

THEORETICAL FOUNDATIONS REGARDING STEAM EDUCATION AT PRESCHOOL AGE

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Abstract: *This article supports and promotes the introduction of STEAM education in preschool education and its advantages. Modern education is not a renunciation of the valuable heritage of the past, but a restructuring of its relationship with the future, a 180 degree turn of its point of departure. STEAM education is a challenge of the modern, technological world. Unlike the classical lessons in the traditional system of education where the teacher teaches the students, STEAM is an active, applied and constructivist method of "learning by doing". The children, regardless of their age, should be encouraged to think deeply, so that they have the chance to become innovators and leaders who can solve the most pressing challenges facing our future. STEM and STEAM projects put the foundations of an openness to concepts that would normally come across a lot later and much more theoretical. Postmodern education is adapting day by day the needs of tomorrow's future adults, the key to success being knowing how to adapt and how to use what you have learned, for continuous change and development.*

Key Words: STEAM education, experiential learning, early education, non-formal education, outdoor activity, preschool age, STEAM behaviors.

1. Introduction. Theoretical Foundations of STEAM Education at preschool age

STEAM education is a concept at the beginning in Romania, because it is not provided for in the Curriculum for early education, at the moment, STEAM – the English acronym for Science, Technology,

Engineering, Art, Mathematics is an innovative method based on an interdisciplinary approach that trains the child in transversal skills through 5 disciplines. Using this method from an early age develops to children: critical thinking, the ability to solve problems and find solutions, creativity and imagination, interest and curiosity for new information, exercising both sides of the brain, communication skills and competences, as well as active involvement in the learning process, increasing self-confidence, autonomy, teamwork, learning through discovery, training technical and digital skills.

Thus, the focus of STEAM education is on developing the specific skills of the 21st century, on building the foundation of a future adult who will successfully integrate into a European society, open to continuous change and development.

Postmodern education adapts daily to the needs of the society in which we live. To face new changes and keep pace with them, it is necessary to adapt and use what we have learned, thus combining traditional, classical approaches with modern ones, innovative.

The challenge of the current world requires solutions that assume a new educational paradigm, a transformation of the educational model so as to facilitate and make authentic learning accessible, to offer an interactive, personalized, creative, relevant and quality approach. (Coşarbă, E., 2023)

STEAM education (STEAM: S- Science, T. Technology, E-Engineering, A- Arts, M-Mathematics(en) was born in 2007, through the fusion of STEAM education with the arts. The term art in the context of STEAM education has been considered in different ways (Perignat, K.B., 2019): visual arts (painting, drawing, photography, sculpture, media art, design); visual arts, performing arts (dance, music, theater), aesthetics, craft arts; literal arts and humanities. Carl Jung, who proposed the archetype of the artist - scientist - and Albert Einstein who said that science and art share common roots in mystery, actually led to a slow historical perspective: the two fields have a natural affinity. Thus, since 2007, STEAM education has developed to increase students' interest and motivation in science and technology. Thus, students acquire the necessary skills to keep up with technology and obtain a profession in the 21st century. First, STEAM has the potential for innovation and overall youth achievement through the cognitive results obtained. STEAM education has been characterized according to the type of integration of disciplines as follows (K.B., Perignat, 2019):

- transdisciplinary STEAM education, which involves the total fusion of disciplines and whose main element is problem solving;

- interdisciplinary STEAM education, in which a team represents the common point between the disciplines, but respects the specific approach of each discipline;
- multidisciplinary STEAM education, which involves collaboration between several disciplines. But they do not merge;
- transversal STEAM education, in which the examination/observation of one discipline through the perspective of another discipline is practiced.

In "Educated Romania" project, a sub-chapter is dedicated, which also includes the latest option of integrating Art in the integrated teaching of these STEAM subjects. The sub-chapter that starts from Romania's poor results in PISA and TIMSS studies, which evaluate the results of students in the field of sciences, calls for "the initiation of a strategic approach, national to raise the profile of sciences in education and in society". The report mentions that this "strategic approach" is aimed at children from the pre-school level. The STEAM domain is addressed in the chapter: "Priority domains".

„Preschool education is a crucial stage of learning where children develop social, cognitive, and emotional skills that form the foundation for their future academic and personal success. The role of preschool teachers is essential in ensuring quality of education Behay”. (A. Redeş, D., Rad, A., Roman, M.D., Bocoş, 2023, pag 13).

STEAM education represents a new vision in the field of preschool education. It is a modern method that is carried out both in class and in non-formal activities. The STEAM project involves a combined approach that encourages children's hands-on experience and gives them the chance to apply relevant knowledge in the real world, thus encompassing a number of strengths (<https://plei.ro/blog/educatia-steam/>):

- arguing and capitalizing on own ideas;
- learning through application, collaboration, teamwork, learning motivation;
- personalized learning;
- development of critical thinking;
- development of communication skills, creativity;
- learning through open questions, inquiry and curiosity.

By combining the four sciences and art whose initials make up its name: S – Science T – Technology E – Engineering A – Arts M – Mathematics creates a learning environment attractive for participants in this type of education, starting from preschool age to applying the methods in everyday life. By integrating STEAM education concepts, subjects, and assessment standards we have a way to change the approach of the ordinary learning process. The introduction of the field

of ART in teaching improves and optimizes the learning process, interconnecting and integrating several fields of learning, thus providing children with a complex learning that will prepare the adults of tomorrow to successfully integrate into today's society.

“This is why a considerable number of studies use ludic or dramatic strategies in the teaching-learning process, with the declared goal of integrating the interlocutors as much as possible, of transposing them into a more manageable reality,, (E., Balaş, A., Roman, D., Rad, 2023, pag. 7)

2. Theoretical Approaches to STEAM Education

STEAM education incorporates critical design thinking and the design process to provide a solution to problem solving, providing experiential learning opportunities through which the children think critically and self-educate. Also, through this type of education, perseverance is encouraged through the understanding of mistakes, as a process in which if something did not go well, the solution is sought.

STEM stands for: SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS. This type of education has been implemented in the education system. In this teaching system, the student learns by doing, in a much more self-taught way, specifically for the system in the Nordic countries. Associated with STEM, the term STEM+ or STEM Plus refers to the application of ICT (Information and Communication Technology) in cyberlearning, which should not be confused with cyber learning, with e-learning or online learning, as they are different concepts.

The term STEAM has also taken over the artistic skills ("A" from Art) that value curiosity and the search for solutions to the same problem, but with a new creative and artistic perspective. The STEAM method was born around 2001, at Rhode Island School of Design, in the United States of America, during a workshop that brought together about 60 experts from different artistic and scientific fields. They sought to develop strategies to merge science and art while teaching new approaches to creative problem solving. Overseas, this is a widely used method today.

In STEAM education, more and more acronyms are added, and the term appeared recently (Science-Technology-Robotics - Engineering-Arts-Mathematics). Introducing robotics brings students closer to electronics, programming, mechanics, etc. Derived from STEAM, the term STEMM also appeared, the last "M" of which corresponds to Music, to also combine with the musical arts.

Traditional education versus modern education should be a topic of reflection for all those who have a role in the training and education of children.

An early introduction to the basic concepts of Steam education can help children develop critical thinking. This learning method must be applied from an early age of the child. To implement this method, teachers must teach using appropriate tools, applying in one approach the five disciplines, which, although it seems complicated, will be a game for children and everything will become natural.

Traditional education encompasses a number of characteristics, among which we mention:

- the school prepares students for life;
- the teaching staff provides children with knowledge, the learning process is a linear progression through the accumulation of information and skills;
- students are serious consumers of information;
- the content of the program is presented globally;
- the emphasis is on the acquisition of basic skills;
- the evaluation is done at the times fixed by an annual planning, etc.

Centering on the child is already a characteristic of contemporary education, which has as its purpose the optimal exploitation of it as a subject of learning. Interactive methods support modern education: "Group learning exercises decision-making and initiative capacity, gives a more personal touch to the work, but also a greater complementarity of skills and talents, which ensures greater, more active participation, supported by many elements of emulation, of mutual stimulation, of fruitful cooperation". (I., Cerghit, 2006)

Interactive methods: create skills, facilitate self-paced learning, stimulate cooperation not competition, are attractive, can be approached from the point of view of different learning styles. STEAM education is a challenge of the modern, technological world. Unlike the classic lessons in the traditional education system where the teacher teaches the students, STEAM is an active, applied, constructivist method of "learning by doing". Children of all ages should be encouraged to think deeply so that they have the chance to become innovators and leaders who can solve the most pressing challenges facing our future. Projects like STEM and STEAM lay the groundwork for an openness to concepts that would normally be encountered much later and much more theoretically.

The advantages of STEM/STEAM education are multiple, among which we mention:

- the STEM and STEAM projects promote learning through experience, through direct exploration and investigation, and engaging

as many senses as possible will help them remember what they learn more easily, so that children create and explore learning;

- STEM/STEAM education includes real world problem solving activities, by creating real situations that have applicability in everyday life;
- integrating Art with Science in a fun way, so children learn to connect seemingly opposite subjects; children work together, find solutions and solve problems;
- encouraging curiosity and analytical thinking through: experiment, questioning, investigation and exploration;
- providing greater control over learning, and when children are in control they care more, will be more engaged and willing to make things happen.

Postmodern education adapts day by day to the needs of young people who are preparing for a future in which the key to success is knowing how to adapt and use what you have learned for continuous change.

The "STEAM educational concept", is referred to as flexible and usable by all educational actors, which harmoniously combines thinking and planning of student variability as a key component towards the design of inclusive and humanistic educational experiences. In addition, STEAM education exponentially contributes to the "catalysis" of the student's creativity, to the individualization of the educational process, to providing the possibility for the 21st century learners to develop, to apply collaborative problem-solving tools and soft skills. (P.Ch.S., Taylor, 2016) The 21st century offers many technological processes resulting from the research of scientists and engineers in higher education institutions, industries, national and international laboratories.

The STEAM concept is a means to bring more innovation and creativity to education. As an educational program it helps embed all activities, lessons and class cohesion, pushing students to further embrace the experiential learning environment.

STEAM education can be applied both within the instructional-educational activities carried out in the kindergarten, as well as within the extracurricular, non-formal activities carried out in the state environment and the private environment within the clubs and educational centers, respectively within the holiday clubs. STEAM education in preschool age is not limited to the accumulation of knowledge. Children will learn through experiential learning activities and become curious and creative, this period will determine how children relate to learning throughout school and life. (Dughi & Torkos, 2022) Meaningful learning also takes place in an informal,

non-formal environment, taking place throughout life as a permanent, complementary, but essential process. (A.F., Roman, 2014)

3. Practical Approaches to STEAM Education

We exemplify an extracurricular activity from the non-formal environment:

Level: II, 5-6 years

Subject of activity: Thanksgiving Day

S. SCIENCE – SCIENCE CLUB entitled: "FUN SCIENCE CLUB" :

- Curiosities about poultry;
- Carrying out experiments:
 - "The turkey swelled up!" (ingredients and materials: plastic netting, markers, water, watercolors, Alka Seltzer effervescent tablets);
 - "Dancing corn" (ingredients and materials: corn kernels, mineral water, vinegar, glass cup);
 - "How do leaves change colors?" (materials: glass jars, autumn leaves, coffee filters, scissors, isopropyl alcohol, food plastic film).
- Conversation: "What is the meaning of Thanksgiving?" (reading pictures about customs and traditions from other countries)
- Autumn story: "About gratitude" (explanation of the term "gratitude").

T. TECHNOLOGY – TECHNOLOGY CLUB entitled: "KIDS TECH CLUB":

- Power Point Presentation on "Thanksgiving", new images and information;
- Using the telephone to photograph the activities carried out;
- Using cookie cutters to get turkey-shaped bread;
- Using plastic knives to cut vegetables;
- Assembling the turkey using the bread forms and cut vegetables

E. ENGINEERING – ENGINEERING CLUB entitled: "GREAT BUILDERS CLUB":

- Making: "The turkey coop" (materials: marshmallows, toothpicks, toilet paper rolls, straws, chopsticks, adhesive tape, template for the image of the turkey);
- Construction game: "Friendly turkeys" (making the construction out of lego pieces);
- Exploring the concept of merging

A. ART - CREATION AND ART CLUB "ART KIDS CLUB":

- Collage: "Happy Turkey" (making a collage using the following materials: colored feathers, turkey template, glue);
- Artcraft: "Turkey Hats" (materials: turkey template, colored cards, scissors, glue, feather template, turkey eyes);
- "Congratulations for Thanksgiving" (cards, palm print with the child's name, autumn decorations)

M. MATHEMATICS – SMART KIDS CLUB called: "SMART KIDS CLUB":

- Didactic game: "How many feathers does the turkey have?" (numbering within the limits of 1-10);
- Developing the ability to understand and use numbers, using an appropriate vocabulary;
- Solving the proposed math worksheet, which contains integrated elements from the following fields: Science Field, Language and Communication Field, Aesthetic and Creative Field

4. Conclusions

Through this approach, children will form Steam-type skills: mathematical skills and basic skills in science and technology, as well as artistic skills, and this will contribute to the harmonious development of the individual and the formation of new skills and competencies necessary for successful integration in society.

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