SMART EDUCATION FOR SMART TEXTILES

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ABSTRACT

The aim of this paper is to present the main objectives and achievements of the Skills4Smartex project, according to its declared goals. The Erasmus+ project *"Smart textiles for STEM training"* is funded with support from the European Commission and it is a Strategic partnership - KA2 / Vocational Education and Training (VET), in the field of transfer of innovation from research providers towards textile enterprises & VET schools. The students within technical education acquire basic disciplines, such as mathematics, physics, technical drawing, chemistry, biology, mechanics, but the horizon of the end applications and usefulness of such basic disciplines is often not touchable. In correlation with these facts, the Skills4Smartex project is centred on improving knowledge, skills and employability of VET students in the STEM related fields, by providing the adequate training instruments to understand multidisciplinary working.

Key Words: Smart textiles, e-learning, blended teaching.

1. INTRODUCTION

New technologies and their use in textile design and production processes require continuous learning and freshening of knowledge. E-learning is a modern and efficient way to access knowledge and provides some advantages: it enables flexible learning hours, distance learning and benefits from media content, such as pictures, graphs or videos. E-learning may be applied in various fields, however, engineering e-learning courses are especially suitable, due to their rigorous structuring, the possibility to showcase machinery functioning by means of animations and the general compatibility between informatics and STEM fields. The textile field is a multi-disciplinary field, for it applies mechatronics, physics, chemistry, biology, informatics, mathematics etc. Thus, e-learning in textiles has multiple benefits, for it includes various STEM compatible fields with informatics instruments. Moreover, the strong points of e-learning, time and place independency of the learners can be effectively used also for textile studies. A partnership of five European organizations have joined in order to provide adequate e-learning courses for textile professionals. Main aim is to offer learning content in advanced textile fields and innovation solutions for the textile enterprises, represented by these professionals. The outcomes were achieved within two Erasmus Plus project for Vocational Education and Training funded by the European Commission. The two projects are named "E-learning course for advanced textile fields – Advan2Tex" (2014-2016) and "Knowledge matrix for innovation and competitiveness in textile enterprises - TexMatrix" (2016-2018).The Advan2Tex project aimed to provide e-learning content for professionals in textiles, young entrepreneurs and students in higher education. The content was divided in seven modules, meant to foster the involved target group to apply the knowledge within their own textile organizations. The TexMatrix project is based on an organizational management instrument named the Knowledge Matrix for Innovation, where the intangible assets of a

textile enterprise are quantified and improved and their innovation capability is supported [1-5].
The aim of this paper is to present the main objectives of the Erasmus+ project "Smart textiles for STEM training", funded with support from the European Commission, which is a strategic partnership - KA2 / Vocational Education and Training, in the field of transfer of innovation from research providers towards textile enterprises & VET schools. The students within technical education acquire basic disciplines, such as mathematics, physics, technical drawing, chemistry, biology, mechanics, but the horizon of the end applications and usefulness of such basic disciplines is often not touchable. Skills4Smartex project assumes the performing novel educational materials in smart textiles with the purpose of creating a touchable link between theory and practice in multidisciplinary STEM domains.

2. TECHNOLOGICAL AND EDUCATIONAL CONTEXT

Smart textiles are nowadays used for various application fields within the textile technical applications. Textile products have overcome the barrier of classical products. They are omnipresent, used in numerous and different fields. Some examples include agriculture, medicine, buildings, PPE, defense-military applications etc. They combine textile technologies with electronics, chemistry, physics, and informatics and thus they represent a multidisciplinary domain [5]. A smart textile system has basically five functions: sensors, actuators, data processing, energy supply and communication. The progress in the smart textile domain was possible due to simultaneous development of several technological domains: synthetic fibers, textile technology, electronics and information technology. To the best of our knowledge, the single educational e-learning project, for e-learning course on smart textiles is TRITex [6], which developed courses remotely available through a digital platform, consisting of two modules, on Functional and Smart Textile Materials, and on Smart Textile Systems. The entire course gives the trainee a profound insight in the working principals of smart textiles and is completed with examples of prototypes and commercially available products. Throughout the course, online interaction with the teachers of the course was possible. At the end, the acquired information was tested through an extensive assessment at the end of each module.

The quality of Vocational Education and Training (VET) in technical fields at European level means competitiveness leverage in the international context. European VET schools have a good performance and a strong tradition, however, the key competences have to be maintained and developed. The professional education has registered a positive number of trainees in the last 10 years and needs thus support by reorientation towards the requirements of the world-of-work. The speed-up of technological development is a challenge for the young VET students, while the development of the textile industry needs well prepared specialists in multidisciplinary fields. VET students within technical education acquire basic disciplines, such as mathematics, physics, technical drawing, chemistry, biology, mechanics, but the horizon of the end applications and usefulness of such basic disciplines is often not touchable. On the other hand, the labor market in STEM fields needs appropriate skilled professional workers, in order to compete on the global market.

3. SKILLS FOR SMARTEX PROJECT

In correlation with these facts, the Skills4Smartex project is centered on improving knowledge, skills and employability of VET students in the STEM related fields, by

providing the adequate training instruments to understand multidisciplinary working. This project has an innovative concept for it aims, to provide up-to-date outcomes for the VET students, meant to motivate and support them into the world-of-work. In the following, the most innovative outcomes will be presented, in actual stage of the proposed work.

3.1 Project main outcomes

The speed-up of technological development is a challenge for the young VET students, while the development of the textile industry needs well prepared specialists in multidisciplinary fields. In this context, Skills4Smartex aims to improve the knowledge, skills and employability of students in the fields related to STEM (Science, Technology, Engineering and Mathematics) by providing appropriate training tools to understand multidisciplinary work through smart textiles. Thus, the Skills4Smartex project envisages the accomplishment of three innovative and sustainable outcomes (Figure 1), respectively: a guide for smart practices, one course in smart textiles and the dedicated e-learning instrument. These outcomes will address the following target group: VET students in secondary education, students in basic stage of higher education and young professionals from the industry.

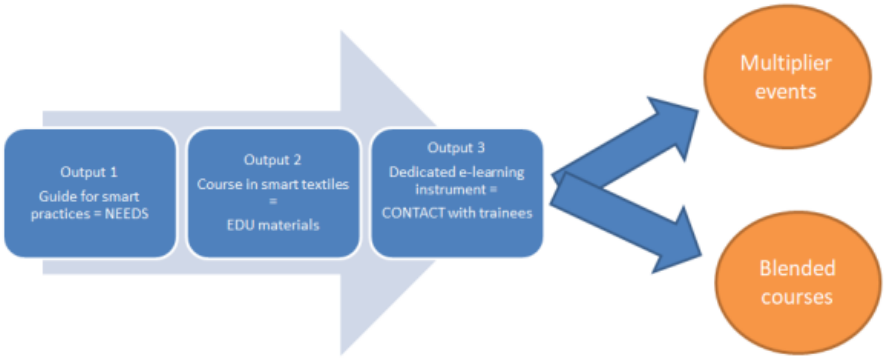

Figure 1. The main outputs of Skills4Smartex project

The Output1, "Guide for smart practices" will be tailored according to Bardach's methodology, which focuses on a smart and interesting idea in a given practice that deserves attention. This type of studies characterizes basic and general aspects, as well as the links between them and are thus called "smart practices" research. The survey's aim is to produce a state-of-the-art report on Technical and Smart Textiles in a number of European countries, based on data collected from 60 Textile enterprises in Romania, Belgium, Slovenia, Portugal and Czech Republic. It aims to identify existing opportunities for producing smart textiles in enterprises and forecasting expected occupations and work profiles for young trainees. The results will be published in a guide meant for transferring smart practices from enterprises to Vocational Education and Training (VET) schools and young students.

The methodological approach is based on the questionnaire based survey, which was organized with the participation of 60 textile enterprises. The questionnaire was commonly prepared by the project's partners and included aspects related to:

- Analyzing the interest and capacity of textile enterprises to perform smart and technical textiles.
- Finding the profile and the number of the workplaces needed by the textile industry.
- Identifying the availability of textile enterprises to organize one-day visits with VET students or practical training.

- Transferring the guide towards important stakeholders, such as: VET schools, professional associations, enterprises, regional educational agencies.

An example of questions to be answered are Multiple Answering Questions where the interviewee can choose between a rose of alternatives (Figure 2).

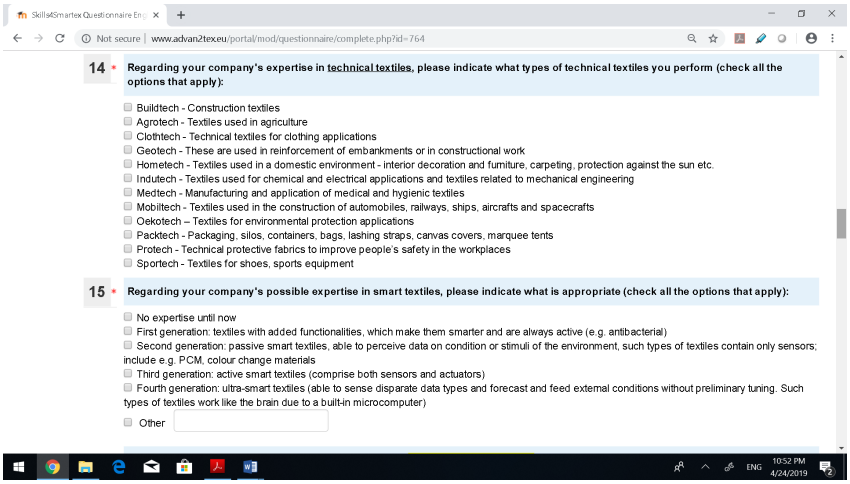

Figure 2. Multiple Answering Question

Likert scales, with selectable values from 0 to 5, referring to the company interest in the smart textiles development are also part of the questionnaire. An example is given in the Figure 3.

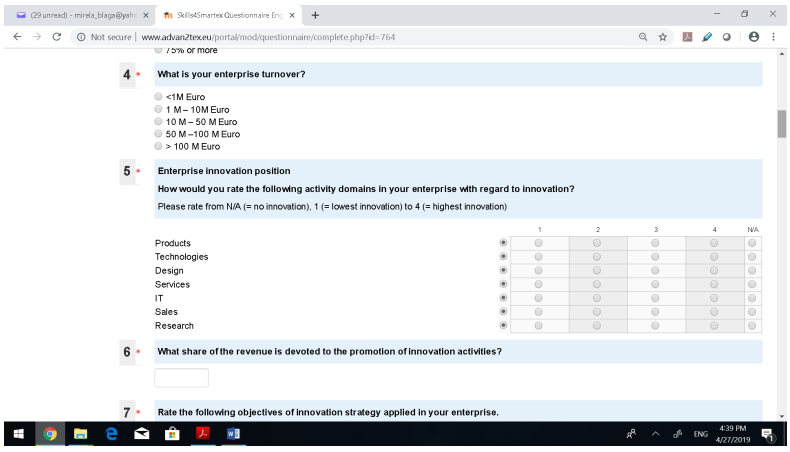

Figure 3. Likert scales questions

The data gathered from the survey will be used to identify the sources sites, namely the textile enterprises providing profiles for high value-added workplaces.

3.2. Blended learning courses

The usage of Learning Management Systems (LMSs), such as Moodle, has been widely integrated in the higher education process [2]. The Skills4Smartex outcomes implemented on the e-learning platform will create synergies with the Open Educational Resources already implemented on www.advan2tex.eu/platform (Figure 4), complementary to the Erasmus+ projects Advan2Tex and TexMatrix. Advan2Tex aimed to perform 7 modules in advanced

textile fields and 4 Guides, to increase the level of competitiveness of the young professionals from the textile industry. TexMatrix was focused on the implementation of the Knowledge Matrix of Innovation in textile enterprises in order to quantify and improve the intangible assets of the textile enterprise (www.texmatrix.eu).
Skills4Smartex aims to provide the useful instruments in order to motivate and support the young VET students to follow a career in STEM.

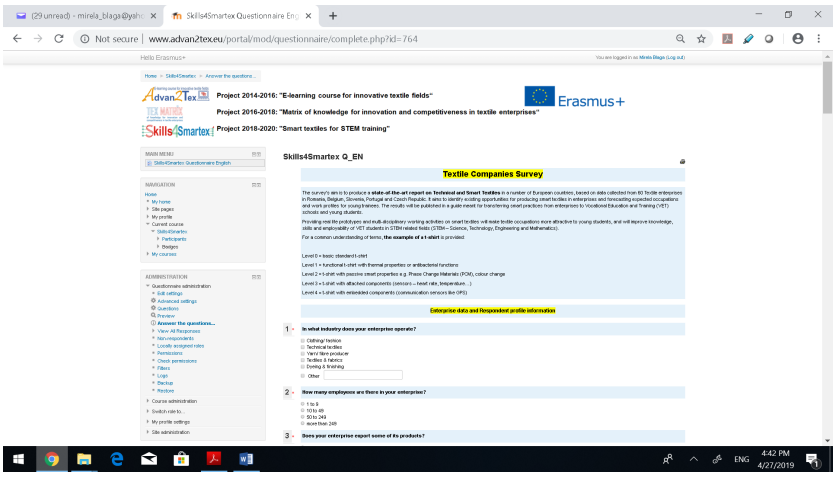

Figure 4. Moodle platform

The Output2, "Course in smart textiles" will introduce the VET students into a multidisciplinary domain and to perform practical skills by working with a prototype. The content of the course will be implemented as e-learning content on the e-learning instrument and platform (Moodle) and delivered as blended courses. The course in smart textile will have the following features:

- Novel educational material with creation of a touchable link between theory and practice in STEM;
- Knowledge integration between various basic disciplines;
- End-application showcase of knowledge acquired;
- Skills development by working with a prototype.

Each chapter will be conceived in modular form on two dimensions:

- The bottom-up approach: from STEM to SMART, meaning that the educational materials are focused on the modality basic sciences (maths, physics, chemistry and electrics) contribute to the construction of a smart textile product. One module consists of basic science applicability for a smart textile (Figure 5).

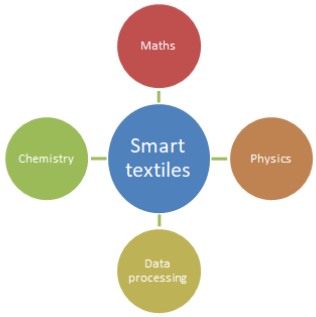

Figure 5. STEM to SMART approach for educational courses

The top-down approach: from SMART to STEM, will focus the educational materials on a smart textile prototype, which will be constructed by the project partners. Providing real life prototypes and multi-disciplinary working activities on smart textiles will make textile occupations more attractive to young students, and will improve knowledge, skills and employability of VET students in STEM related fields. A set of 60 multiple choice questions per chapter, on three levels of difficulty, and a test will contain 12 questions, having 4 questions on each level of difficulty, randomly selected.

4. CONCLUSIONS

Due to the digital technologies, young learners think that they should spend less time listening to teachers and more on problem-solving with computers. They prefer a more variety of activities than they currently receive and their view is worth entirely to be asked for. At the end, it is their level of self-esteem, confidence and motivation which will determine whether the environment is likely to be one in which they can engage their intelligence creatively.

Starting with the development of the Internet and hardware technology, e-learning has evolved as an alternative to classical classroom teaching: it enables flexible learning hours, distance learning and includes media format for visualization of technological processes. It enables some basic features regarding communication between tutor and trainee and regarding the self-assessment tests [5], [7].

However, for some specific fields, like textiles, blended learning courses, can be a good option, as they combine face-to-face and online learning. This method of learning is for students who do not want to miss out the traditional classroom experience, but want the flexibility essential with online learning .

5. ACKNOWLEDGMENTS

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