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## BEST PRACTICES OF STEAM SKILLS DEVELOPMENT IN HE

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**Abstract.** The interest for the STEAM educational concept that promotes the learning through the key of 5 study - science disciplines, technology, engineering, arts, mathematics, has increased in the last decades both worldwide and in the Republic of Moldova, highlighting the need to develop the skills associated with these disciplines. The implementation of the STEAM educational concept in the education in the country comes as a basic objective stipulated in the Moldova's National Strategy for Education 2030. From here we also deduce the conclusion that the curriculum of the Business and Administration study program, within the TUM, must be subject to the process of reconfiguration and adapt to the new requirements of the educational field.

The research in question is dedicated to the analysis of the best practices of implementing STEAM skills in the universities of the European Union. The given analysis will allow us to better understand the importance of implementing STEAM competences in higher education in the Republic of Moldova, to ensure a quality education.

**Keywords:** *Education, Higher education, Skills, STEAM, Sustainable development.*

**JEL code:** *I21, I23, I25*

STEAM (Science, Technology, Engineering, Arts, and Mathematics) skills education is becoming increasingly important in today's world, where technology is advancing rapidly, and innovation is a key driver of economic growth. Moldova's National Strategy for Education 2030 recognizes the importance of STEAM skills education in achieving its goals, which include providing quality education and promoting sustainable development.

Moldova's National Strategy for Education 2030 aligns with the United Nations' Sustainable Development Goals (SDGs), which are a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity. STEAM skills education is essential for achieving several of the SDGs, such as Goal 4 (Quality Education), Goal 9 (Industry, Innovation, and Infrastructure), and Goal 12 (Responsible Consumption and Production) [1].

By incorporating STEAM skills education into its national strategy for education, Moldova can help its students develop the skills they need to become innovators, problem-solvers, and critical thinkers. These skills are not only essential for the future workforce but are also necessary for addressing global challenges such as climate change, poverty, and inequality.

Furthermore, STEAM skills education can help Moldova promote sustainable development by encouraging students to explore innovative solutions that are environmentally friendly and socially responsible [2]. For example, by teaching students about renewable energy sources or sustainable agriculture practices, Moldova can empower its citizens to make informed decisions that protect the environment and promote economic development.

Moldova's new National Development Strategy 2030 places a strong emphasis on sustainable development and recognizes the importance of integrating education objectives into the SDGs. The strategy includes several provisions aimed at promoting education as a key driver of economic growth and social progress [1].

One of the main provisions of the National Development Strategy 2030 is the promotion of lifelong learning, which is essential for achieving SDG 4 (Quality Education). The strategy aims to provide access to education and training opportunities for all citizens, regardless of their age or

background. This includes promoting early childhood education, vocational education and training, and higher education, as well as adult education and training.

The National Development Strategy 2030 also recognizes the importance of STEAM education, which is essential for achieving several of the SDGs, including SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production). The strategy aims to promote the development of STEAM skills in students through the integration of science, technology, engineering, arts, and mathematics into the curriculum.

Another important provision of the National Development Strategy 2030 is the promotion of inclusive education, which is essential for achieving SDG 10 (Reduced Inequalities). The strategy aims to promote equal access to education for all citizens, regardless of their gender, ethnicity, or socioeconomic status. This includes promoting gender equality in education, as well as providing support for students from disadvantaged backgrounds.

Furthermore, the National Development Strategy 2030 recognizes the importance of education in promoting sustainable development and achieving several of the SDGs. The strategy aims to promote education for sustainable development, which includes teaching students about environmental sustainability, social responsibility, and ethical values. This includes promoting the use of sustainable practices in education, as well as promoting research and innovation in sustainable development.

There are several key initiatives, policies documents, and non-policy documents, and recommendations for transversal skills development in education and training fields, both at the national and international levels, such as the following:

1. The European Commission's New Skills Agenda for Europe: This initiative aims to ensure that people develop the skills they need for the jobs of today and tomorrow. It includes measures to promote the development of transversal skills, such as digital skills, entrepreneurship skills, and problem-solving skills.

2. UNESCO's Education 2030 Framework for Action: This policy document sets out a comprehensive vision for education and includes a strong emphasis on the development of transversal skills. It recognizes the importance of skills such as critical thinking, problem-solving, creativity, and communication skills for achieving the SDGs.

3. The World Economic Forum's Future of Jobs Report: This report highlights the importance of transversal skills development in preparing workers for the jobs of the future. It identifies skills such as complex problem-solving, critical thinking, and creativity as some of the most important skills for the future workforce.

4. The OECD's PISA Global Competence Framework: This framework identifies the key transversal skills that students need to succeed in a globalized world. It includes skills such as intercultural understanding, empathy, and respect for diversity, as well as critical thinking, problem-solving, and communication skills.

5. The Moldova National Qualifications Framework: This document provides a framework for the development of qualifications in Moldova and includes a strong emphasis on the development of transversal skills. It recognizes the importance of skills such as problem-solving, communication, and teamwork skills for the future workforce.

Overall, these initiatives, policies documents, and non-policy documents, and recommendations demonstrate a strong consensus around the importance of transversal skills development in education and training fields. They recognize that these skills are essential for preparing individuals for the jobs of the future and for achieving sustainable economic growth and social progress.

The provisions embedded in Moldova's new National Development Strategy 2030 demonstrate the country's commitment to achieving the SDGs through the integration of education objectives. The strategy recognizes the importance of lifelong learning, STEAM education, inclusive education, and education for sustainable development in achieving sustainable economic growth and social progress. By promoting these objectives, Moldova can help create a better future for all its citizens.

The Republic of Moldova performs below the regional average in all GII pillars. The Republic of Moldova performs above the upper-middle-income group average in four pillars, namely: Human capital and research; Market sophistication; Knowledge and technology outputs; and, Creative outputs.

The strengths that led to Moldova’s rise in the ranking are: Utility models by origin, Loans from microfinance institutions, Trademarks by origin, Industrial designs by origin, etc.

The same ranking also reveals the weaknesses of the country such as: Domestic market scale, State of cluster development and depth, Policies for doing business, Logistics performance, University-industry collaboration, etc.

Strengths and weaknesses for the Republic of Moldova are presented in Table 1.

**Table 1. Strengths and weaknesses for the Republic of Moldova**

Strengths			Weaknesses		
Code	Indicator name	Rank	Code	Indicator name	Rank
2.1.1	Expenditure on education, % GDP	13	1.3.1	Policies for doing business	107
2.1.2	Government funding/pupil, secondary, % GDP/cap	23	2.3.3	Global corporate R&D investors, top 3, mn USD	38
4.1.3	Loans from microfinance institutions, % GDP	5	2.3.4	QS university ranking, top 3	72
4.3.1	Applied tariff rate, weighted avg., %	14	3.2.2	Logistics performance	106
6.1.3	Utility models by origin/bn PPP\$ GDP	1	4.3.3	Domestic market scale, bn PPP\$	118
6.2.1	Labor productivity growth, %	19	5.1.3	GERD performed by business, % GDP	74
6.3.4	ICT services exports, % total trade	13	5.2.1	University-industry R&D collaboration	101
7.1.2	Trademarks by origin/bn PPP\$ GDP	8	5.2.2	State of cluster development and depth	114
7.1.4	Industrial designs by origin/bn PPP\$ GDP	13	5.3.5	Research talent, % in businesses	67
7.3.4	Mobile app creation/bn PPP\$ GDP	22	7.1.3	Global brand value, top 5,000, % GDP	77

Source: compiled by the authors on the basis of [1].

The highest place occupied by the Republic of Moldova in this ranking was 39 in 2011[3].

According to the 2022 edition of the Global Innovation Index, Switzerland leads the ranking, maintaining its top position since 2011. It is followed by the United States, Sweden, the United Kingdom and the Netherlands.

Analyzing the best practices at EU& international level of STEAM skills implementation, we would like to present the example of the European University of Cyprus [4], how the training of specialists with project thinking, management training and flexible skills to meet the needs of the modern economy is carried out in practice.

One successful example of the use of a unified system of training in the university in question is the master's program in the School of Humanities, Social & Education Sciences: Technologies of learning & communication and STEAM education [5].

This curriculum addresses the market demand for educators with skills in the design and application of contemporary learning environments, educational tools and educational materials using emerging technologies.

Training takes place in Greek in a distance learning format, lasting 18 months, UST: 90.

Integrative education trains teachers, administrators, and other education professionals with a deeper understanding and specialization in new technologies.

The analysis of practical implementation is done in tabular form based on the basic principles [5] of the STEM-education training model (Table 2).

**Table 2. Practical implementation of STEM-education model by the example of the training program „Technologies of learning & communication and STEAM education”**

The basic principles of the STEM education model	Practical application within the framework of the European University of Cyprus, Master's Program
Interdisciplinary nature of learning	The educational curriculum under consideration helps to move the student's thinking from the traditional learning model to one that builds learning communities within the digital world of cloud technologies, on-line learning and multi-media [6]. In this way a connection between several disciplines is ensured.
Creativity and innovation	Graduates of this program become teachers, managers and leaders in the education sector who are capable of bringing about change using these evolving technologies [6].
Project form of the educational process	The curriculum provides for the development of project thinking and teamwork skills ("agile" skills) through close interaction between students and faculty, the provision of student services and modern technology through the active collaboration of members of the teaching community with businesses, and a commitment to online learning [7]. The distance format of training students in this program allows the university to attract qualified teachers. At the same time, students can plan their schedule more freely and do not depend on dormitories or rental housing.
Practical focus	The program offers coursework in distance and e-learning, educational multimedia and Internet applications in learning and communication to equip students with tools they need to develop programs using these new technologies [7].
Choice of disciplines	The curriculum [6, 8] provides for the study of a number of compulsory core disciplines (Compulsory Core Courses and Compulsory Concentration Courses), which together allow the student to accumulate 60 credits, 10 for each of the compulsory disciplines. At the same time, in order to accumulate the required number of cumulative credits (90 credits for the entire period of study) a student can choose either to develop a thesis (30 credits) or to select three alternative courses within the Master's program in Education, including one of them can be from another Master's program (with at least equal ECTS and with the approval of the coordinator) to complete the program requirements.
Critical Thinking	The course allows students to redefine their professional identity and have the potential to continue their studies on a doctoral level [9].

Source: compiled by the authors on the basis of [5, 6, 7, 8, 9].

Thus, the new educational paradigm applied by the European University of Cyprus as an example of the training program "Technologies of learning & communication and STEAM education" provides training of STEM personnel in three main areas:

1. Personalization of education through an individualized learning plan, which corresponds to the needs of future employers.
2. Development of team leadership skills and teamwork experience.
3. The use of blended learning formats.

The rapid development of information and communications technology fundamentally changes our lives, in all its diversity. Education is no exception. In essence, it is susceptible to innovations, not only those of technological character, but also to the innovations that concern the very essence of the educational process.

During the last decades, teachers in higher education institutions in our country have accumulated a certain experience in the use of information and communication technology in the educational process. However, if previously computers were used only in computer science lessons

and only in specialized laboratories, today they are found in every classroom. Moreover, personal computers, especially notebooks, tablets and smart phones connected to local and global networks, are becoming learning tools accessible to the general public, as are books. Consequently, every teacher, regardless of the teaching discipline, has the opportunity to make use of the latest innovations in the field of information and communication technology in their daily practice.

Therefore, the research carried out leads us to think that the STEAM educational concept, being relatively new for the field of Education in the Republic of Moldova, quite important for the socio-economic development of the country, has been less publicized and to a lesser extent explained and promoted among teaching staff.

There are still many things to be done to support that we have an education focused on the development of STEAM skills, skills that are so necessary for the 21st century.

Based on the analysis made in the given report, we come up with the following conclusions and recommendations:

1. Internationally, there are several approaches in defining STEAM skills, the main ones being those recommended by the European Union. Broadly speaking, the Republic of Moldova followed the model recommended by the European Union, however, both in the academic environment and in the practice of Moldovan curriculum development, there is no common vision on how the actual competencies should be defined and formulated. Consequently, the Moldovan curricular policy documents remain heterogeneous, a fact that disorients, to a certain extent, the teaching staff and management staff in educational institutions.

**Recommendation's:** Here the emphasis should be placed on the modernization of the curricula, and at the same time the forces and knowledge of STEAM scientists should be concentrated to produce guides, models of concrete examples focused on the STEAM conceptual approach.

2. Overall, the methodologies for evaluating the level of training and development of STEAM skills, implemented by the Ministry of Education of the Republic of Moldova, correspond to European trends. An indisputable achievement of the Moldovan educational system is the transition to methodologies for evaluating the skills acquired by students based on processes and products. At the same time, the efforts of the authorities were less consistent in ensuring the participation of our country in international evaluations. This fact creates significant difficulties in the objective and relevant assessment of the achievements of the Moldovan educational system in comparison, for example, with the educational systems of Poland and Cyprus.

**Recommendation's:** Teachers must be well trained because in many cases insufficient training leads to demotivating results for both the teaching staff and the student. It is also necessary to emphasize the need to revise the initial training programs for teachers, to emphasize the elements of STEAM learning, because teachers are the ones who must provide students with quality STEAM educational experiences.

3. The research carried out leads us to think that the STEAM educational concept, being relatively new for the field of Education in the Republic of Moldova, quite important for the socio-economic development of the country, has been less publicized and to a lesser extent explained and promoted among teaching staff. There are still many things to be done to support that we have an education focused on the development of STEAM skills, skills that are so necessary for the 21st century.

**Recommendation's:** To create within each university in the Republic of Moldova, a center for the development and promotion of STEAM skills. this would also be a support in ensuring a sustainable development of the university.

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