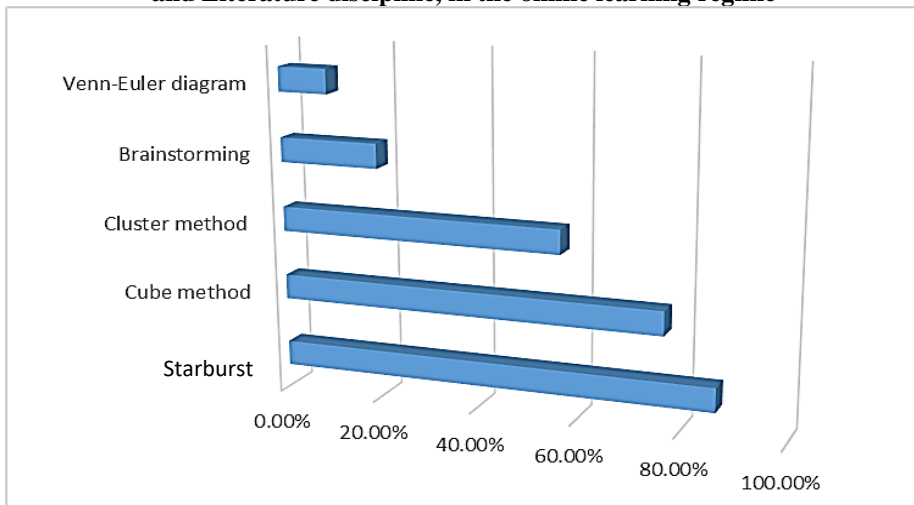
Figure 2. The use of interactive methods applied to the learning process in the online scenario



Source: own calculations.

On the sixth question, students had to select three options regarding the interactive methods that are frequently applied to the Romanian Language and Literature subject, in the online learning regime. As can be seen from Figure 3, 86.7% of the percentages were recorded for the “Starburst” method as the most used interactive method in LLR teaching activities, in the online environment. The cube method ranked 2nd and 3rd with 76.7%, respectively, the cluster method with 56.7%. Among the students’ options, in descending order, were also Brainstorming (20%), and the Vann-Euler diagram (10%).

Figure 3. Interactive methods frequently applied to the Romanian Language and Literature discipline, in the online learning regime



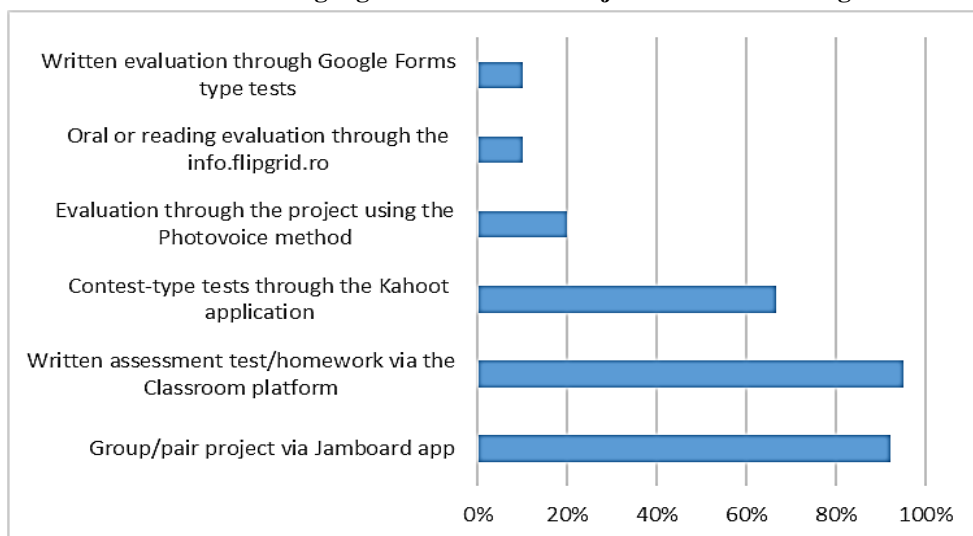
Source: own calculations.

On the seventh question, regarding the preferred interactive methods to learn better in the Romanian Language and Literature subject, the students had to complete a short, open-ended answer, naming three options. The following were mentioned, in descending order: the cube method, the starburst, the cluster method, the role-playing game, think, work in pairs, communicate, and the author's chair, leading this ranking certainly due to the routine, skill, and habit of using them.

It is clear that students have divergent preferences in terms of interactive methods suited to their learning style, but a ranking can be outlined. Their varied choices are explained by the fact that they have strong personalities and inclinations towards originality.

Regarding the eighth question of the questionnaire, presented in Figure 4 and concerning students' opinions regarding the evaluation methods that better verify knowledge in the Romanian Language and Literature subject in online learning mode, approximately 95% of students considered that the evaluation through group projects and written evaluation tests/homework on the Classroom platform are the most suitable for them to find out their level of knowledge. The percentages obtained by the contest-type tests through the Kahoot application are also not to be neglected, which recorded 66.7% of the options and the 20% of the options for the evaluation through the project through the Photovoice method. Only 10% consider that the oral or reading evaluation through the info.flipgrid.ro application and the written evaluation through Google Forms type tests can optimally verify knowledge.

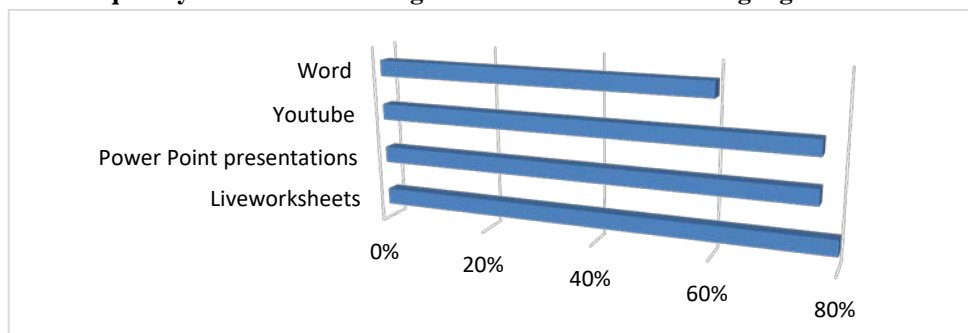
Figure 4. Students' opinions on the assessment methods that better verify knowledge in the Romanian Language and Literature subject in online learning mode



Source: own calculations.

On the ninth question, regarding the applications/programs/media channels most frequently used in the teaching activities of Romanian Language and Literature, online, students had to choose from 3 options. As shown in Figure. 5, 80% of students decided that Worksheets (Liveworksheets) are the most used, followed, in descending order, by an identical percentage of 76.7% by Power Point presentations and views accessing the Youtube media channel and finally by 60% by Word presentations.

Figure 5. Students' opinions on the applications/programs/media channels most frequently used in the teaching activities of Romanian Language and Literature



Source: own calculations.

Regarding the tenth question, "Do you consider that certain conditions must be met for the application of interactive methods in teaching activities carried out online?", students had to choose between 3 options out of the 6 offered. According to the answers presented in Table 1, students considered that the most important conditions that must be met for the application of interactive methods in teaching activities carried out online are: "the mandatory existence of devices connected to the Internet" (73.3%); "permanently functional platform" (70%); "students' satisfactory digital skills" (56.7%); "correct choice of interactive methods" (53.3%); "students' training and training" (46.7%). It should be noted that no student considered "teachers' digital skills" as a necessary condition, which means, in the students' view, that they are trained.

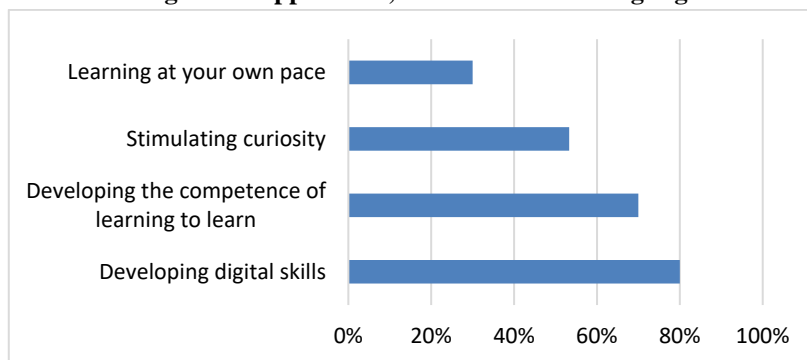
Table 1. The conditions necessary to be met for the application of interactive methods in teaching activities carried out in the online environment

No.	The conditions necessary to be met for the application of interactive methods in teaching activities	Weight in student responses (%)
1	Mandatory existence of internet-connected devices	73.3
2	Permanently functional platform	70.0
3	Satisfactory digital skills of students	56.7
4	Choosing the right interactive methods	53.3
5	Student training and instruction	46.7

Source: own calculations.

In question 11, regarding the students' opinion on what learning effects interactive methods produce through their application, in the online learning regime, it was necessary for students to reflect on the consequences given as an example and to choose three options. The vast majority considered that one of these effects is "development of digital skills" (80%). 70% of the options were for "development of the competence of learning to learn", and 53.3% for "stimulation of curiosity". Only 30% chose one of the 3 options as "learning at one's own pace".

Figure 6. Students' opinions on learning effects of interactive methods produce through their application, in the online learning regime



Source: own calculations.

On the last question, the twelfth, regarding recommendations, proposals for activating Romanian Language and Literature classes that take place in the online environment, students were able to formulate open answers. Various suggestions and recommendations were recorded in which they expressed their wishes and needs, giving some alternative solutions that lead to the idea of group work methods, cooperation, collaborative projects, role-playing for experiential learning, watching podcasts, and last but not least, where appropriate, they want more practical exercises.

From the results presented, it is observed that students easily recognise the fact that in the online environment, the application of interactive methods has an important role and is useful for the easy assimilation of content and their activation in the learning process. In their conception, having the experience in the classroom, they indicated the range of interactive methods that they had already practiced and in large numbers they expressed their desire to work as much as possible in groups on various projects, to collaborate, to investigate, to discover, to watch podcasts and to work in the offline classroom using the applications in the online environment. It is clear from their answers a strong appetite for experiential, innovative learning, in which they would be totally involved in the teaching-learning-evaluation process.

5. Conclusions

Interactive - creative learning is the architect of thinking, it can shape students' character, shape their personality, develop their imagination, instil autonomy, responsibility, make them productive, help them discover themselves and be sociable and receptive, to more easily reach their maximum potential. This does not mean, however, that traditional methods, such as lecture, exposition, conversation, explanation and all the others do not have their contribution to the student's training, they are complementary methods to the interactive ones and through them the student comes into possession of a varied knowledge base, worthy of consideration, from which both he and society will benefit and which he will later use in his profession. Through the mastery and skill that we demonstrate, we can develop creativity in students, but we can also achieve self-stimulation of creativity.

The introduction of interactive methods in the instructional-educational process of primary education facilitates the student, and not only, the formation of useful capacities and skills for understanding and realising authentic situations, as well as transforming him into an active participant in the life of society. In this way, interactive methods become a strong link between classical and the most recent methods, offering students the opportunity to explore new areas, acquire new knowledge, and develop new skills. All the more so since all of this is doubled by computer-assisted instruction, starting from preschool.

The results obtained after using the research tools demonstrated at the micro level (school unit/class) that the learning effects, application conditions, limits and benefits of applying interactive methods in teaching activities carried out in the offline or online synchronous/asynchronous environment have their specific particularities adapted depending on the characteristics of the method and the way in which education is carried out.

Regarding the results obtained from the research, it can be stated that the application of interactive methods in teaching activities in the Romanian Language and Literature discipline, in the offline or online learning environment, facilitated the formation and development of communication skills in Romanian, but also the other 8 key skills targeted for young schoolchildren.

Creativity and critical thinking are closely related and influence each other in the learning process. Critical thinking helps students analyse information, ask questions, and find original solutions, which stimulates creativity. On the other hand, creativity helps them explore new ideas and approach problems from different perspectives, which improves their critical thinking. Techniques such as "Thinking Hats" or the "6/3/5 Technique" help students exercise their creativity and analyse problems from different perspectives. Compared to other studies in the literature, the results obtained seem to indicate that methods for stimulating creativity are applicable in the online environment but also that they stimulate curiosity and develop learning-to-learn skills, thus confirming the conclusions of studies (Hernández-Torrano & Ibrayev, 2020; Gajda et al., 2017).

Through the responses obtained from the student questionnaire, the conditions and effects of learning following the application of interactive methods in the offline

or online learning environment were specifically identified. It should be noted that the two learning scenarios assume completely different conditions in terms of the learning process, the mode of content delivery, the necessary teaching aids, the preparation and training of students, as well as the obligation to adapt interactive methods to the distance learning formula.

Regarding the effects of learning following the application of interactive methods, more positive aspects stand out than negative ones. It is thus demonstrated that the application of interactive methods in offline or online teaching activities contributes and visibly facilitates the formation of key skills of young schoolchildren and will have as a final product the increase in students' learning outcomes. Students will demonstrate greater ease in terms of learning activity, as well as in terms of the formation of an adequate language with all its positive consequences.

Through this work, we wanted to demonstrate the usefulness and efficiency of applying interactive methods within the teaching approach both in the offline learning environment, and especially in the one carried out in the online learning environment, through their quality of engaging students in the teaching-learning process, through their ability to transform a passive, banal, unattractive subject into an active subject, through their interest in the needs of students, but also in the needs of teachers.

The main limitations of the study are the sample size and its structure, in the sense that the sample included students who are of the same age, learn together under the coordination of the same teacher and were involved in the study at the same time. These elements largely limit the potential for the generalisation of the results to the entire school population but do not reduce their significance in terms of the contribution of interactive methods to stimulating the creativity of primary school students. For this reason, in future research directions in studies conducted on the same topic, we will expand the sample to include students from the middle school cycle and also change the research approach from a cross-sectional to a longitudinal one.

Declaration of Generative AI and AI-assisted technologies in the writing process: During the preparation of this work the authors did not use Generative AI and AI-assisted technologies in the writing process. The authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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