Promoting educational materials in digital fashion

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ABSTRACT – REZUMAT

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Specialized fashion software, as a technological instrument for virtual modelling, has a critical role in reducing the length of the design process and time to market, simplifying communication with other departments and improving the quality of the creative process.

This paper presents a survey of the modelling technologies used in Romanian clothing companies as a critical starting point for outlining a new methodology in teaching digital fashion. As part of the larger European survey in the framework of the Erasmus+ Digital Fashion Project, collected data from Romanian textile companies present their current needs for clothing designed with computer technologies and 3D software for virtual prototyping.

According to the sampled companies, most have high (over 42%) and medium (over 33%) levels of digital skills. The most needed occupational profile was the 3D Designer, and the age expectation was between 25–40 years. The ability to design clothing patterns using virtual prototyping was the most selected preference when asked about future development requirements. The survey results are valuable both in establishing the new methodological framework for teaching digital fashion and in identifying the needs for the other project outcomes, such as the textile database, the virtual training platform, and the new curricula.

Keywords: *virtual garment prototyping, technical drawing, garment pattern design, e-learning*

Promovarea de materiale educaționale în domeniul proiectării digitale a articolelor de îmbrăcăminte

Aplicațiile software specializate pentru proiectarea articolelor de îmbrăcăminte, ca instrumente tehnologice pentru modelarea virtuală, au un rol important în reducerea duratei procesului de proiectare și a timpului de lansare a unui produs pe piață, la simplificarea procesului de comunicare între departamente și la creșterea calității procesului creativ. Acestă lucrare prezintă un studiu legat de tehnologiile de prototipare virtuală utilizate de către companiile producătoare de articole de îmbrăcăminte din România, ce reprezintă un punct de referință pentru elaborarea unei noi metodologii de învățare în domeniul proiectării digitale. Ca parte componentă a unui studiu mai larg pe plan european în cadrul proiectului Erasmus+ DigitalFashion, datele colectate de la companiile textile din România creionează necesitățile actuale privind proiectarea digitală și prototiparea virtuală a produselor de îmbrăcăminte prin tehnologia calculatoarelor și softuri 3D.

În conformitate cu datele primite de la companii, cele mai multe dintre acestea au deprinderi digitale ridicate (peste 42%) și medii (peste 33%). Cel mai necesar profil ocupațional a fost Proiectantul 3D, la categoria de vârstă 25–40 de ani. Abilitatea de a proiecta tipare de îmbrăcăminte prin utilizarea prototipării virtuale a rezultat ca fiind necesitatea cea mai stringentă, când s-au chestionat companiile legat de necesitățile acestora pentru viitor. Rezultatele studiului sunt relevante atât pentru stabilirea unui nou cadru metodologic pentru învățarea proiectării digitale, cât și pentru alte elemente ale proiectului, precum baza de date pentru materiale textile, platforma de învățare online și noile materiale educaționale.

Cuvinte-cheie*: prototiparea virtuală a îmbrăcămintei, schițe tehnice, proiectarea tiparelor, e-learning*

INTRODUCTION

Interdisciplinary cooperation and development are currently supported by education and research in every domain of activity, with new opportunities for the future. The textile industry is rapidly integrating modern information technologies (IT) used in the design and development of fabrics and garments [1]. This integration is needed, given the unprecedented dynamics of the textile and clothing industry: it is one of the most varied and fast-moving industries, considering the reduction in product manufacturing time and the increased level of product complexity.

As a 21st-century concept of our life, digital fashion design is defined as overlapping the domains of fashion and information and communication technologies (ICT), in which "the virtual creation, production, and representation of one's identity are possible via computer-generated design" [2]. Digital fashion brings together advanced digital technologies such as 3D software, 3D scanning [3], 3D body scanning [4], pattern design/making [5] and software for the design of

fabrics [6]. Joint efforts have been recently made in the field of virtual prototyping for proposed articles of clothing, which enables a reduction in labour costs by eliminating "first cutting" and "first sewing". Virtual prototyping, often known as VP, is a software-based engineering discipline that involves modelling a clothing system, simulating 2D and 3D visualization and garment behaviour under real-world operating conditions and refining its design through an iterative process [7]. The virtual construction should be identical to the specifications intended for the final product, and as such, VP is increasingly used as a substitute for rapid prototyping. The concept of Fashion 4.0 is related to the digital fitting system and provides general requirements for the development of virtual clothing systems [8].

Various 3D fashion and patternmaking software is already on the market, with commercial names such as *Browzwear, OptiTex, Lectra Modaris, SpeedStep, Gerber,* and *CLO 3D*, which use computer-aided design (CAD) and computer-aided manufacturing (CAM), bringing together design, development, marketing and a comprehensive suite of easy-to-use solutions to obtain designs to market faster than ever before. This software may be used at any step of the production chain by conducting virtual garment simulation and digital fitting, focusing on fabric modelling, and criteria for qualitative assessment of the fit and the appearance of the garment [9]. The strength of 3D software for fashion design is related to reduced time in the design process and time to market, simplified communication with other departments in real-time and improved quality of the creative process. In various situations, the benefits can become much more particular [10].

Another domain of interest for our research study is related to the benefits of e-learning. Even though the COVID-19 pandemic seems to be passing away, distance learning and e-learning instruments remain a convenient and important way to deliver educational materials through digital resources. Some benefits of e-learning include easy access and use of educational materials by the target group, accommodation of everyone's needs and personalization of educational materials, quick updates to the content and quick delivery to the target group, less impact on the environment, reduced costs, and rapid career advancement [11–12].

Online training in the field of textiles and clothing has already seen a series of contributions. The e-learning platform (www.advan2tex.eu/portal/) of the Erasmus+ projects Advan2Tex (2014–2016), TexMatrix (2016–2018), Skills4Smartex (2018–2020) and OptimTex (2020–2022) includes valuable training materials for advanced textile fields, innovation in textile companies, STEM training via multidisciplinary study of smart textiles and software solutions for fabric design [13–16]. The Erasmus+ Texstra (2017–2019) and Digitex (2021–2023) projects produced training materials in the field of e-textiles [17–18]. The T-Crepe (2019–2021) project addresses textile engineering and virtual design solutions [19]. Green

textiles, sustainability and eco-friendly textile manufacturing are addressed by the projects Cleantex (2020–2022) and Factive (2020–2022) with open education materials on the web [20–21]. The Costume project (2018–2020) elaborated a new occupational profile of clothing technicians [22].

In light of the importance of software for virtual prototyping for the European textile industry, this paper aims to identify e-learning instruments that address the needs of higher education students and young professionals in this domain of activity. A survey organized at representative clothing companies in five European countries has provided supporting data for this analysis. These activities were conducted within the frame of an Erasmus+ educational project entitled "Digital Fashion – Collaborative Online International Learning in Digital Fashion" (2022–2025), which is funded by the European Commission. The first project results of Erasmus+ Digital Fashion are related to the identification of the industry requirements for education in virtual prototyping to further prepare a database and a digital platform for the training of students and young professionals. This paper presents these educational requirements as identified at the national level in Romania about other contributions in the textile field. The research was accomplished by two Romanian key players in textile education: The National R&D Institute for Textiles & Leather INCDTP – Bucharest and Technical University Iasi, Faculty of Industrial Design and Business Management.

THE SOLUTION: THE ERASMUS+ PROJECT DIGITAL FASHION

The European Erasmus+ project "Digital Fashion" has a consortium of six European partners, who will join within three years of 1 February 2022.

The activities are built around the main project results that fulfil project objectives, schematically described in figure 1. The project website includes up-to-date outcomes http://digitalfashionproject.eu.

The activities within the consortium have been allocated according to previous work experience as well as interest expressed by the partners that will be involved in all planned activities, with different tasks. The project activities are structured in four main project results (PRs) presented in table 1.

The first activity within PR1 was the identification of what partner countries would require for an educational curriculum in virtual prototyping undergirded by new digital educational methodologies. Based on these requirements, a database with fabrics, garments and styles (PR2) was conceived and implemented by the project partners to further support a digital training platform for students (PR3). New curricula using training materials for virtual prototyping (PR4) will be implemented on this training platform, and all educational resources will be validated within a joint staff training event in the last year of the project (2024).
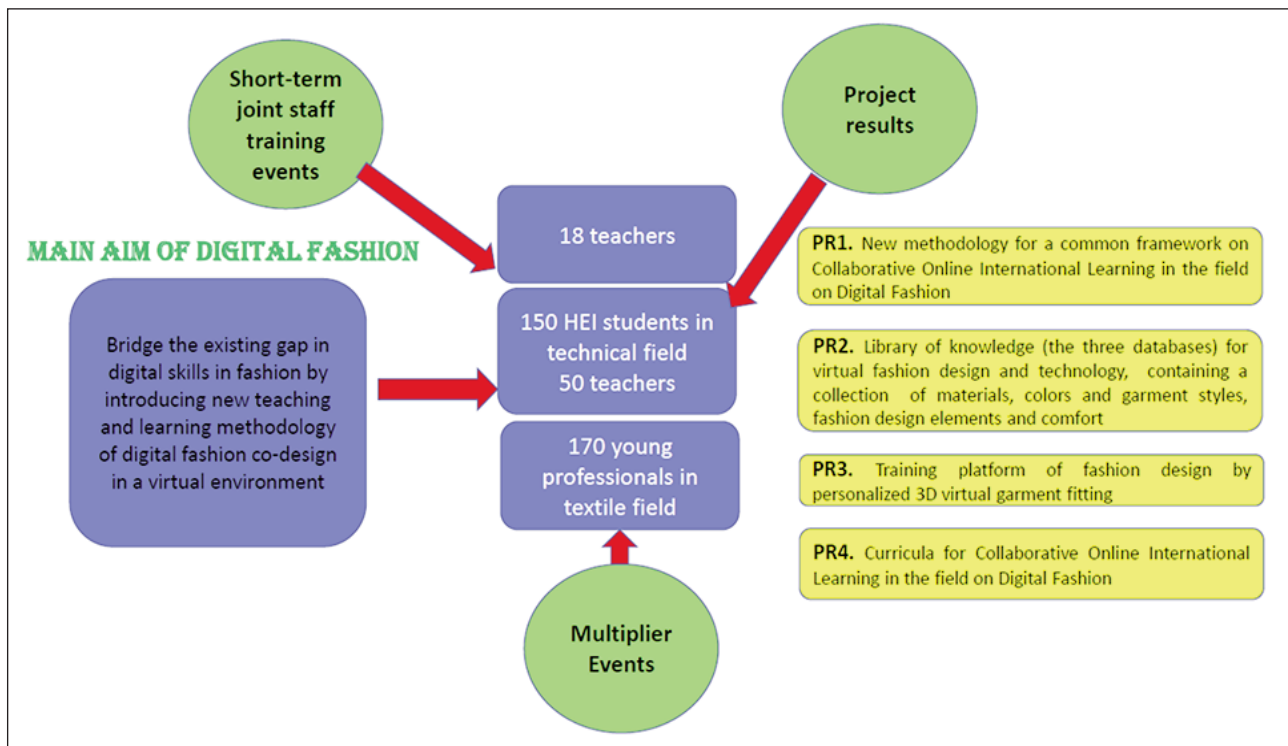
Fig. 1. Main scheme of project results, target groups, and project activities

MAIN PROJECT RESULTS (PRS)	
Result	**Status**
PR1. New methodology on a common ground on Collaborative Online International Learning in the field of Digital Fashion.	already finished at this stage of the project (October 2022)
PR2. Library of knowledge for virtual fashion design and technology	already finished at this stage of the project (October 2023)
PR3. Training platform of fashion design by personalized 3D virtual garment fitting	already finished at this stage of the project (October 2023)
PR4. Curricula for Collaborative Online International Learning in the field of Digital Fashion	in progress (up to 2023/2024)

SURVEY OF TEXTILE ENTERPRISES TO IDENTIFY EDUCATIONAL NEEDS IN VIRTUAL PROTOTYPING

In the framework of PR1, the survey provided an up-to-date report on the need for digital skills for clothing and fashion companies and the status of the industrial application of *virtual prototyping* in European countries. Data were collected from 30 fashion and clothing companies in Romania, Belgium, Slovenia, Portugal, and France. This paper includes the outcomes of the report on the Romanian national level. The survey had as key points the assessment of digital fashion skills, applied and needed industrial software and needed occupational profiles. Eleven companies from Romania active in the field of clothing design and development participated in the survey. The companies were encoded C1–C11 to maintain confidentiality. The companies presented different sizes, turnovers and various product portfolios for the internal or external market, as presented in table 2.

Most of the sampled companies produce outerwear and underwear (over 63.6%), followed by those that produce fashion clothing (over 45.4%) and those that produce sportswear (over 27.2%). Approximately three-quarters (72.7%) of the companies produced more than one category of clothing (figure 2).

Only 27.2% of the companies indicated that they had experience in the use of *virtual fashion technology*, while the remaining companies did not (figure 3). Of the total respondents who answered positively, 66.6% had between 1 and 3 years of experience in using *virtual fashion technology*, while 33.3% had less than 1 year of experience. Of those with no experience in using *virtual fashion technology,* more than 62% intended to implement this new digital asset in their companies, while only 12.5% did not express this intention. The remaining 25% preferred not to answer (figure 3).

When asked about clothing software for industrial production, the highest use was for *computer garment*

Table 2

	GENERAL DATA OF THE COMPANIES			
Code	What types of clothing do you produce in your company?	How many employees are in your company?	Does your company export products?	What is your company turnover?
C1	Knitwear	10 to 49	75% or more	1 M – 10 M Euro
C2	Sportswear	1 to 9	No	<1 M Euro
C3	Underwear, tights	10 to 49	No	<1 M Euro
C4	Fashion clothing, Women's outerwear, Men's outerwear, Sportswear	more than 249	75% or more	10 M – 50 M Euro
C5	Sportswear	1 to 9	No	<1 M Euro
C6	Fashion clothing, Women's outerwear	1 to 9	No	<1 M Euro
C7	Women's outerwear, Men's outerwear, Children's outerwear	more than 249	75% or more	10 M – 50 M Euro
C8	Fashion clothing, Women's outerwear, Men's outerwear, Children's outerwear, Knitwear, Protective work clothing	more than 249	75% or more	10 M – 50 M Euro
C9	Fashion clothing, Women's outerwear	10 to 49	75% or more	10 M – 50 M Euro
C10	Fashion clothing, Women's outerwear	10 to 49	75% or more	<1 M Euro
C11	Protective work clothing	50 to 249	75% or more	10 M – 50 M Euro

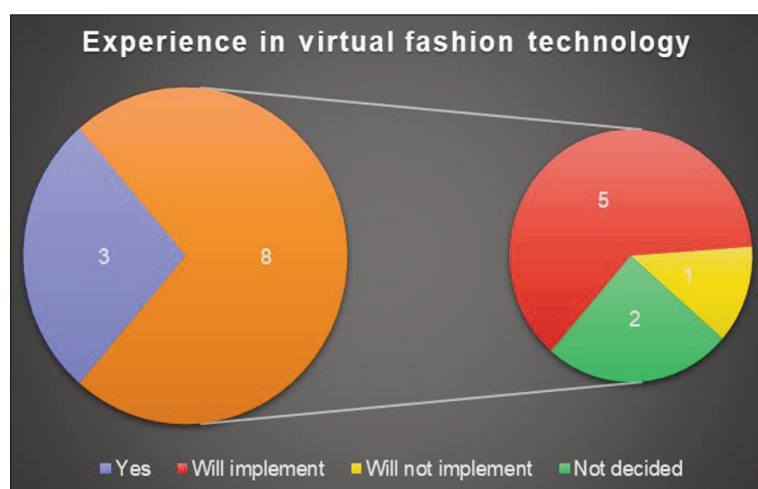
Fig. 2. Specific products of the sampled companies

Fig. 3. Experience with virtual fashion technology among the sampled companies

pattern design (approximately 91% of all companies), while over 63.5% mentioned the use of software for *technical drawing*, 54.5% mentioned the use for *fashion drawing/illustration* and 27.2% mentioned the use for *garments virtual prototyping/fitting/visualization* (figure 4).

The most commonly used software for *fashion drawing/illustration* is Adobe Illustrator (45.5% of the sampled companies) and CorelDraw (36.3%), followed by 3D design for Illustrator and Adobe Photoshop (with 18.2% each). The least used software is Corel Photo-Paint, Graph 6+, and CLO 3D. Inkscape and Kaledo software are not used by the sampled companies (figure 5).

CorelDraw is used by most of the sampled companies (54.5%) as specific software for *technical drawings*, followed by Corel Photo-Paint, Adobe Photoshop, and 3D design for Illustrator with 18.2% each. Graph6+ and Lectra Modaris have only 9% each (figure 6).

Gemini is the most commonly used software for *2D garment pattern design*, selected by over 63.5% of the responding companies. The remaining sampled companies use each one (9%) of the following software programs for *computer 2D garment pattern design*: Lectra Modaris, Gerber, Assyst, Clo3D, and Apex3 Shima Seiki (figure 7).

The occupational profile indicated as most necessary is the *3D designer* (approximately 82% of the sampled companies). When we talk about fashion designers,

approximately 45.5% of the respondent companies replied that they need such an occupational profile, while 36.3% replied that they need a *technical designer*. Concerning the occupational profiles of *computer pattern-making designers*, approximately 92% of the sampled companies said that they do not need more specialists. These answers show the need to employ well-prepared clothing specialists for *3D design*, a task envisaged by Digital Fashion (figure 8). Age expectation was between 25–40 years.

The level of innovation varies according to the size and investment capacity of the sampled companies, with medium to high scores for approximately 72% and with 5–10% of revenue devoted to innovation. When asked about interest in 3D virtual prototyping of garments, all sampled companies answered positively. More than 72% of these companies intend to use 3D virtual prototyping instruments or software for developing clothing pattern designs; over 18% intend to use this software for virtual try-ons, and the remaining approximately 10% intend to use these for virtual presentations of collections to customers.

DISCUSSION

E-learning in the field of textiles and clothing is supported by various contributions. Existing educational materials were created to be complementary to the large domain of textile technology and were always a response to a current need [13–22]. The main aspects of e-learning materials in textiles focus on innovation, the contribution to existing curricula and validation using pilot training courses. Some online resources were created based on the structure of the learning materials [23]. Such open educational resources (OERs) highly support the mission of academia, research and industry in Europe by training higher education institution (HEI) and vocational education and training (VET) students and young professionals in textiles. In many cases, training is supported by mobility.

The outcomes of the Digital Fashion project are conceived on the innovative theme of virtual prototyping as a complementary fit with the other contributions in the textile and clothing field. The first question was related to the need to implement virtual prototyping educational materials within the industry. This need was deeply assessed by a survey conducted with 30 companies in Europe, out of which
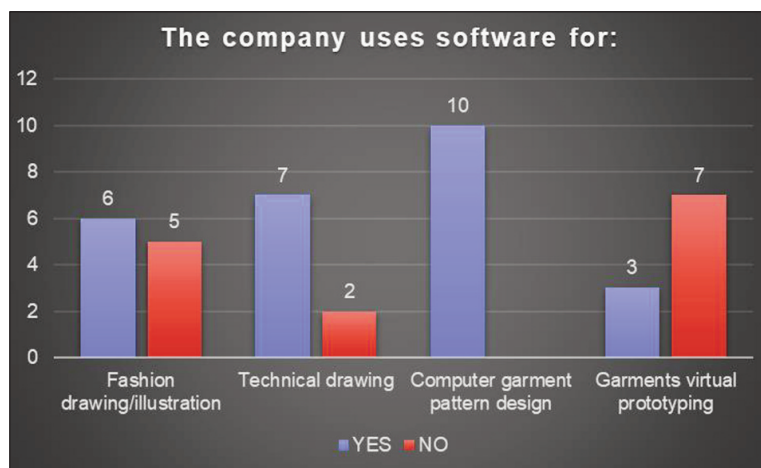

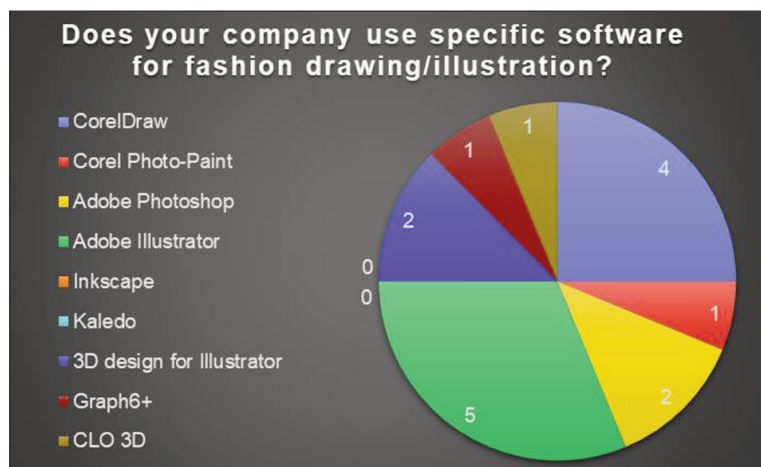Fig. 4. Types of software used in the sampled companies

Fig. 5. Types of software used for fashion drawing/illustration in the sampled companies
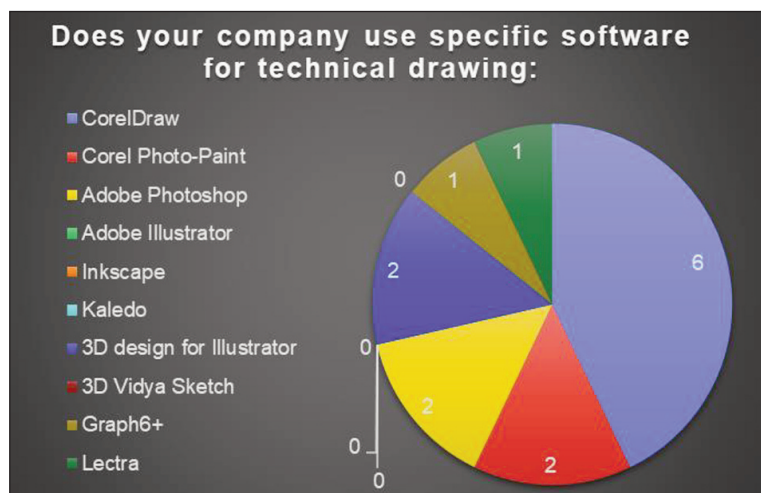

Fig. 6. Types of software used for technical drawing in the sampled companies

11 companies were at the Romanian national level. The outcomes of the survey were underlined in this paper: there is a clear future need for virtual prototyping knowledge and qualified workers for Romanian textile and clothing companies. E-learning instruments will deliver this knowledge in a fast and reliable way for HEI students and young professionals. The complete reports
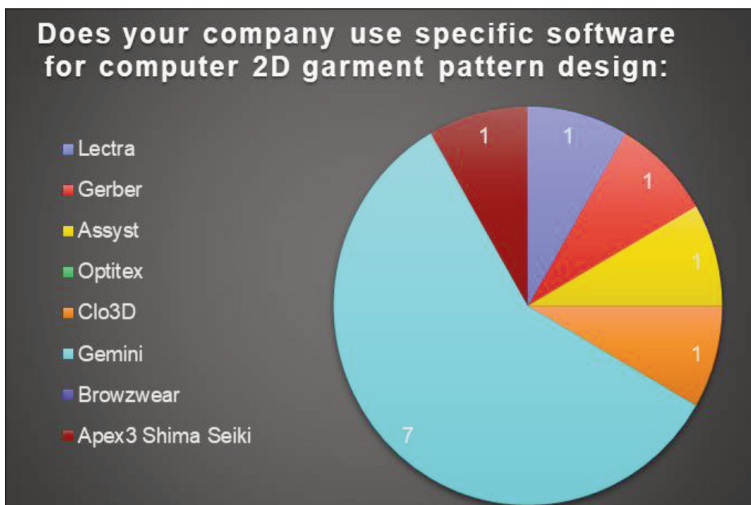
Fig. 7. Types of software used for 2D garment pattern design
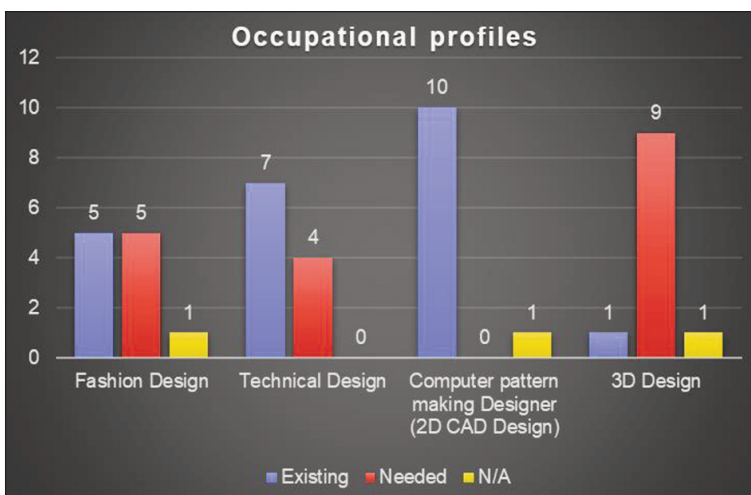in the sampled companies

Fig. 8. Needs for the different occupational profiles in the sampled
companies

from the survey and updates of project results are available at www.digitalfashionproject.eu.

CONCLUSION

This paper presents the results of a survey regarding the modelling technologies used in Romanian clothing companies as a critical starting point for outlining the need for new methodologies in teaching digital fashion. This first project result of the Erasmus+ Digital Fashion project is meant to support the other project results, namely, the database and the training platform, in understanding the existing needs. According to the survey results, there is a consistent need for virtual prototyping for textile and clothing companies, a fact that may be further exploited by developing an online training platform for digital fashion. As part of an ongoing project, the first project result yields promising support for the other three project results.

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