ProgeTiger Programme 2015–2017

2015

Contents

1. Introduction

One of the strategic goals in the Estonian Lifelong Learning Strategy 2020 – a digital focus – aims at applying modern digital technology to teaching and learning in a more efficient and effective way, improving the digital skills of the entire population and guaranteeing access to the next generation of digital infrastructure [3].

Estonian national curricula for basic schools and upper secondary schools identify digital competence as a general competence, describing it as follows: the ability to use evolving digital technology to cope in a rapidly changing society – when studying, acting as a citizen and interacting with communities; to find and retain information using digital tools and to evaluate its relevance and reliability; to participate in creating digital content, including the creation and use of texts, pictures and multimedia; to use appropriate digital tools and techniques to solve problems, and to interact and collaborate in different digital environments; to be aware of risks in the digital environment and know how to protect one's privacy, personal data and digital identity; and to follow the same moral principles and values in the digital environment as in everyday life. By integrating digital competence into the teaching and learning process, the compilers of these curricula wish to shape learners into innovative individuals who are able to use modern technologies purposefully and who are comfortable in the rapidly changing technology-rich living, learning and working environments [2, 6].

Digital competence is closely connected with technological literacy. Since nowadays technological development is largely connected with information technology, sufficient age-appropriate digital competence ensures the knowledge and skills to use technology purposefully, but technological literacy means the ability to create technology as well. Enhancement of technological literacy leads one to understand the essence of technology, how different software or hardware works and how to create, modify or improve technology. This is closely related to manual activities such as robotics, electronics and mechatronics.

Technological competence has been described in the national curriculum for basic schools as follows: the ability to cope in the technological world, understand technology trends and the connections between technology and other scientific achievements; to acquire technological literacy for age-appropriate, creative and innovative use of technology tools, integrating thinking with manual activities; to analyse opportunities and risks associated with the implementation of technology; to comply with the requirements for intellectual property protection; to solve problems by integrating thinking with manual activities and carry out ideas purposefully; to cope with household chores and eat healthy [7].

The government has set a strategic objective for the Information Technology Foundation for Education (HITSA), to ensure that sufficient age-appropriate digital competence necessary for further studies and to succeed in society is acquired at all levels of education, by integrating the use of digital solutions into the entire process of teaching and learning [4]. Accordingly, the ProgeTiger programme has been established as a measure to help students understand the basics of technological

creativity and the relationships among technologies, to support the development of problem-solving skills and to achieve better learning outcomes in general – in preschool, general and vocational education domains.

Activities carried out within the framework of this programme will contribute significantly to developing age-appropriate digital competence of learners, or developing the skills necessary to cope in a society of technological abundance, and support the emergence of the creators of technology.

2. Goal, Approach and Planned Activities of the Programme

The goal of the ProgeTiger programme is to enhance learners' technological literacy and digital competence.

Sub-goals:
1. To enhance technological literacy of teachers and instructors, by supporting them with the development of technological literacy and with integration of relevant activities into the process of teaching different fields, including the use of age-appropriate methodologies and educational activities.
2. To encourage interest, skills and the involvement of children and young people in the fields of engineering sciences, by increasing the availability and attractiveness of technological activities for different age groups, aiming to encourage algorithmic thinking, problem-solving skills and programming skills of children and young people.
3. To promote networking by teachers and instructors who are active in the field.
4. To support the procurement of equipment for institutions of preschool, general and vocational education that they need in order to use different teaching methodologies and to conduct learning activities.

Target groups of the programme:
Teachers and instructors – the programme offers teaching and learning materials, methodologies and trainings to enhance teachers' and instructors' competences relating to technological literacy, to integrate relevant methodologies into the teaching and learning process and to teach related subjects (electives, hobby groups). Activities of teacher and instructor networks are supported.
Institutions of preschool, general and vocational education – institutions are supported by enhancing learners' competences related to technological literacy, and by procuring equipment.
*Learners* – the programme contributes to the development of competences related to technological literacy and the various elements of digital competence of learners at different ages, as well as generates interest in the field by employing promotional activities.
The programme supports the principles of the "Huvitav Kool" (Interesting School) initiative by making learning more diversified as well as more playful and interesting for learners.

2.1. ProgeTiger Programme Approach

Within its framework, the ProgeTiger programme provides opportunities for development of technological literacy and digital competence. Technological literacy gives learners the ability to cope in the technological world, understand the nature of technology, use technological equipment, and to develop and apply technology creatively and innovatively. The competences that are needed to develop technological literacy are identified in the ISTE Standards for Students, the DIGCOMP report by EC JRC-IPTS (2013), the national curricula for general education and the Standards for Technological Literacy (STL) [1, 5 and 9]. To develop these competences, the ProgeTiger programme focuses on activities related to **integration of three thematic fields** – engineering sciences, design and technology (D&T), and information and communications technology (ICT) – **into the teaching and learning of different subjects and extracurricular activities** (see Figure 1).

Figure 1. ProgeTiger programme approach
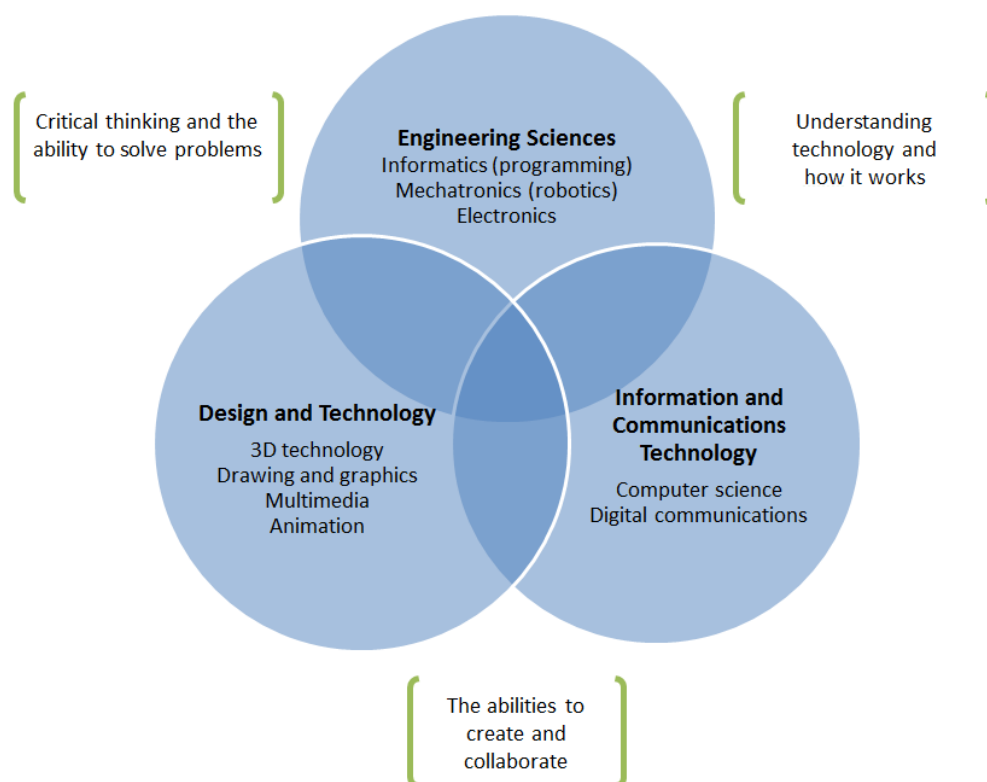
Engineering Sciences
Knowledge in the field of engineering sciences, or technical sciences, includes skills in the use of informatics (including programming), electronics and mechatronics (robotics). This knowledge is related to building specific technology tools and practical activities associated with them, as well as to logical and algorithmic thinking.

Design and Technology (D&T)
D&T-related knowledge includes skills in the use of 3D technology, drawing and graphics, multimedia and creation of animation. This knowledge is related to creating technologically user-friendly and aesthetic design.

Information and Communications Technology (ICT)
ICT-related knowledge includes skills in the use of information and communication technology, telecommunication technology, as well as in the use of computers, computer systems, software and servers. This knowledge is related to the ability to gather, retain and analyse information using technology tools.

Development of technology or the use of existing technology in teaching and learning involve many competences. For example, several students are often involved in the same technology-related creative process, each having a different role in it. By integrating technological disciplines into subjects, students are being motivated and encouraged to enhance their competences in technology to reach an understanding of what interests them most (e.g. design, development, or construction) or whether they are interested in a technological field at all. The activities of the programme will indirectly support the development of learners' other general competences as well, such as critical thinking and problem solving, creative and cooperation skills, and an understanding of how technology works.

2.2. ProgeTiger Programme Activities

Based on the goal and sub-goals of the ProgeTiger programme and the findings of the research [8], the following activities are planned within the programme:

1. **Developing, updating, translating and adapting learning and sample materials.** These materials include both methodological guidelines and examples of how to integrate technology with teaching and learning. Among other things, learning materials are adapted to SEN students to take into account their needs. All materials will be available free of charge under a Creative Commons license. Development of learning materials and guidelines is based on the needs of both beginners and advanced learners to ensure the continuous development of their competences. Learning materials and guidelines are created to improve technological literacy by integrating it into the learning of various subjects.
2. **Trainings for teachers and instructors**, including instructors of technology-related activities who assist with implementing the activities of the thematic fields of the programme (including initial trainings for understanding the field of technology and trainings related to new technologies and tools used in teaching and learning; and trainings for organising relevant elective subjects or hobby groups). When developing these trainings, we keep in mind the HITSA concept for teacher in-service training, which is in accordance with the concept for in-service training for teachers and heads of educational institutions developed by the Ministry of Education and Research [10].
3. **Activities by programme networks.** This involves employees of educational institutions active in the field of technology who, in one way or another, are

engaged in programme-related activities at their institutions. By coordinating networks, we wish to ensure a new generation of instructors for the programme. Members of the networks are instructors of the training programme, information sharers and popularisers at the regional level.

4. **Supporting procurement of** technological **equipment** that educational institutions need to implement the ProgeTiger programme and for teaching and learning (robotics kits and additional sensors, microcontrollers, minicomputers, Kano, 3D printers, etc.).

5. **Information-sharing and popularising activities**, including organising student competitions, preparing information materials for target groups, organising informative events, organising student events and contests which develop technological literacy, supporting students and teachers who participate in international student contests, and introducing the programme and its results to a wider public.

The planning of programme activities and outputs is based on the skill levels of target groups, identifying three proficiency levels – **basic, intermediate and advanced**. Activities planned for different proficiency levels and the competences sought under each level are outlined below. These levels are not related to the levels of formal education, but to the levels of students' knowledge and skills.

Basic level
The target group
- Designed for learners who need systematic guidance on how to use technology tools for learning purposes.

Activities
- Methodological materials on how to link existing materials to the teaching process are prepared for teachers and instructors, and suggestions of technology tools suitable for teaching at the basic level are offered. In addition, learning guidelines which include learning outcomes and sample exercises are compiled. Learning activities offered and technology tools used at the basic level should generate learners' interest and encourage their creativity, logic and fantasy. Their spatial thinking, fine motor skills, innovative and mathematical thinking, and manual activities are encouraged as well as their horizons broadened. The development of children is supported by different learning software, interactive tools, computer games and mobile applications, integrating them with other learning activities.
- Examples of the existing learning materials: the learning material entitled "First Steps in Programming", MSW Logo, KODU Game Lab, Scratch, LEGO WeDo, and materials available at the Koolielu web portal (www.koolielu.ee). Within the framework of the programme, new materials which use new technological possibilities are adapted.

Competences sought
- Learners know the basic techniques of using information technology and use digital devices for producing creative works. Learners apply their creativity by means of information technology tools and they use digital tools for communicating, searching for information and gathering information. Learners are able to diversify their learning activities and creative works with

photos, videos and animations, as well as to make and use models or simple robots to complete their learning tasks. Learners understand the simpler technological processes (how technology works around them, what puts it in motion or makes it solve a certain task, etc.).

Intermediate level

The target group

- Designed for learners who are able to complete tasks independently and understand the technology, but need guidance at solving various problems.

Activities

- Methodological materials are prepared for teachers and instructors, and suggestions of technology tools suitable for teaching at the intermediate level are offered. In addition, learning guidelines which include learning outcomes and sample exercises are compiled.
- Examples of possible existing learning materials: MSW Logo, KODU Game Lab, LEGO Mindstorms, Scratch, MIT App Inventor, materials available at koolielu.ee, and user guides for 3D graphics packages.

Competences sought

- Learners use technology tools in group work, inquiry learning, active learning and homework. Learners are able to resolve primarily school- and learning-related practical tasks that require critical thinking and problem-solving skills. Learning activities must maintain learners' interest, develop their inquiry skills and their ability to analyse different technological processes. Learners are able to design and implement a few simple products (a game, app, animation, object) as well as create mechanised objects to perform specific tasks.

Advanced level

The target group

- Designed for learners who are able to use technology creatively and solve more complex problems using technology.

Activities

- Methodological materials are prepared for teachers and instructors, and technology tools being suitable to teach advanced learners are suggested. These materials focus on teaching engineering sciences, ICT and technological design. In addition, learning guidelines which include learning outcomes and sample exercises are compiled.
- Examples of possible existing learning materials: microcontrollers and minicomputers at schools, Scratch, Python, codecademy.com (JavaScript, HTML/CSS, jQuery).

Competences sought

- Technology tools are used to produce creative works that are no longer linked to academic activities, but resolve some wider societal problem or are associated with some innovative idea. Learners demonstrate an in-depth understanding of technology concepts, systems and operations. Learners are able to offer solutions by analysing technological problems – by investigating, asking questions and raising hypotheses. They are able to turn ideas they generate into products (a game, app, robot, etc) and are able to test and

evaluate them, as well as modify or improve them as needed.

3. Programme Implementation

The ProgeTiger programme is carried out by the HITSA Development Centre of IT Education. The programme was started and is funded by the Estonian Ministry of Education and Research who participates in designing programme activities, planning the resources required, and preparing the annual programme action plans.

Programme partners:
The Estonian Ministry of Economic Affairs and Communications – is involved in the process of preparing programme action plans and the action plans related to information-sharing and popularising activities (by training teachers and hobby group instructors, the "Enhancement of Digital Literacy" activity, funded through the EU Structural Funds 2014–2020, facilitates the availability of ICT-related hobby activities).
Universities, the private sector and institutions of the third sector – are involved in the development of training and methodological materials as well as in information-sharing and popularising activities.

Annual action plans of the programme (which also identify the roles and activities of partners) and reports on the implementation of action plans are to be approved by the Ministry of Education and Research.

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