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2020-1-TR01-KA227-ADU-098071
INTERGENERATIONAL LEARNING FOR ADULT LEARNERS THROUGH STEAM: FROM THE POINT OF HOFSTEDE'S 6D MODEL (STEAM PLUS)

STEAM and Adult Education Knowledge Pack

Culture vs Creativity Portfolio

IO1:
Culture vs Creativty;
STEAM Literacy Questionnaire

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STEM/STEAM

STEM is an acronym that encompasses the fields of Science, Technology, Engineering, and Mathematics. STEM education aims to help students understand the relationships between these disciplines and develop skills such as critical thinking, problem-solving, and creativity. STEAM is an extension of STEM, incorporating the concept of Arts. This approach believes that art plays a significant role alongside science and technology. The addition of art aims to provide students with creative thinking, aesthetic understanding, and design skills.

Seen as one of the ways to invest in the future for economic prosperity and a good life, STEAM is an education approach that involves many components. This educational approach can be implemented in schools as part of the curriculum or in after-school STEAM communities. Additionally, processes such as robotics applications, developing one's own device, or project-based manufacturing serve as methods within this educational approach. One significant reason for integrating art into STEM education is to enhance the 'imagination and aesthetic' understanding perceived to be lacking in the training process applied by engineers and scientists when creating products or developing projects for the service sector. For instance, a student may learn physics, mathematics, and biology to create a robot but needs art to shape the form, structure, and aesthetic aspects of the robot (Mercin, 2019: 28-30).

Adult Education

Adult Education," generally involves education programs provided to support individuals' personal or professional development. In a global context, where knowledge and skills rapidly become outdated and insufficient, it is inevitable for individuals to continuously benefit from adult education services, regardless of their level of education. Therefore, adult education stands out as a critical service that shapes the future of individuals and communities. The effectiveness and quality of the adult education system involve the ability to generate knowledge, utilize innovations stemming from new scientific discoveries, and thus maintain a constant state of being "contemporary. The vital importance of adult education services in the global world can be understood by comprehending the challenges and potential drawbacks that globalization brings to adult education. Overcoming these challenges and seeking solutions to address potential issues is necessary to adopt an effective strategy in this field (Miser, 2002: 56).

Globally, key topics that researchers primarily focus on in the field of adult education include learning processes in adults, group dynamics, teaching methods, managerial and organizational processes, evaluation, and participation. Research projects have shown significant interest in participation events, mainly because it is easier to develop research projects related to the attitudes, interests, and characteristics of participants (Lowe, 1985: 214).

Adult education, by enabling individuals to continue learning and developing, can contribute to increasing the overall knowledge and skill levels of society. The history of education research in Turkey, including adult education, should be evaluated in conjunction with research in the general education field. Developments such as inviting Western experts, translating foreign literature, and sending educators abroad were factors that increased interest in educational science in Turkey in the early years of the Republic. The institutionalization process of educational sciences began with the introduction of "terbiye" (education) courses in the Philosophy department of Istanbul University in 1922 and reached a significant stage with the establishment of Ankara University Faculty of Education (Sciences) in 1965. However, it is observed that research in the field of adult education intensified in the 1960s, parallel to the adoption of the understanding of treating education as a science. The establishment of the Ankara University Faculty of Education (Sciences) in 1965 made a significant contribution to the academic development of adult education as a discipline (Yıldız, 2004: 78-79).

Since that time, various individuals in Turkey have conducted research on adult education. The data from these studies are mostly based on descriptive statistics, and assessments determining needs and situations are made. In this context, adult education in Turkey is still an emerging field, and therefore, efforts should be made to increase the quality and quantity of research in adult education.

General Overview of STEM/STEAM Implementation/Education Worldwide

STEM education is implemented in many places worldwide. These applications take place in schools, museums, science centers, special education programs, and various organizations. STEM was initially expressed as SME&T in a report published by the National Science Foundation (NSF) in 1996 (NSF, 1996). This approach, initially referred to as SME&T, later adopted the name STEM. STEM is an abbreviation formed by the combination of the first letters of Science, Technology, Engineering, and Mathematics. The STEM approach signifies the integration of these disciplines with each other over time.

Countries have implemented various programs with the dual goal of spreading quality education equitably to all segments of society and enhancing the quality of education. In 1996, the United States (US) developed a curriculum program under the National Science Education Standards, guiding states and schools on what and how to teach in the field of science. The aim of this program is to provide students with an inquiry-based learning experience in classrooms and to adopt an approach that prepares students for real-life, prioritizing the needs of the modern workforce. STEM has received significant support both in the US and in different countries worldwide. Many countries have been influenced by the STEM movement in the US and have developed various STEM programs. However, due to the diverse interpretations of what STEM entails, there is a variety of implementations (Akgündüz et al., 2015: 10-11).

STEAM is considered a key to preparing students for analytical and creative thinking. In this context, the United States, particularly in 2008, financed STEM education projects and encouraged the spread of STEM education from preschool to postdoctoral levels throughout the country (Mercin, 2019: 30). For instance, a STEAM undergraduate program has been established at Potsdam University. In this program, developers from fields such as art, music, theater, biology, psychology, chemistry, computer science, mathematics, physics, and business have come together. This is because undergraduate programs that encompass both art and STEM disciplines benefit professionals like astronomers, geologists, analysts, quantum linguists, robot engineers, medical mathematicians, and crypto privacy engineers (Land, 2013: 550).

The European Schoolnet, with the participation of education ministries from 30 European countries, aims to promote innovation in education through various projects. Operating since 1997, this network has pioneered many STEM-focused projects such as "eSkills For Jobs 2016, European Schoolnet Academy, I-LINC for Information Accessibility in Learning (ICT4IAL), Scientix, STEM Alliance.

In the United Kingdom, in 2004, the "Science, Technology, Engineering, and Mathematics (STEM) Program" was established with the aim of enhancing skills in science, technology, engineering, and mathematics. This program aspired to position the United Kingdom as a global leader in scientific and technological advancements.

Holland aimed to make changes in its education systems through a plan spanning from 2004 to 2010, focusing on increasing the knowledge, skills, and abilities of future innovative workers in the field of STEM education. The workforce action plan, particularly concentrating on boosting the number of scientists and engineers, aims to increase the number of experts in these fields within the country's population (Gülgün et al., 2017: 463).

Rusya has primarily focused on improving the quality of higher education institutions in its national education policies. Through newly established programs, Russia continues its efforts to address shortcomings in the education systems. The government is implementing three main strategies in STEM education: enhancing the quality of engineering programs, improving mathematics education, and aiming to develop engineering, medical, and natural sciences programs at higher education institutions under the leadership of universities (Morrison, 2006).

Norway places significant importance on STEM education as a priority area in its national policies. Since 2002, Norway has developed a development and strategy plan known as "STEM of course." The key goals of this plan include: enhancing students' abilities in STEM education, supporting more effective learning and motivation by renewing STEM practices, reducing the number of students with low levels of proficiency in mathematics and science education, increasing the number of students talented and compatible in STEM, and ensuring that all teachers from preschool to secondary education have a certain level of STEM teaching skills (Gülgün et al., 2017: 462-463).

India has been taking significant steps towards development in the field of STEM (Science, Technology, Engineering, and Mathematics), despite the recent integration of the STEM concept into its education system. In the past decade, there has been a proliferation of STEM education companies, contributing to progress (Peer, 2017). The awareness that pursuing a career in STEM can lead to globally competitive opportunities has been further strengthened by the "Make in India" initiative launched by the Indian Government. This initiative aims to produce qualified graduates, especially in the fields of science, technology, engineering, and mathematics, by academic institutions in the country. Under the slogan "Together for Complete Development," the initiative aims to reach every corner of the country, encouraging participation in education and research activities across the entire society (Krishnan and Hariharan, 2016).

China, with a rich historical tradition, has placed great emphasis on science education, emphasizing the vital importance of scientific disciplines in elevating the society's welfare. Within China's distinctive education system, the teaching of science and technology has a unique structure. This structure, coupled with the integration of STEM education, has made biology, chemistry, and mathematics courses mandatory at the high school level. In higher education, STEM education has been further developed, and interest in STEM applications has increased in the last six years. Various innovations have been introduced into the curriculum to capture the interest of students in STEM applications in grades 10-12. These changes have not only been tailored to students but have also been adapted to teacher training programs that incorporate STEM topics, aiming to engage not only students but also educators in the realm of STEM (Morrison, 2006).

South Korea, closely monitoring advancements in science and technology worldwide, has embraced the STEAM (Science, Technology, Engineering, Arts, and Mathematics) education model. Rather than implementing STEM (Science, Technology, Engineering, and Mathematics) as an integrated education approach, South Korea, through the Ministry of Education, Science and Technology (MEST), has adopted the STEAM approach by incorporating the discipline of arts alongside the four main disciplines (Ceylan, 2014: 10).

In 2011, France formulated a strategic plan for STEM education. The primary objective of this plan is to integrate science and technology topics more effectively into middle school curricula. Additionally, it aims to prepare projects across different disciplines through STEM education to increase students' interest. The action plan of the French Ministry of National Education also identifies the improvement of teacher training related to the use of experimental materials at the middle school level as a significant goal (Gülgün et al., 2017: 463).

Malaysia, with the initiation of the New Economic Model (NEM) in 2010, has embraced the goal of becoming an inclusive and sustainable nation by the year 2020. The NEM focuses on promoting economic growth by increasing labor productivity and aims for development across all sectors of society. Concurrently, the Science, Technology, and Innovation National Policies (NPSTI) 2013–2020 has concentrated on strategies for Malaysia to become a sustainable and inclusive knowledge-based economy. Both the NEM and NPSTI underscore the crucial role of STEM education in achieving a vision of a scientifically advanced nation with socio-economic transformation and inclusive growth for both men and women. Furthermore, the strengthening of STEM is a significant element in Malaysia's Education Blueprint 2013–2025, which was formulated after a comprehensive review (Azkın, 2019: 3-4).

In 2011, Malta published a strategic plan for STEM education. A collaborative working group consisting of the state university, private universities, and church-affiliated universities was formed to update middle school-level science programs. With these updates, students in lower-level classes were identified, and proposals were made for them to progress to higher levels. Talented students were granted the freedom to choose the science branch they desired. Among the objectives of the strategic plan are: examining and adapting various science programs and research processes, changing pedagogical processes effective in science education, focusing on learning outcomes along with processes in the curriculum, and incorporating the interpretation of TIMSS and PISA exam results into the strategy plan (Gülgün et al., 2017: 463).

In 2014, Singapore established a Science Centre and initiated a Science, Technology, Engineering, and Mathematics (STEM) applied teaching program. The Ministry of Finance in Singapore allocates special resources for the establishment of the science center and the implementation of the program. This program provides middle school students with the opportunity to apply what they have learned in STEM subjects to solve real-world problems and gain practical skills. The Science Centre offers interactive experiences in various fields, including food science and technology, health science and technology, engineering and robotics, information and communication technology and programming, material science, environmental science and sustainable living, transportation and communication, and simulation (Asin, 2014).

Lithuania has shifted its focus from STEM to STEAM (Science, Technology, Engineering, Arts, and Mathematics) and has adopted this approach in its action plans spanning from 2015 to 2020. One of the primary objectives of the action plan is to conduct creative and innovative initiatives to increase students' interest in the STEAM field. The goals of the plan include modernizing the curriculum, enhancing student achievement, improving teachers' competencies in STEAM, and increasing the popularity of STEAM in society (Azkın, 2019: 10).

Finland has implemented a comprehensive plan in the field of STEM education, which is the most extensive framework among its kind. Initiated in 2014, this plan aims to create social working groups to increase young people's interest and abilities in STEM education and careers. These groups aspire to serve as cultural and educational leaders. Additionally, there is a framework in place for institutes and universities to determine their own STEM education strategies (Gülgün et al., 2017: 463).

General Overview of STEM/STEAM Practices and Education in Europe

In the report titled "Science Education Now: Renewed Pedagogy for the Future of Europe," published by the European Union in 2007 (Rocard et al., 2007), it was emphasized that science and technology education across Europe raised concerns. The report particularly highlighted a significant decrease in the interest of young individuals in the fields of science, technology, and mathematics. It underscored that without effective action plans, Europe's long-term innovative capacity would significantly diminish. The relevant report not only addressed science and technology education in schools but also emphasized the importance of acquiring knowledge usage skills that enable society to sustain itself and adapt to the scientific and technological atmosphere of our era.

Following the preparation of this report, the European Union provided opportunities for collaboration among researchers across Europe by issuing project calls in the science and society domain aimed at renewing science and technology education on a pan-European scale and implementing inquiry-based science education as specified in the report. Under the 7th Framework Programme, which was implemented between 2007 and 2013, several projects involving partners from Turkey, such as PROFILES, S-TEAM, MASCIL, SAILS, ARK OF INQUIRY, were supported. After the conclusion of the 7th Framework Programme, the Horizon 2020 program commenced between 2014 and 2020 (HORIZON 2020, 2015). (Akgündüz et al., 2015: 16).

General Overview of STEM/STEAM Practices and Education in Turkey

If applications are developed with different perspectives on a national scale in Turkey, it is believed that a unique contribution will be made to the STEM knowledge base. There is an obligation to cultivate a generation in schools that is interested in STEM fields, innovative, entrepreneurial, and capable of creative thinking in order to achieve the miracle created by Japan in the 1980s and South Korea in the 2000s in Asia in Turkey (Akgündüz et al., 2015: 20).

A comprehensive report has been prepared by the Ministry of National Education (MEB) for the integration of STEAM education into our education system to sustain the economic development of our country. This report was created by a team of experts working within the Ministry of National Education's Directorate of Innovation and Educational Technologies, with academic experience in STEAM education. In the report, STEAM education is first defined, and its origins and objectives are explained. Additionally, STEAM education studies conducted in various regions of the world, including the United States and European countries, were examined, and the situation in our country was discussed. Prominent recommendations in the report include the establishment of STEAM Education Centers, support for STEAM education research, training of teachers in STEM education, adaptation of curriculum to be compatible with STEAM, and the creation of STEAM education environments in schools. The report also notes that there were goals for strengthening STEAM in the 2015-2019 Strategic Plan, but a direct action plan was lacking. The report highlights TÜSİAD's emphasis on the importance of STEAM education, suggesting the need for strategies and supporting not only employment planning but also research and development (R&D) investments. It is mentioned that the TÜBİTAK's project works and competitions, as well as science and art centers opened by TÜBİTAK, stand out among the organizations supporting STEAM education in our country. The STEAM teacher training program prepared by Bahçeşehir University is also noted as the first professional development program of its kind in our country (Erdoğan, 2020: 306).

The Ministry of National Education took significant steps in the field of STEM education with the release of the STEM Education Report in 2016, the STEM Teacher Training Handbook in 2017, and the Curriculum Reports in 2018. Furthermore, numerous initiatives related to STEM education and approaches have been undertaken by private schools, universities, and business environments. Some noteworthy examples include the Hacettepe Laboratory for Science, Technology, Engineering, and Mathematics Education and Applications, METU Science, Technology, Engineering, and Mathematics Education Application and Research Center, Özyeğin University STEM Academy, STEM& Makers Fest Expo events, Istanbul Aydın University STEM School and STEM Teacher Program, and the TÜSİAD STEM+A Project. Additionally, the Turkey Scientific and Technological Research Council (TÜBİTAK) incorporates activities supporting STEM education in its project calls (Altunel, 2018: 5).

METU Design Factory provides STEAM education. The purpose of this unit is defined as "to ensure that researchers and students working in design, engineering, informatics, social-administrative sciences and other related fields develop new products in interaction and cooperation with the industry by forming interdisciplinary teams" (Tasarım Factory, 2018).

We need an educational culture that gives individuals responsibility, makes them think, makes them make mistakes, equips them with technological knowledge such as computer programming from an early age, values solidarity and instills an entrepreneurial spirit. Creating such an educational culture will make it possible to raise a generation that understands science, mathematics, engineering and computers and creates products using their skills in these fields. Therefore, STEM is of great importance for Türkiye. In this context, education policies and programs need to be developed considering the needs of the country within the scope of STEM education, entrepreneurship (STEM-Entrepreneurship, STEM+E), art/design (STEM-Art, STEAM) and programming (STEM-Computing, STEM+C) (Akgündüz et al.). , 2015: 20).

How would you define the STEAM approach? Are you using STEM or STEAM including Arts? Since when have STEAM activities been practiced (taught) in your country?

Turkey

Nowadays, students in many countries; They aim to raise students as productive individuals who contribute to economic and social developments and have 21st century skills. With the developments in technology, the need for individuals who research, think, question and find new ideas is increasing day by day. For this reason, STEM (Science, Technology, Engineering, Mathematics) education has been included in the curriculum of many countries in the world. STEM education; It is an interdisciplinary approach that aims to transform theoretical knowledge into practice, products and innovative inventions.

Two different views prevail in the literature on STEM education. The main difference between the two views is that the word "science" is accepted as science in one and as science in the other. The second of these views is more accepted than the first. The first and most common view accepts STEM as science, technology, engineering and mathematics and limits the field to only positive sciences. In the second view, it includes social and human sciences in addition to positive sciences. It is observed that the first view is used more widely in formal or informal STEM education in Turkey (Altunel, 2018,1)

The place of technology in human life continues to increase day by day. The ability to adapt to technological developments that directly affect the quality of life is directly proportional to the age of individuals and the education they receive. It is not a healthy attitude to evaluate technological developments solely on their own, isolated from environmental conditions and paradigm shifts that mark the time. Based on this perspective, new perspectives that blend social and physical sciences are needed. STEAM education is generally given with an emphasis on science and has some deficiencies in this respect. The regional conditions where training is provided should be taken into consideration, and the deficiencies of disadvantaged regions should be eliminated. Introducing young people and adults to scientific and technological developments from an early age and increasing their awareness of the opportunities offered by modern technologies will not only contribute to their personal development processes but also offer them many advantages in school and business life. However, most of the training provided in this field is not at the desired level for various reasons and is introductory in nature. Regardless of their age, most individuals receiving education cannot instill the necessary curiosity. This situation appears as a great loss in terms of human capital in the country.

Conceptually, STEM is in parallel with the international field in Turkey; It is defined as an educational approach that aims to enable individuals to identify problems and produce practical and accurate solutions to these problems with an interdisciplinary approach from pre-school to higher education by bringing science, technology, engineering and mathematics together. There is almost no art in STEM/STEAM education, which is carried out explicitly and implicitly in Turkey. Education in this field, which is still new for the country, is mostly carried out with an emphasis on STEM. However, recently, art education has been tried to be included in the process, although it is not at the desired level. In this inclusion process, it seems that a singular understanding rather than an interdisciplinary approach is more dominant.

The historical development of STEM education in Turkey can be examined in two phases. This period, which can be called the covert period, begins with the opening of Science High Schools within the framework of US-Turkey relations (Establishment of the first Science High School: Ankara Science High School in 1964). The establishment of Science and Art Centers (BİLSEM) in the 90s and the updates in educational programs in the 2000s are one of the steps in the ongoing development process of STEM education. The explicit period can be considered as a reflection of the STEM approach in the USA after 2010 and as a whole of the implicit period. After this date, many activities have been carried out and continue to be carried out in the field of STEAM by the public and private sectors. Recently, as a result of field studies carried out by the Ministry of National Education, Design and Skills Workshops have been opened in schools. Activities focusing on Science, Engineering, Design and Art are organized in these centres. Additionally, as a result of the joint efforts of the Ministry of Youth and Sports, TUBITAK and the Turkish Technology Team Foundation, Try-Do Technology workshops are being established in every province. Additionally, the opening of STEM centers within MEB institutions continues (Özcan,2021,8). The number of STEAM centers established in universities and Science Centers established with the support of the Ministry of Science and Technology is increasing day by day.

Austria

STEM is recognized as abbreviated "MINT" in Austria, with the initials MINT standing for Mathematics, Informatics, Sciences, and Technical topics. Schools are invited by the government to apply to become designated "MINT" schools. The school must provide STEM-based subjects, projects, and initiatives in teaching and teacher education to receive this certificate (CPD). The STEM specialization school intends to ensure that all aspects of STEM are represented equally (Wong, Dillon und King, 2016).

The principles of STEM education have been represented in Austrian schools for over a decade (Amon et al. 2021). Later, A was added to STEM, and it signifies art. In Austria, STEAM stands for Science, Technology, Engineering, Arts, and Mathematics disciplines, as academic and learning disciplines. Austria is active in STEM research and education and has achieved international success. Universities, universities of applied sciences, institutes of the Austrian Academy of Sciences, the Institute of Science and Technology Austria (IST-Austria), Johannes Kepler University, and other university and non-university research centers such as the Austrian Institute of Technology (AIT) or MedAustron are at the forefront of this study. Access to high-tech research infrastructure for the STEM sector is generally supported in Austria. Nonetheless, STEM is frequently mentioned in the public discourse about the high demand for STEM graduates in the labor market and the necessity for action to raise the number of STEM students, particularly female students. In collaboration and dialogue with universities and non-university research institutions, as well as the Austrian funding agencies, the Austrian Science Fund (FWF) and the Austrian Research Promotion Agency, the Federal Ministry of Education, Science, and Research (BMBWF) coordinates priority fields in the STEM sector. Improving digital competence is a priority in the education and training system (Education and Training, Monitor 2019, https://education.ec.europa.eu/sites/default/files/document-library-docs/et-monitor-report-2019-austria_en.pdf).

Finland

There is a growing emphasis on the role of multiple creativities in today's society. Companies in the Finnish labor market place a higher value on their workers' flexibility, fast and smart decision-making abilities, creative and critical thinking skills, innovation, teamwork, communication, and entrepreneurial spirit. To respond to these growing expectations, Finnish students in the system of basic education and adults in professional development and Lifelong Learning programs are supported to learn new ways to approach problems, gain 21st century skills and competencies, and create and use various learning environments and study materials in innovative ways.

Flexibility and high level of adaptivity ought to be the goal of education – preparing young people and helping adults to apply tools creatively, in real and in online / hybrid communities with others, across former disciplinary boundaries. Authenticity and personalization plays important roles in basic and adult educational study projects, which are often linked to real-world and real-life problem-solving and provide opportunities for learners to develop their applicable skills and be appraised based on their contribution to the success of their communities in terms of solving social problems or contributing to sustainability.

STEAM is an acronym for Science, Technology, Engineering, Arts, and Mathematics. While there is a growing body of literature focusing on various aspects of STEAM education (Belbase et. al, 2021), "the term STEAM is as contested in its understanding as it is diverse in its practice" (Burnard & Gray, 2021). This is stands on the one hand for STEAM's widespread application from early childhood education to adult education, on the other hand these approaches are not always called "STEAM" and there is no standardized or systematized way of application, therefore it is sometimes hard to identify, characterize STEAM practices from a general educational perspective. Despite the diversity of understandings and practices, it can be said, that STEAM refers to an educational approach promoting integrated teaching and learning by studying phenomena or topics from multiple perspectives by implementing multiple study and learning methods.

STEAM inherited the difficulties of defining STEM, with the added complication of a lack of clarity related to the meaning and role of the "A", as Arts. STEAM is mostly associated with the 21st Century Skills and competence-based education and inter-, cross-, multi-, and transdisciplinary approaches, implemented in project-based frameworks to go beyond the traditions of subject-based learning in education. John Maeda in the Rhode Island School of Design successfully coordinated the STEM to STEAM movement to include design thinking,
creativity and innovation [3] in educational policies around the globe.

Globally, STEAM became a popular educational concept in 2010s as an extension of STEM integration with the Arts. Finland started to adopt the concept in the middle of the decade, however it became most popular around the turn of the 2020s.

Experience Workshop is operating as an international STEM and STEAM network. Our international organization is connecting teachers, artists, scholars, artisans, designers, inventors, and producers of educational toolkits. Since 2010, our organization has been actively representing the STEAM approach in / from Finland.

Although Experience Workshop's activities are continuously broadening and transforming, the primary goals have not changed since the beginning:

- Integrating art-, creativity-, and play-oriented activities into mathematics learning and playfully integrating mathematics in learning other subjects, especially the arts.
- Implementing math-art and STEAM approaches into real-world problem-solving as part of the learning process.
- Organizing math-art and STEAM events to introduce best practices in the experience-oriented teaching of mathematics.

- Making students, future, and in-service teachers familiar with the most recent results (including didactics, toolkits, resources, etc.) of experience-oriented mathematics education; researching, collecting, and publishing outstanding achievements in the field and making these accessible for the academic, artistic, and educational communities.
- Expanding educators' everyday collection of innovative educational approaches, toolkits to increase learners' mathematical, logical, combinatorial, and spatial skills, computational thinking, developing perception, aesthetic sensibility, motivating individual and collaborative problem-solving, interdisciplinary and inter-artistic approaches on all levels of education.

What is the general purpose and scope of STEAM? Who is the target audience: is it used only for children's education? Are there examples of adult education with STEAM (or its use in different fields such as vocational training) in your country?

Turkey

The effectiveness of technology in our lives increases day by day, and the productivity and perspectives of individuals who meet science at an early age change. However, parallel to this, the differences between the east and the west in our country are making themselves felt more and more every day in various areas. Especially in disadvantaged regions in the east, it is very difficult for students to access training and activities that include scientific applications other than basic education. Individuals with different abilities may become mediocre in the system due to the problems they experience in accessing information. Thus, the education levels of individuals with low income levels also decrease; Individuals with low education levels act under the guidance of their children.

The general purpose of STEAM training in Turkey is to provide individuals with 21st century skills. In this context, general education is the conduct of STEAM training at primary and secondary education levels. On the other hand, although it is not formally named, training is provided on some topics within the STEAM field with a lifelong learning approach through public education centers and maturation institutes in the provinces. However, these trainings are given singularly and far from the interdisciplinarity approach, which is one of the basic principles of STEAM. There is currently no systematically planned and implemented STEAM education for adults in Turkey. In general, the target audience of STEAM education in Turkey consists of children.

Austria

Some of the main goals of STEAM education in Austria are to enrich education with a variety of resources and methods; to increase equal opportunity interest in science, technology, engineering, mathematics, and art/design; to bring innovative ideas to applied education, and to motivate students with an accurate interdisciplinary education at a young age is to enable them to recognize their interests and show them how they can develop themselves in these areas. Education is a critical component of a country's social and economic prosperity. The Federal Ministry of Education, Arts, and Culture is in charge of Austria's whole education system, from compulsory education through intermediate level 2 completion, as well as all university institutions of teacher education. They are also responsible for adult education and lifelong learning. There are both free and public schools in Austria. Education is required for nine years, figure 1 shows the Austrian education system.

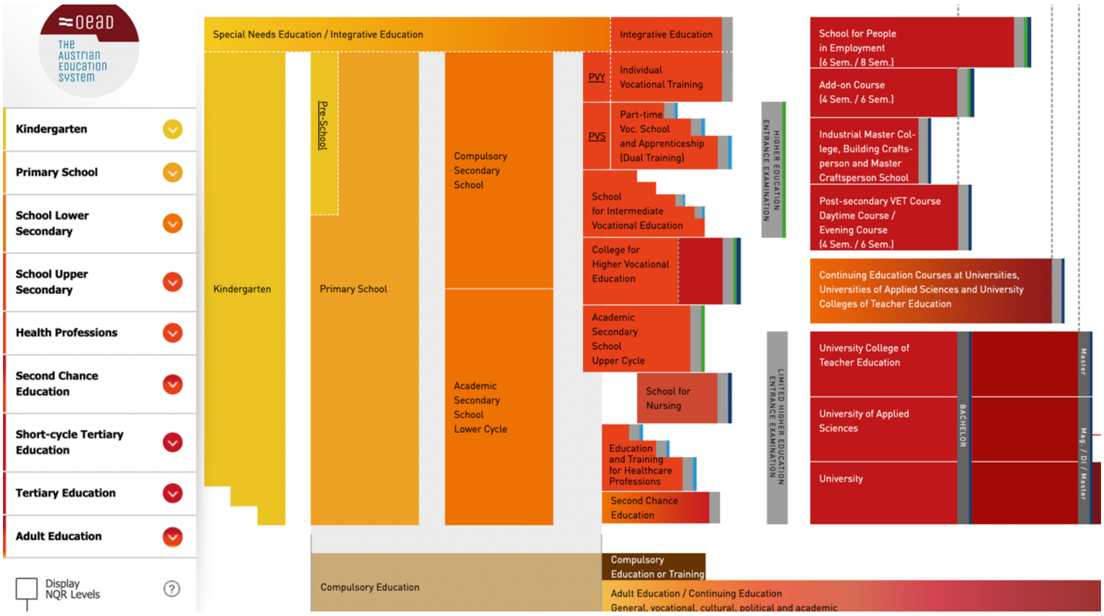

Figure 1: Austrian education system (source https://www.bildungssystem.at/en/)

What is the concrete objective of creating a "STEAM school" with a "STEM curriculum" in Austria? The answer to this question is central to the design of the school type:

- STEAM should make learning processes more tangible and appealing for children and young people, leading to more autonomy, education, and opportunities to shape life.

- In addition, the graduates, especially girls and young women (especially those from educationally disadvantaged and not STEAM-affine parental homes), are encouraged to do so to see STEM professions as an option (Amon et al. 2021)

According to Müller, Krainer, Haidinger (2013), and Seidel et al, (2016), the following approaches are used in Austria to achieve STEAM teaching in schools:

- The conception of time-extended, interdisciplinary blocks. This allows students to examine a phenomenon from different professional perspectives
- .
- Space for experimentation and research-based learning.
- Use cooperative forms of learning and thereby create variety.
- Use the "work lessons" to technically implement the theoretically acquired knowledge from the STEAM subjects in an interdisciplinary approach.
- Use of digital media to bring the reference to the living environment closer.
- Open and action-oriented teaching, since the principle of self-reliance and experiencing one's effectiveness is central to developing skills and interests.
- Takes place at different learning locations (in addition to the classrooms, learning locations are laboratories,
- workshops, libraries, museums, learning resource centers with IT support, companies, etc.)
- Learning support in the STEAM area through cooperation with companies and research institutions.

With the Austrian strategy for lifelong learning "LLL:2020," the different educational fields are linked to a common goal and thus reinforce each other. Without committed action by the actors concerned – i.e., the educational institutions, the teachers and trainers in further education, the companies, and before all of the learners themselves – the strategy "LLL:2020" cannot be brought to life, and likewise are new forms of cooperation between municipalities, states, and the federal government. The social partners have also been involved in implementing the LLL strategy plays a central role. One of the goals of this strategy is to increase STEAM training for lifelong learning. Austria has one of the EU's highest adult engagement rates in lifelong learning. Since 2010, the rates have steadily risen, from 13.8 percent in 2010 to 14.9 percent in 2016, nearly achieving the ET2020 targets. In Austria, however, participation in Lifelong Learning highly depends on an individual's educational level (secondary or higher education). Lifelong learning in the field of STEAM education in Austria is most often in the form of various training, workshops, and courses under the auspices of the university, NGO, and educational institute. Some of the priority topics for lifelong learning in Austria are:

- intercultural learning,
- the social dimension, older workers;
- digital and information and communication technologies (ICT),
- STEM, youth (participation, work and policy),
- citizenship, migration, teachers' training, and nonformal and informal learning validation.

Finland

The primary purpose of STEAM as combining various perspectives both in basic and in adult education is to move beyond the traditional subject-based education and achieve cross-, inter-, multi-, or transdisciplinary connections while building up the learning experience. Arts and artistic processes contribute directly to the inquiry by creating, performing, and connecting scientific content and methods with arts-based content and pedagogies. STEAM integration offers an interface for combining formal and non-formal educational approaches in formal or non-formal environments.

Between August 2018 and June 2020, Experience Workshop employed the STEAM framework to support the social integration of young immigrants in Finland. Backed by the Finnish National Board of Education's funding, the Finnish NGO organization called Settlement of Jyvälä was the main coordinator of the project, and Experience Workshop provided the pedagogical program based on math-art connections in STEAM context. Settlement of Jyvälä runs an adult education center, organizes after-school activities and civic programs for children, provides children, youth, and family services based on a comprehensive experience of working with immigrant youth and families as well.

The project was called "Sillat" in Finnish, which means "Bridges," and it had two priorities:

- Supporting the integration, inclusion, and well-being of young immigrants through Experience Workshop's math-art methodology and STEAM approach.
- Promoting good cultural relations: increasing the opportunities of encounters and dialogue between "the Finns," those already living in Finland, and those who have moved recently to Finland from elsewhere. This latter means a very heterogeneous group of international students, refugees, etc.

The basic structure of the project was (1) group activities with young adult immigrants who had recently moved to Finland, (2) public events open to local families and anyone else and (3) workshops for teachers, youth workers, and other specialists, mainly from the social sector.

Experience Workshop implemented the integrated approach to STEAM in the Sillat project. STEAM was useful in creating links to the Finnish National Core Curriculum, which recommends multidisciplinary projects for developing transversal skills and student-centered, multidisciplinary, and phenomenon-based learning methods. The STEAM approach also supported applying these methods in a youth and adult learning context, where inclusion has a critical role. In Experience Workshop's STEAM projects, it is essential to introduce different perspectives to motivate all learners. STEAM proved to be an effective pedagogical tool to achieve the socially and culturally inclusive goals of the project.

In the Sillat project, STEAM approach also played an essential role in enhancing community work, a critical component in our program. As part of the collaborative problem-solving activities, all participants recognized each other and themselves mutually as creative and skilled individuals with diverse competencies from which others can learn. To share their knowledge and skills, participants first had to discover and identify their own strengths to build self-confidence. They gained motivation through engaging activities, developed their social competencies, and recognized the values of creative exchange. During the workshops and public events, participants developed their communication and mentoring skills, picked up Finnish language, and got familiar with local culture, including people's attitudes, children's interests and many more details. Meanwhile, they could also introduce their cultural and personal background to each other and to locals participating in Sillat's public events and professional workshops (Figure 1-4).


www.experienceworkshop.org


www.experienceworkshop.org

Figure 1-4: Snapshots from Experience Workshop's Sillat Project for Social Inclusion.

What are the methods and materials of the applications within the scope of STEAM education? Are only theoretical lessons/training given? What is the method in practical slopes/lessons? Training units provide formal or informal training. Where and how to obtain content related to STEAM education? Is access to the content open or paid?

Turkey

There is no generally accepted curriculum-based system regarding STEAM education in Turkey. Educational periods, contents and student admission systems of institutions and organizations providing services in the relevant field vary from each other. While the awareness of STEAM trainings in Turkey is increasing day by day, short-term awareness trainings are also carried out on a project basis by local governments, non-governmental organizations and the private sector, apart from institutionalized structures. In general, STEAM trainings are carried out on an application-based basis. Internationally used training kits are used in the training as much as financial conditions allow. Practical training in institutionalized structures is supported by theoretical knowledge. However, even in trainings, it cannot be said that interdisciplinary interaction is fully implemented. It is generally seen that training focuses on certain areas of STEAM. Robotics-coding training is one of these areas. The training provided is based on raising awareness informally in a short time rather than on formal procedures. The content used in the trainings is based on the experience and experience of the trainers and there is no standardized curriculum. A curriculum prepared by TÜBİTAK is used in DENEYAP workshops carried out by TÜBİTAK and the Turkey Technology Team. In the trainings carried out in other institutions, the contents are produced by the individual efforts of the institutions and trainers providing the training. In Turkey, it is not currently possible to access educational content related to STEAM fields from a single source. However, it is possible to access some of these trainings, albeit scattered, in online and printed environments. It is almost impossible to access the educational content of private sector and institutionalized institutions. Ministry of National Education resources are used as resources in the Design and Skills Workshops carried out within the Ministry of National Education and the trainings carried out in Science and Art Centers. It cannot be said that the variety of materials in STEAM trainings implemented in Turkey is widespread. Although some units have sufficient resources in terms of materials, material deficiencies are noticeable in some institutions. It can be said that the western regions of Turkey are richer in terms of education and materials than the east.

Austria

Research (Krainer et al., 2016) on STEM teaching in Austria suggests specific teaching characteristics:

- teaching is problem-solving or application-oriented;
- Interdisciplinary teaching that explicitly creates connections is prioritized between learning activities and real-life situations,
- The principle of self-activity and experiencing one's effectiveness is central to the development of petitions and interests;
- the lessons are open and action-oriented.

All STEAM syllabuses have the following in common:

- Student-centred approach
- Implementation of "inquiry-based learning"
- Working on concrete problems that are relevant to the students
- Development of scientific ways of thinking and working techniques
- Deepening and refinement through spiral learning paths
- critical and ethically-reflective thinking, problem-solving skills, experimental
- Learning, practical work, and teamwork.

Resources available to schools for STEM lessons contribute to successfully implementing projects in STEM subjects, STEM offers in the curriculum, and STEM additional offers. In concrete terms, resources mean financial, human, and material resources (Seidel, 2016). In connection with various studies of schools about their socio-economic background, it has been shown that projects in the STEAM can be successfully implemented if the appropriate resources are available at the locations. These resources come, for example, from public donors and, in some cases, also from support associations or external cooperation partners (e.g. companies). Such offers for the STEM curriculum are, for example, STEM laboratories, the technical equipment of the IT rooms, and additional STEM offers (Rosemann, 2015). STEM teachers are rated as central. These are appropriately trained teachers who, in addition to their specialist skills, have interdisciplinary skills in mathematics, biology, chemistry, and physics. Appropriate further training for teachers in the STEM field is a relevant aspect of academic success (Schleicher, Creswell, et al. 2007, quoted in Rosemann, 2015). Teachers who are well-trained in pedagogy and subject didactics with a lot of personal commitment prove essential for STEM lessons. In addition to higher motivation, it is necessary to have the professional competence to teach in an action-oriented, interdisciplinary, and gender- and diversity-sensitive manner and to initiate innovations in the school (Rosemann, 2015; Müller, Krainer, Haidinger, 2013). To establish a sustainable learning culture in the field of MINT, a culture of cooperation among the teaching teams should be initiated. The education managers who will contribute to realizing STEAM educational projects are planned for Austria. The material resources in the schools are undoubtedly central to the successful implementation of MINT locations. Both spatial and technical equipment are understood as material resources. The specific STEM rooms include, for example, laboratories and rooms with enough computers for all students. Various schools point out that the MINT rooms and the associated equipment should be of a good standard (Seidel, 2016). Learning with digital media based on suitable pedagogical concepts opens up new chances and possibilities, especially for the STEM field. Modern, exciting teaching with the help of digital offers can help to keep students interested (Federal Ministry of Education and Research (BMBF), 2019). Through the increased inclusion of digital media and computer-based applications in MINT lessons, it is possible to loosen up more traditional teacher-centered structures and promote the students' media skills. The focus should be on solving interactive tasks. Examples of possibilities for learning with digital media are electronic exercise systems, tutorial systems, simulation systems, learning software, or computer-based tasks. However, the decisive factor is not that an entire class often works with tablets but how and why the students use the medium (Seidel, 2016). This coincides with the goals of digital basic education (bmbwf.gv.at):

- Social aspects of media change and digitization
- Information, data, and media literacy
- Operating systems and standard applications
- Media design
- Digital communication and social media
- Security
- Technical problem solving
- Computational thinking

Many organizations and institutions support the implementation of STEAM principles in schools in Austria, and one of the globally recognized is GeoGebra. GeoGebra (a portmanteau of geometry and algebra) is an interactive geometry, algebra, statistics, and calculus application for learning and teaching mathematics and science from primary school to university. GeoGebra is available on multiple platforms, with apps for desktops (Windows, macOS, and Linux), tablets (Android, iPad, and Windows), and the web. Linz School of Education is led by Professor Dr. Markus Hohenwarter, the head of GeoGebra, together with those working on improving education. GeoGebra is a global learning platform with more than 100 million users today and contains about 10 million educational materials, most of which are free for educational purposes, photo 1.

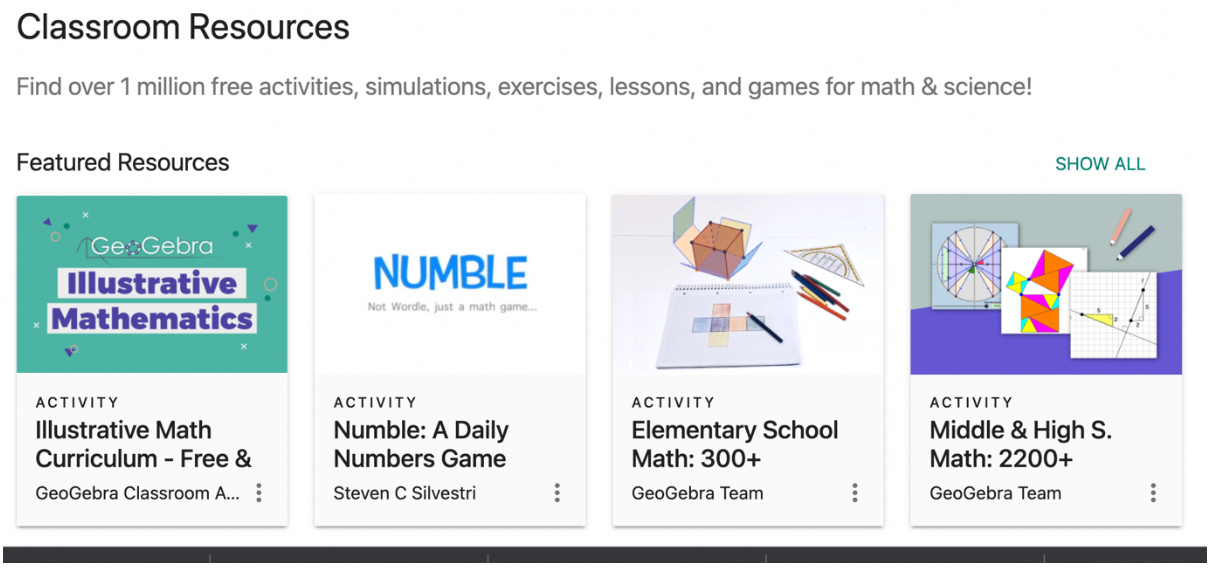

Photo 2: GeoGebra- interactive mathematics software suite for learning and teaching science, technology, engineering, art, and mathematics (STEAM) from primary school up to the university level.

Finland

Implementing STEAM Education engage and motivate students through relevant, meaningful, playful, and multisensory learning experiences. These experiences emerge from the individual and collaborative design and problem-solving activities (Figure 5). The STEAM activities both on the basic education and on the adult education level are characterized by higher-level thinking, process-over-product perspective, applicable and transferable skills and competence-development over memorizing facts, hands-on activities, embodied learning over solving textbook problems, and cultural and emotional literacy development. STEAM education is usually organized in project-based formats and encourages divergent ("out-of-the-box") thinking and authentic assessment. (Cofield, 2017) Breaking down “subject silos” by developing the multidisciplinary and phenomenon-based forms of learning – where the Arts are integrated into problem-solving – adds a creative and human dimension which can bring children’s and adult’s learning to life in several areas.

Figure 5: Finnish teachers, Merja Sinnemäki (left) and Leena Kuorikoski (right) introducing the results of their students' Polyuniverse STEAM project, merging Dirk Huylebrouck's fractal tree design with János Saxon's Polyuniverse math-art modules at a professional development event for teachers. Photo: Kristóf Fenyvesi.

According to So et al. (2019), teachers' educational competency in STEAM pedagogies is reflected in knowledge, skills, attitudes, and competency in creative convergence. This stands for adult educators as well. As a background knowledge, it is recommended that STEAM teachers both in basic and adult education are understanding education policy, have an overview of integrative knowledge, integrating technology and able to work and collaborate in an integrative educational community. On the skills level, it is recommended that teachers and adult educators are prepared for enacting STEM/STEAM classes. This includes establishing cooperative/collaborative learning, providing problem-based and inquiry-based learning, supporting individualized learning and ready for leading the creative and authentic assessment/reflection sessions. Finnish teacher and adult educator training programs are fully embracing these aspects and whether it is called STEAM or not, we can find all these components in the Finnish training programs.

In terms of attitudes, it is recommended that teachers on basic level and adult educators have a positive attitude and recognize the need for STEM/STEAM education. It is required to appreciate art, have a positive attitude towards science and accepting novel technologies. They also need to practice coming up with new ideas by seeing and combining the relevance of existing knowledge sources and applying such transdisciplinary knowledge to real-world problems in an applicable format.

What is the prevalence of STEAM education and practices in your country? What level of awareness and awareness is there? What is the prevalence in the country? Are there any examples that show its equivalent in social life? Does it carry traces (cultural codes) of your own culture?

Turkey

In the primary and secondary education system in force in our country, information is generally conveyed to students within a theoretical framework. Because the process of transferring knowledge in practice poses some difficulties in terms of space and cost. Especially the education period in which information is provided is a process that directly affects success. Individuals who are introduced to applied science at an early age have an increased success in comprehending scientific knowledge and applying it to their lives. While families with high income levels and awareness levels can have their children receive this education, at least partially, through various activities outside of school, families with low income levels cannot benefit from these opportunities. Some segments of society are either not aware of or are indifferent to such trainings, which are given free of charge within the scope of various social responsibility projects. Most of the training provided within the scope of social content projects is of a promotional nature and is not aimed at increasing the curiosity of individuals.

In some regions of Turkey, which has a wide geography, households are in a worse situation than other regions in terms of average income level. In these regions, there are generally almost no supportive educational environments outside the national education system. Even though individuals living in the region, especially children of educational age, are curious about science, they have problems reaching the structures where they can satisfy their curiosity. Although short-term promotional events organized by local governments or various public institutions and organizations in the region raise awareness in various areas, their outputs are not at the desired level. Educational institutions or NGOs trying to offer scientific activities to different age groups in the region experience serious difficulties in terms of physical space, machinery equipment and especially instructors.

Although there is no agreed upon curriculum in STEAM trainings currently carried out through different units, the trainings are generally given in short periods of time for support purposes outside the national education system. In these trainings, there are no new approaches and examples regarding the cultural differences of the country. Similar educational contents applied internationally are applied to individuals.

The authorized and responsible institution at the center of the Turkish education system is the Ministry of National Education (MEB). The mission of drawing the road map of educational reform movements in the country and carrying out reforms in cooperation with stakeholders belongs to the Ministry of Education. Although STEM education is on the agenda of the Ministry of Education, it cannot be said that the steps to be taken regarding STEM are being taken quickly. Although there is no direct action plan prepared by the Ministry of National Education for STEM education in our country, there are objectives to strengthen STEM in the 2015-2019 Strategic Plan. The statements under the heading of education in the Tenth Development Plan, which determines the road map of the country between 2014 and 2018, coincide with the goals of the STEM approach. It is aimed to achieve a globally competitive higher education system within the framework of an academically, administratively and financially autonomous university model that is sensitive to the needs of society and economy, interacts with its stakeholders, transforms the knowledge it produces into products, technology and services. The targeted higher education model aims to increase global competitiveness by encouraging interdisciplinary study, going beyond the use of information and technology and encouraging production. (Altunel,2018,4)

In addition to the Ministry of Education, private schools, universities and business circles have many studies on STEM education and approach: Hacettepe Science, Technology, Engineering and Mathematics Education and Applications Laboratory, METU Science, Technology, Engineering and Mathematics Education Application and Research Center, Özyeğin University. STEM Academy, STEM&- Makers Fest Expo events, Istanbul Aydın University STEM School and STEM Teacher Program, TÜSİAD STEM+A Project, Erzurum Technical University MUCİTPARK Science and Idea Workshop are some of these.

STEM approach and education are also on the agenda of the Scientific and Technological Research Council of Turkey (TÜBİTAK). In this context, it is seen that the institution includes activities supporting STEM education in different project calls. TÜBİTAK's (Turkish Scientific and Technological Research Council) 2011-2016 Science Technology Development Plan includes some activities that support students' STEM education. According to this strategy, it is desired to support science education with science fairs at primary and secondary school levels, and activities in the fields of space science, mathematics, science and technology for young people. TÜBİTAK carries out project studies and organizes competitions to reveal successful students and teachers in STEM education. In addition, regarding STEM education in our country, science centers have started to be opened in various provinces by TÜBİTAK. Science centers aim to eliminate prejudices against science in society by making students love science and scientists. In science centers established for this purpose, STEM activities are carried out with students during extracurricular times.

Türkiye is not completely unfamiliar with the STEM education approach. Although it has not been long since its emergence, while supporting the STEM approach with different disciplines has been discussed in the world (STEAM, STEM-C, STEM-H, STEM-E STEM+ etc.), the foundations of this approach are just being laid in Turkey.

In Turkey, many studies are carried out by the public and NGOs to raise awareness in STEM fields and to meet educational needs. Some of these studies;

• The "School-Industry Cooperation Istanbul Model" project was implemented by the Istanbul Provincial Directorate of National Education. According to this project, "it has started to be carried out with the cooperation of all sector representative businesses and institutions, chambers, non-governmental organizations and universities that need qualified workforce."[16] With this model, it is aimed to develop technological infrastructure in schools, to share experiences of businesses with students and to develop an employment-oriented perspective.

• STEM education is implemented in Bahçeşehir Schools and higher education STEM fields are supported.[17] Additionally, STEM research is carried out by the STEM Center (BAUSTEM or FeTeMM) established at Bahçeşehir University.

• Hacettepe Science, Technology, Engineering and Mathematics Education and Applications Laboratory (Hacettepe STEM & Maker Lab) has been established since 2009 to increase Turkey's scientific research and technological development capacity and to support its social and economic development. This laboratory carries out projects that support an innovative educational approach. These projects; Science – Advanced Practices in Teacher Education
(S-TEAM), Assessment Strategies for Inquiry-Based Science Learning (SAILS) and Mathematics and Science for Life (MASCIL).

• Istanbul Aydin University Educational Sciences and Technologies Center STEM School was established in 2015. The aim of this school is to increase the competencies of teachers and students in STEM fields and to contribute to the transformation of schools into STEM schools. "STEM Teacher Certificate Program" was implemented by this center.

• Openfab Istanbul, which was established with the aim of a productive generation at the STEM Academy within Özyeğin University, provides maker (coding, robotics, electronics, etc.) training for children between the ages of 6-12.

• Stem&MakersFest Expo is organized as a conference and event on STEM every year with participants from different universities.22 There are PDStem applications for STEM project implementation created with the participation of academics from many different universities.

• BİLTEMM, located within the Middle East Technical University (METU), was established to develop educational opportunities and policies in the fields of Science, Technology, Engineering and Mathematics. It provides teacher workshops, projects and training to improve the educational opportunities offered to schools, teachers and students.

• The STEM Education Report was published by the General Directorate of Innovation and Educational Technologies (YEĞİTEK) of the Ministry of National Education and a model was suggested for the transition to STEM Education in our country.

In the report titled "Research on Demands and Expectations for the Workforce Educated in the Field of STEM", it was determined that the average employment rate of graduates of STEM education fields in our country was 19% (TÜSIAD, 2014). When ÖSYM's data is examined, it is seen that the rate of graduates from the STEM field in Turkey is 19% (ÖSYM, 2014). When the field contributions of companies were examined, it was observed that there was a significant difference between those working in the STEM field and those working in non-STEM fields, and it was emphasized that our country should have a STEM education strategy. (TUSİAD, 2014). Although there is no general national strategy for STEM education, it appears that there are aims to strengthen STEM in Turkey in the 2015-2019 Strategic Plan.

The renewed curriculum studies in our country in 2018 have enabled the integration of education in new areas such as coding and robotics. More real life problems are included in the curriculum. Curriculum that has enabled applications also envisages interdisciplinary work. When we look at the impact of STEM studies carried out in our country on students; It should be taken into consideration whether these activities provide students with the desired skills and characteristics and whether the studies are suitable for the purpose. In a study investigating students' opinions about STEM-FeTeMM activities, students expressed positive opinions that STEM-FeTeMM activities provide benefits in many ways, that they want to improve themselves in these fields, and that courses should be taught with STEM-FeTeMM activities (Gökbayrak & Karışan, 2017, 25).

In recent years, STEM activities have started to be held in every province, although they are not widespread enough and the entire target audience is not reached. Through the Science and Art Centers of these activities, programs aimed at developing the students' special abilities continue to provide knowledge, skills and behavior that will be in-depth or expanded by taking into account disciplines and interdisciplinary relations.

Austria

In the 2018/19 academic year, around 21,400 bachelor's and diploma programs were started in the STEAM field,24 of which 16,300 (76%) at public universities (out of around 10,800

first-year students; 5,500 students have already begun another STEAM) and 5,100 (24%) at universities of applied sciences. One of the main principles of Austrian STEAM education is to encourage students to think holistically about their interests. STEAM projects in contexts that are important for students and their immediate and broader environment make it possible to experience the importance of STEAM for individual everyday life in the family, at school, and in society, and this approach is recommended in Austrian schools and training. It is recommended to place STEAM thematically around controversial, current social issues (e.g. climate change, digitization, genetic engineering). Such projects can show that STEAM is one perspective among others (e.g. ethical, artistic, or political) on the world that can be helpful in everyday life. In addition, various STEAM-related (professional) activities can be experienced directly, including social, artistic, or design aspects. Central to developing such projects is establishing a network with partners (e.g. institutions and associations that offer informal learning environments, municipalities and companies) who provide different areas of experience as learning environments that the (academic) offers and exceed the possibilities of STEAM lessons at school. Synergies with school STEAM lessons must be explicitly considered so that the learning experiences in these settings can also be used at school. In addition, it is essential that this cooperation is long-term and that participation in projects is planned jointly. Although the design of these projects is not primarily aimed at opening up a relevant professional career but rather at enabling social-democratic participation, they make it possible to learn applicable scientific methods (analyze, measure) on the one hand and give the opportunity, on the other hand, to get in touch with people with relevant technical expertise. This leads to a more differentiated idea of the world of STEM professions. Annex 1 shows some successful STEAM educational projects from Austria.

Finland

"Holistic," is an often-used term to summarize the essence of Finnish education. Holistic, integrated instruction – which is also the basis of the STEAM educational approach –, along with multisensory, phenomenon-based methods to support transversal competencies, including multiliteracy, are delineated throughout the Finnish National Core Curriculum (FNCC [FNAE, 2016]). Nevertheless, the term *'holistic'* appears most frequently to describe *holistic well-being. Holistic well-being* and *holistic growth* are complex concepts that characterize the Finnish Curriculum on all levels, including policy, content, pedagogical methods, educational leadership, and implementation. Holistic well-being provides the framework for ensuring safety, physical and mental health, for meeting basic needs, for individual and community care across all levels of Finnish basic education. Holistic well-being and pupil welfare also serve as the background and a goal for building trust, shared responsibility, improving participation, agency, inclusion, the joint reflection of the school and home values, and promoting sustainable lifestyles. These social values are expected to be represented in the work life and later career stages, as important components of the Finnish Lifelong Learning models.

What is the definition, scope and purpose of adult education in your country? At what level are formal, informal and unofficial implemented? Who constitutes the target audience? What are examples of applied training content? What are the adult education practices that can be evaluated within the scope of the STEAM approach?

Turkey

Although its roots date back to ancient times, the spread of adult education dates back to very recent times. The concept of adult education, which emerged on the axis of religious activities, was perceived as a social service provided to adults in order to eliminate vocational and basic education deficiencies until the 1950s. Nowadays, adult education undertakes important functions in enabling people to act and make decisions more consciously and freely (Yaya, 2009, 1).

Adult Education, also referred to by different names such as community education, public education, and non-formal education, is defined as a regular and organized educational effort for adults and those outside of school (Geray, 2002).

Adult education in Turkey includes all kinds of learning activities in which individuals who are at any level of the formal education system or who have left or completed this level participate in order to improve their individual, social and employment-related knowledge, skills and competencies within the scope of lifelong learning (HBÖKY, 2018).).

Adult education programs in Turkey are carried out through İŞKUR courses, MEB courses, Continuing Education Centres, Public Education Centres, Maturation Institutes, Vocational Education Centres, Open Education Schools and Higher Education Institutions. These programs are commonly carried out by public institutions and organizations. In general, the target groups of these programs consist of individuals with low income levels and waiting to be employed. Although there are people who apply to these programs to improve their professional qualifications, the number of this group is below the desired level. With the EU candidacy process, adult education has become more widespread and has reached a higher level of awareness in Turkey. Adult education in Turkey is coordinated and carried out by the Ministry of National Education.

Studies carried out within the scope of adult education are provided on a practice-based and course basis. Contents and materials are provided by the institutions. Theoretical contents are covered by the Ministry of National Education.

Adult trainings have almost no STEAM content. The fact that these trainings are planned and implemented on a course basis does not coincide with the interdisciplinarity feature of STEAM. Although not on the STEAM axis, some of the artistic activities can be evaluated on the STEAM axis. Instrument making and modernizing traditional products using today's technology can be given as examples.

Austria

Adults in Austria can take a number of complementary courses on personal and occupational themes, which are offered by both public and commercial sources. In Austria, the discussion on lifelong learning is mostly framed via the lens of human capital, which firmly relates lifelong learning to economic issues. Adult learning, especially in regard to the concept of employability, is frequently debated in relation to the knowledge society, new technologies, increasing certification requirements, and demands for qualified labor. The selection of courses available to employed people is similar to that available in secondary education, and the goals are aligned with those of the respective schools and colleges. Non-profit organizations in the area offer courses that provide vital qualifications and life skills. Demand drives supply in this case. Further vocational training in businesses is defined by the type and scale of the business and is frequently organized by the business itself (Federal Ministry for Education, Arts and Culture, http://www.bmukk.gv.at/enfr/school/adult/Adult_Education4582.xml).

The government program for adult learning includes many projects designed to strengthen lifelong learning. These include: (i) revising the legal foundations for adult learning, (ii) improving the strategic orientation of adult education and its management; and (iii) further developing the three-year performance contracts with the federal associations of non-profit adult education. The lifelong learning strategy 11 will be further developed. Other proposals include (i) the financing of continuing education and training through education vouchers for special qualification measures, (ii) the strengthening of financial literacy and entrepreneurship education, and (iii) the promotion and strengthening of democracy/citizenship education. An overall strategy will also be developed for the continued training of employees (https://magazin.vhs.or.at/magazin/2019-2/269-winter-201920/editorial/regierungsprogramm-2020-2024/).

Austria continues to pursue its adult education plan, which aims to improve socioeconomically disadvantaged people's access to adult learning and raise their educational level. It allows persons without basic skills or who have never completed lower secondary education to continue and complete their education for free. The Austrian digitization policy also includes programs to encourage adults to learn digital skills. Fit4internet12 allows all Austrians to check their digital skills and obtain training recommendations as a foundation for their personal development, photo 2.

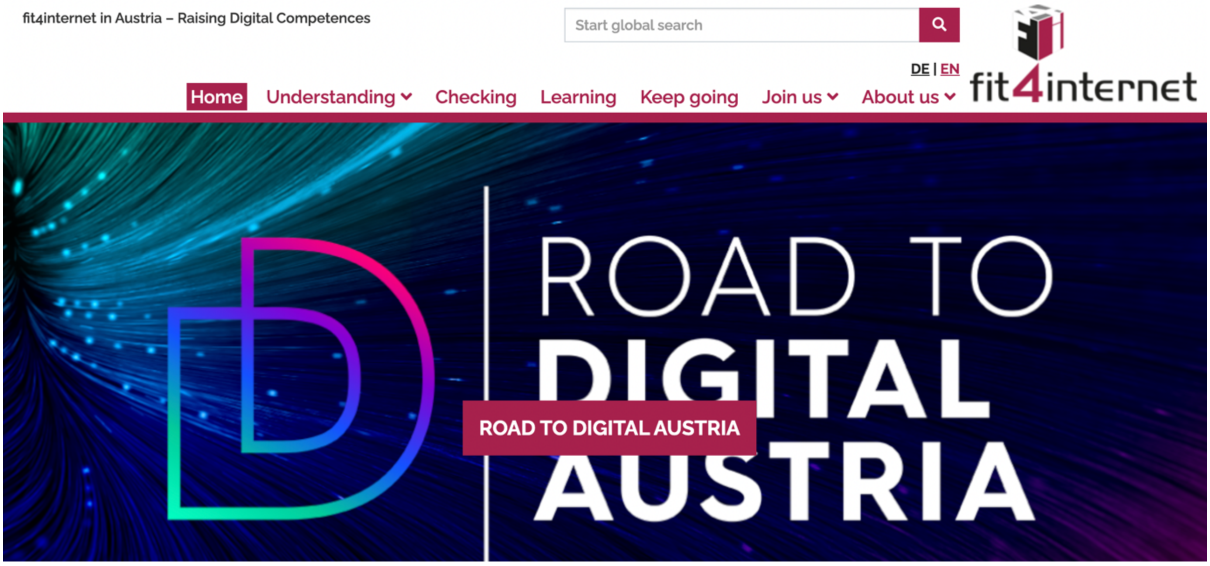

Photo 2: fit4internet in Austria – Raising Digital Competences (https://www.fit4internet.at/page/home).

The KMU digital13 initiative aims to improve digital literacy in small and medium-sized businesses, and a slew of media literacy courses have shown up in general education. The Public Employment Service for jobless individuals, as well as Austrian provinces and chambers of commerce, offer a variety of support programs for employees to gain digital skills (https://www.kmudigital.at/, https://www.fit4internet.at/).

In Austria since the 19th century, Volkshochschulen (VHS) or "people high schools" have existed. They offer a variety of courses in a variety of fields of self-development, including languages, nonvocational courses in areas like art and music, courses in politics, IT and computer training, and many more hobby-related topics. The VHS are funded in a variety of ways, including at the federal level (the BMBWK), by the Länder, municipalities, and the Chamber of Labor; nevertheless, fees paid by individual course participants account for more than half of their income. Fachhochschulen (FHS) is a relatively new segment of the formal education system (founded in 1994), with the goal of expanding postsecondary education in more occupationally-oriented forms than universities. FHS is primarily geared toward full-time students of traditional age who are preparing for employment. However, some of FHS, on the other hand, have developed evening programs for part-time working students who attend during the nights while working full-time during the day, with the goal of retraining adult workers. Evening programs appear to be attended by around one-third of the students at these universities. These are four-year curricula, as they are in other portions of the Beruf-oriented system. Furthermore, the FHS was created with employers in mind; its programs typically mix classroom learning with on-the-job training, and they are designed to work closely with them.

Finland

In Finland Lifelong Learning including Adult Education has great traditions. Education is available for adults at all levels of education. Adult students can also pursue any diploma-oriented education designed for young persons. Many educational institutions also offer separate adult education with courses taught in the evening and online. Adults can study at work, alongside employment or in their own time.

Official Statistics of Finland (OSF) maintains comprehensive data about Participation in adult education in Finland (see: http://www.stat.fi/til/aku/index_en.html). The following details are quoted from their webpage by including the currently available survey information (see: https://tilastokeskus.fi/til/aku/2017/01/aku_2017_01_2018-01-12_tie_001_en.html):

In 2017, every second person in Finland aged 18 to 64, or 1.6 million, took part in adult education, that is, education or training arranged specifically for adults. The share of adults having taken part in adult education and training has fallen by four percentage points from 2012 (Table 1). This information derives from the preliminary data of Statistics Finland's Adult Education Survey for 2017.

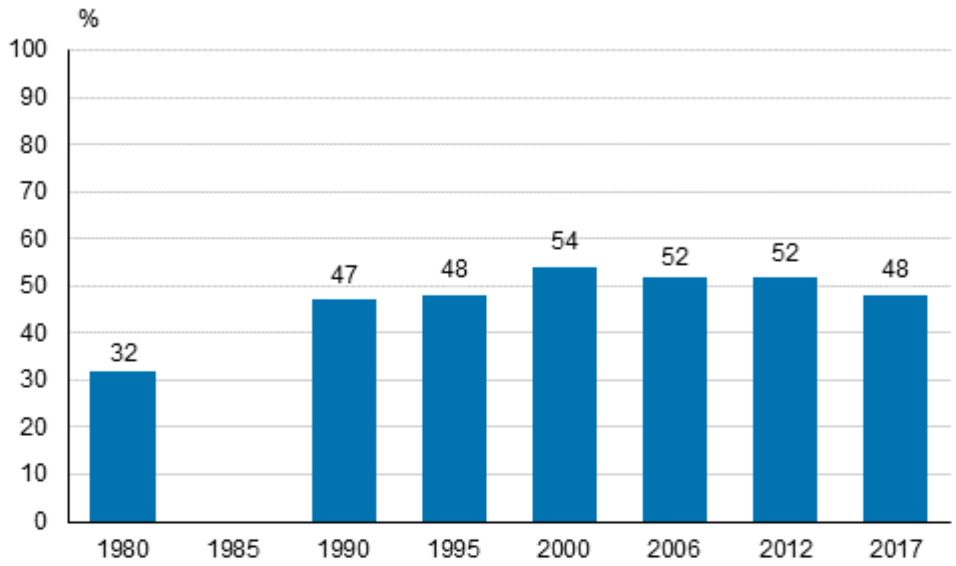

Table 1: Participation in adult education in 1980, 1990, 1995, 2000, 2006, 2012 and 2017 (population aged 18 to 64), %

Most of adult education was professional, that is, the reason for participating in education and training was related to work or occupation (according to respondents' own estimate). Such education was attended in 2017 by 1.2 million persons, that is, nearly one-half of the labour force (employed and unemployed persons).

The majority of education and training related to work or occupation was supported by employers, that is, so-called personnel training. In 2017, personnel training was received by one million wage and salary earners, 53 per cent of all wage and salary earners.

Nearly 390,000 persons aged 18 to 64 participated in adult education and training not related to work (excluding students and conscripts) in 2017. Women were clearly more interested in these general education or hobby-related studies than men. Participation activity in education or training related to leisure or hobbies remained at the same level from 1990 to 2012. In 2017, four percentage points fewer than before participated in such training, 14 per cent of those aged 18 to 64.

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INTERGENERATIONAL LEARNING FOR ADULT LEARNERS THROUGH STEAM: FROM THE POINT OF HOFSTEDE'S 6D MODEL (STEAM PLUS)

Culture vs Creativity Portfolio

IO1:
Culture vs Creativty;
STEAM Literacy Questionnaire

Culture Relationship of STEM/STEAM Education Practices

In our country, STEM education, or STEM education, which is the abbreviation of the words Science, Technology, Engineering, Art and Mathematics, makes significant contributions to the development of students' critical thinking and problem-solving skills by ensuring their enrichment in physical, intellectual and cultural areas (Çorlu and Aydın, 2016).

STEM education also aims to enable individuals to acquire universal and cultural values in order to raise their knowledge and skills above the level of contemporary civilizations. For example, one of the aims of the Preschool Education Program (OÖEP) published by the Ministry of Education in 2013 is to support children in recognizing the values of the society they live in, adopting cultural and universal values, and respecting differences.

STEAM should be designed to accurately represent the surrounding culture and be tolerant of all forms of diversity, both among those represented and across all cultures known to them. STEAM is a public, collaborative educational plan to which all subjects and types of students can validly contribute and where all efforts are encouraged and measurable for group and individual achievements (Yakman and Lee, 2012: 1078).

In 2019, the STEAM PEOPLE project, in which Spain is the coordinator and Portugal, Greece, Estonia, Sweden and Turkey are partners in the European Union Education and Youth Programs Erasmus+ Program Main Action II- Strategic Partnerships in the Field of Adult Education Grant Program, developed the culture of scientific thinking in adult students. It is a project to develop a learning platform that supports the development of skills and values in the fields of science, technology, engineering, art and mathematics along with this culture. The aim of the project is to support the culture of scientific thinking in adult learners within the scope of decision making, problem solving, analysis, creative and critical thinking.

Culture and Creativity Portfolio:

What are your observations on the relationship between culture and creativity on a sectoral basis? For example, in health, education, business life. To what extent are cultural elements used in creativity processes compared to universal elements? We would like to give a concrete example: "Design and skills workshops" were opened in various pilot schools in every region of Turkey. In addition to various trainings in the field of technology, traditional practices such as "marbling art" were modernized and started to be implemented in these workshops.

Turkey

It is obvious today that culture positively affects creativity. At this point, culture affects creativity both directly and indirectly. Culture carried from generation to generation increases individuals' level of creative thinking and potential for action. On the other hand, cultural elements change product diversity and way of thinking.

Cultural elements are used in many areas in Turkey. Alternative medicine units that support modern medicine in healthcare have begun to be established within hospitals. The use of traditional instruments in education, the dissemination of traditional artistic activities such as marbling, the use of cultural motifs in consumer-based products, the modernization and re-introduction of old products in the food and beverage sector, the re-processing and re-introduction of old fabrics and motifs with new production techniques in the clothing sector can be given as examples.

Determining how different cultural structures affect creativity will both increase the interest level and awareness of adult individuals and pave the way for strengthening intercultural interaction.

Austria

Cultural education is defined as the ability to position oneself in a constantly changing, complex aesthetic environment – and to be an active and creative "designer" of our everyday surroundings - cultural and artistic activities play a vital role in gaining skills and abilities in Austria. The Austrian Ministry of Education intends to integrate cultural education into a culture of learning and teaching, encouraging each child's and young person's unique talents. In compliance with government programme that also encourages an improvement of empirical data in the interest of evidence-based policy in cultural and education policy, the department of education, arts and culture has commissioned EDUCULT to carry out an Austria-wide qualitative research on the situation of cultural education.

The intention of this project was to highlight basic aspects like definitions of cultural education, characteristics of quality and value, the specific motivation and qualification of those working in the field – teachers, educators and artists –, plus questions of resources and funding and examples of good practice.

In Austria Cultural education, that is, education in the arts and education through the arts (which means the use of art-based forms of teaching as a pedagogic tool in all kinds of school subjects), as examined by Anne Bamford in her systematized and comparative global review written for UNESCO, entitled "The WOW Factor", makes an important contribution to the achievement of this aim. It is, in effect, a motor of individual development. Parents are becoming increasingly aware of this. In Austria, at least, the most recent cultural monitoring study conducted by the Institute for Empirical Social Research (Ifes, Institut für Empirische Sozialforschung) revealed that parents want to see more art and culture in schools because they believe that cultural education is critical to their children's overall development. Recently, the Nordic Council highlighted cultural education as an area in which schools should focus more intensely in the next years, and which should be expanded and improved accordingly. In recent years, the Austrian educational institutions have begun to combine traditional art-works of art such as knitting or sewing with modern technologies and modern approaches such as robotics, 3D printing, and the like.

Finland

In accordance with FNCC, the core value in Finnish schools is supporting the learning community as the heart of the school culture. The learning community is peaceful and empowering, it relies on self-evaluation and communication with parents and other partners. It is promoting physical and emotional well-being (FNAE, 2016: p. 28.). The establishment of well-being and safety in everyday school life is an important principle in Finnish schools. The school's structures and practices are supposed to create preconditions for learning, equality, flexibility, versatility, accessibility, predictability, fairness, trustworthiness, and warrant for the rejection of discrimination (FNAE, 2016: p. 28.).

The interaction and versatile working approach involve active learning. Learning in Finnish schools is meant to be based on the diversity of learning styles, creative work, play, moving and experiences. FNCC recommends re-connecting formal and informal pedagogical approaches, in-school and out-of-school learning, encouraging project- and module-based education, multisensory learning, and interaction with working life (FNAE, 2016: p. 28-29.).

FNCC promotes cultural diversity and language awareness. According to FNCC, school is at the intersection of local and global perspectives, and part of a culturally transforming and diverse society. This involves the practice of community-based responsibilities and representing multilingualism (FNCC, p. 28.). FNCC supports cooperation between the internal and external actors of education and the society to enhance participation and democratic action (FNCC, p. 29.).

According to FNCC's principles, equity and equality are developed by safeguarding rights, access, and opportunities to fulfill individual needs connected to human diversity and gender equality (FNCC, 30.).

FNCC emphasizes "ecosocial knowledge" as part of environmental responsibility and sustainable future orientation, through the concept of sustainable everyday life-based wellbeing (FNCC, 30.).

The theme of creativity appears in FNCC nearly 100 times in multiple configurations, contexts, and roles. FNCC, as a policy document, establishes the implementation of creative factors to reinforce the educational system’s ecological coherence. The fact that creativity is among the most often mentioned “cross-cutting” topics in FNCC, serves to validate the concept that the creative nature of schooling is a welcome perspectival change in Finnish everyday education. The processes, partnerships, policies, products and the physical and emotional environment are all included in discussions related to creativity. This completes both the descriptive and transformational capacity of Pamela Burnard's concept of multiple, diverse creativities, see: Figure 6 (Szabó et al., 2021).

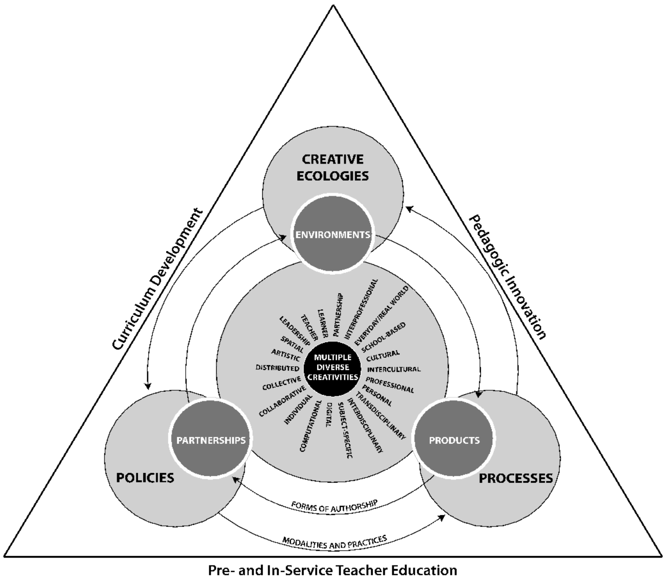

Figure 6. Creative ecologies and micro pluralism of diverse creativities (Szabó et al., *2021*)

Pamela Burnard's model incorporates the dual concepts of 'creative ecologies' and 'multiple creativities.' This model locates the forms, representations, and articulations of collaborative creativity in interprofessional learning and teaching. The model presents *creativities* as multi-stakeholder collaborative *activities,* which are contextualized and reflected by practice-based teacher education, curriculum development, and pedagogic innovations. By highlighting multiple ways of knowing held within a holistic creative ecology, this model's perspectives help shifting the focus from creative capacities or skills to growing creative communities.

Based on Burnard's earlier comprehensive analysis of multiple creativities in music education (Burnard, 2012: p. 223.), the current model also includes reflection on modalities and practices and authorship forms. Just like in the earlier model, the modalities emphasize the role of using several different tools, sharing the production, and blurring the boundaries between formal and informal learning in the collective creative processes. Practice principles can be declared (explicit) or only done without declaration (implicit) and depend on goals and the nature of interaction in communities. In collaborative creativity, the forms of authorship are also subject to dynamic transformation: authorship is negotiated; all actors of the learning process have a role in creating something new; STEAM education toolkits, technologies, such as digital tools, can also contribute to the outcome of the creative process.

In FNCC, creativity appears in multiple functions. The cultural role and embeddedness of creativity emerge from cultural diversity as a source (FNCC, p. 16.). Creativity also appears in a didactic function, as a source for activities that promote learning, inspire pupils, competence development, and the joy of learning emotional experiences (FNCC, p. 17). Creativity's didactic functions also encourage multiple work approaches, characterized differently in every age group and different learners (FNCC, p. 28.). Didactic creativity is reflected in creative thinking in working methods as well (FNCC, p. 32). Creativity appears in organizational functions and is reflected in the learning environment, which has to offer possibilities for creative solutions (FNCC, p. 30.). Creativity emerges as part of personal, individual characteristics, which education needs to develop in every pupil by developing various skills, including creative communication, like engaging in versatile ways of self-expression and constructive interaction (FNCC, p. 31.)

To grasp "everyday creativity" at work in Finnish schools on the policy level, it might be worth taking a closer look at creativity's role in the didactics of the school subjects, offered for different age groups. One can find a progressive and cumulative plan for creative development embedded in FNCC on the subject learning level as well.

It is important to notice that FNCC's creative development plan organically builds on the work defined by the Finnish National Core Curriculum for Early Childhood Education and Care (FNAE, 2019) and overarching the whole period of basic education in Finland from the first grade to the ninth grade.

According to FNCC's recommendations, the creative development in 1-2 grades is explicitly focusing, but not limited to

- language education and literature to develop verbal expression and imagination (FNCC, p. 110.) and support dialogic, collaborative approaches to cultural expression (FNCC, p. 117.). This involves the creative ways of learning the second national language – Swedish or Finnish - (FNCC, p. 133) and the foreign languages (FNCC, p. 135.);
- mathematics education through creative problem-solving (FNCC, p.139.);
- religion education through pupil-centered, creative methods in connection with ethical questions (FNCC, p. 145.);
- music education through "creative production," see: "The pupils' creative thinking and aesthetic and musical understanding are promoted by providing them with opportunities to compose and perform musical ideas and to use their imagination and creativity both independently and together with others." (FNCC, p. 151.). It is interesting to notice that the most enhanced and detailed creative development plan seems to be recommended for music education in this age group;
- visual arts learning through creative applications (FNCC, p. 155.);
- crafts education to develop creativity in close correspondence with spatial, motor and design skills (FNCC, p.156.) and finding creative solutions (FNCC, p. 157.).

According to FNCC's recommendations, the creative development in 3-6 grades is mainly focusing, but not limited to

- transversal competences, especially to "Thinking and learning to learn" (T1), as pupils are encouraged to use their imagination in finding creative solutions in learning (FNCC, p. 165.);
- language education and literature according to similar tendencies as it was seen in the case of 1-2 graders above (see FNCC, p. 173., p. 178., and p. 236.);
- mathematics education through the development of the pupils' logical, precise, and creative mathematical thinking (FNCC, p. 252.) and creative problem-solving as it was seen above in the previous age group (FNCC, p. 255.);
- environment studies through finding opportunities for pupils to experiment, invent and be creative together (FNCC, p. 258.)
- music education, where the theme of "creative production" in this age group grows into a full module of creative development based on complex objectives (FNCC, p. 283. and p. 285.);
- visual arts learning similarly as above;
- craft education, see: "Making crafts is an exploratory, inventive, and experimental activity in which different visual, material, and technical solutions as well as production methods are used creatively […] The pupils develop their spatial awareness, sense of touch, and manual skills, which promotes motor skills, creativity, and design skills. […] Various transversal themes are studied comprehensively while creating natural connections to other subjects." (FNCC, p. 290.).

According to FNCC's recommendations, the creative development in 7-9 grades is mainly focusing, but not limited to

- transversal competencies, including "ICT competence," regarding information management, inquiry-based and creative work online, and safe digital interaction and networking (FNCC, p. 304.);
- language education and literature in supporting pupils to become "creators of culture" (FNCC, p. 311.), in addition to the goals, which were already listed in the case of 3-6 graders above (FNCC, p. 322., p. 349.);
- mathematics education as it was seen as above (FNCC, p. 402.);
- chemistry learning through critical and creative thinking (FNCC, p. 424.);
- history learning through familiarizing with the significance of autonomous culture and identity in "creating, building and defending Finland" (FNCC, p. 447.)
- music education as it was seen as above and enriched with new components, such as developing a creative relationship with music (FNCC, p. 454.);

- visual arts learning through utilising information and communication technology and online environments creatively, critically, and responsibly (FNCC, p. 458.);
- craft education as it was seen above (FNCC, p. 462.);

home economics, to develop manual skills and creativity as well as the ability to make sustainable choices and act sustainably in the daily life at home (FNCC, p. 470.), which also means to "be creative in the household" (FNCC, p. 471.).

Within the scope of STEAM activities implemented in your country, are there any activities that carry your cultural elements other than universal practices? If so, what are they?

Turkey

The use of cultural elements in the STEAM field is not very common in Turkey. It is observed that internationally used methods are widely used in training. It is thought that cultural elements can be used more widely with the expansion of the STEAM field, which can be considered new for Turkey.

Austria

In Austria, there are several applications for linking cultural monuments with STEAM education activities. For example, students model in the program GeoGebra or some of the programs for 3D modeling and printing some of the cultural and historical monuments, churches or similar. This approach is used by teachers in Austria not only to bring Austrian culture and cultural heritage closer to students but also to bring other cultures and cultural monuments closer to students, thus adding cultural elements to STEAM education (El Bedewy et al. 2021). Some examples from this approach provided by El Bedewy et al. (2021) are given below:

(a) (b) (c) (d)

Finland

This does not seem very significant in the case of Finland.

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