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Introducing New Computers Related Subjects within the Study Programme Design and Textile Materials

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Abstract: - According to the existing textile industry guidelines dealing with design of new materials with a high added value, use of environment friendly new technologies, including various fields of application, the contemporary textile and clothing industry needs experts with special knowledge, not only of textile processes but a broader, interdisciplinary knowledge. Only such experts will assure a link-up of textile and clothing industry with other sciences and widen their applicative use in high demanding technologies. Information science and in-depth knowledge of computer based information systems are crucial for understanding new technologies nowadays supporting a wide diversity of textile applications. The inclusion of such specific courses, subjects and topics into university-level and professional studies' curricula must be considered as very important task of universities and other institutions of higher education. Basics of information technology and computer based systems can be given to students in the frame of a larger general subject already in the first year of the study, while special topics, connected with the use of particular new computer based technologies, should be taught within different subjects later on. In this paper, the necessity to build such study programmes that will enable the young textile specialists to understand and fully exploit the potential of specific computer based information systems for textile applications is presented.

Key-Words: - Textile study programmes, higher education, Bologna process, information and computer science, design, advanced textile materials

1 Introduction

Use of advanced information technologies and systems can assure the textile and garment manufacturing companies competitive advantages, such as high and constant quality of products, productivity, flexibility, and quick response to the requirements of fashion and market.

Therefore, the inclusion of new computer based technologies into university-level and professional studies curricula and courses should be considered as very important task of universities and other institutions of higher education. In this paper, the contribution of the Department of Textiles at the Faculty of Mechanical Engineering, University of Maribor to reforming the education systems and strengthening the textile information society with its new undergraduate and graduate study programmes, prepared according to the Bologna process directives, is presented. The study programmes were entitled Design and Textile Materials [1]. Special attention is given to the subjects that relate to the information science and computer based information systems for design and textile applications.

2 Design and Production of Textile Forms Using Computer Based Technologies

A wide range of new technologies, above all those using fascinating possibilities of computer graphics, together with a new generation of computer based systems, assure the textile companies the ability to react extremely fast to the customer demands offering quality and future-oriented services. This enables greater commercial presence and contributes to company's better marketing position. The universities, research institutions and software producers apply nowadays a whole range of new technologies to create the advanced computer solutions that will in the future support the whole cycle starting from the virtual design of fabric and garments through automated production up to virtual merchandising. Therefore, the students should be given the knowledge needed for successful work with the new technologies, which will contribute to developing the textile information society of the future.

Computer based information systems are today widely used for design and production of textiles as well as for the assurance of effective information flows. The producers of such information systems and computer equipment have successfully adopted the special

characteristics of this engineering area. By introducing the new technologies into the processes of design, engineering and production of textiles, a substantial increase in productivity and quality of work can be achieved. Consequently, the textile industries are being transformed from traditional, labour-intensive, into highly automated and computer-aided branches.

Textile and garment manufacture design and production processes require, above all, the development and application of the following computer-aided technologies:

- CAD - Computer Aided Design,
- CAM - Computer Aided Manufacturing,
- CAPP - Computer Aided Process Planning,
- CAQC - Computer Aided Quality Control,
- CAT - Computer Aided Testing,
- NC - Numerical Control, and
- MRP - Manufacturing Resources Planning.

The above-mentioned "conventional" computer technologies have been successfully supplemented by advanced 3D computer graphics for visualisation and virtualisation of products and processes, some methods of artificial intelligence (AI), mainly expert systems (ES), solid modelling and feature based design (FBD) [2, 3]. These technologies are still in intensive development and growth. They can be evaluated as very promising enrichment of conventional CAD/CAM technologies that already support production of textiles. The installed computer-aided modules and appropriate equipment are linked together following the concepts of computer integrated manufacturing (CIM). Open and compatible hardware system architecture is becoming an important factor in the efficiency of CAD/CAM systems. Thus, the majority of computer and information systems producers for use in different textile applications use standard and acknowledged computer networks and data protocols.

3 Computer Based Subjects for Supporting Design and Textile Materials

Good knowledge and understanding of information science and computer based information systems is indispensable for a success and even for survival of textile and garment manufacture companies. This knowledge should be used as a basis for recognising the actual needs and priorities regarding the purchase of appropriate modern computer based information systems for supporting the company's design, construction and production processes.

The managements of textile and garment manufacture companies expect from universities and other higher education institutions that they will produce such graduates who will be able to help them in setting the investment priorities and recognising the latest trends regarding the computer based information systems for modernising different processes within their companies.

In the following text, the set of information science and computer systems related study subjects is presented that we have developed and introduced into the new university-level study programme at the Department of Textiles, University of Maribor. The new study was named Design and Textile Materials [1] and is prepared according to the Bologna process in the European higher education area. Short contents of the main computer subjects are presented [4] that can be used as guidelines or reminders for those higher education institutions that are preparing their new study programmes or renewing old ones.

When designing the new study programme, we started with a set of pre-assumptions, cognitions, requirements and agreements. One of the main starting points was that the students should be given enough theoretical and certainly practical knowledge on information technology, computer systems and computer programmes that can be effectively used in textile and garment manufacture companies. Also, we agreed that a good knowledge of basic subjects, such as Mathematics, Physics, Chemistry and Textile Materials is necessary for building the next generation of textile graduates.

Study programme Design and Textile Materials is composed of a first (undergraduate) or Bachelor Degree study that takes three years and second (graduate) or Master Degree study, that takes additional 2 years (3 + 2 years model).

3.1 Information Science and Computer Systems Subjects in Undergraduate Study Programme

The first two years (each comprehending 60 ECTS) of the undergraduate study programme, Figure 1 [1], are common for all the students. Besides the basic engineering subjects, all of the students attend also the courses related to textile science, such as Textile testing, Textile processes, Ecology and Standardisation and quality. They also receive the basics of art, design and aesthetics – four subjects are foreseen for these areas.

After the first common two years, the students continue their undergraduate studies in two different study courses:

- Textile Materials and
- Engineering Design of Textile Materials.

There are two options to be chosen within each study course: Modern Textile Materials and Ecology and Textile Materials in the first one and Engineering Design of Textile Forms and Ready-Made Production in the second one.

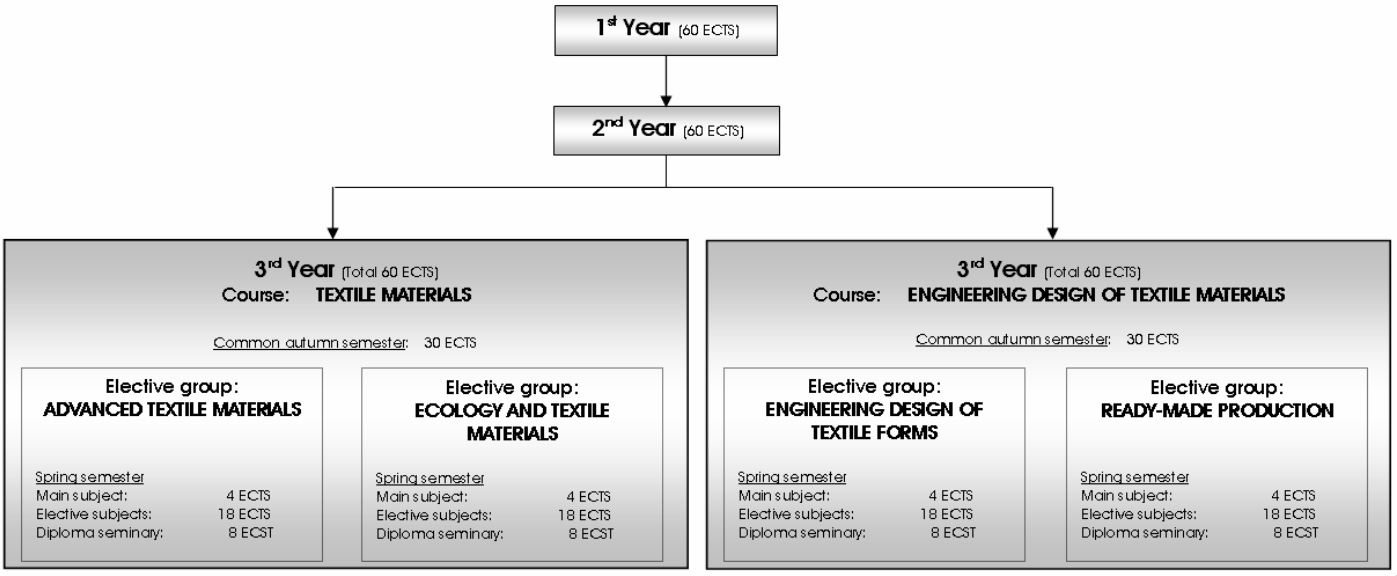

Fig. 1 Undergraduate study programme structure

Considerable changes of the scientific and technological development and globalization as well as those of the economic social world structure call for changes of the education system, their goal being educating and training of experts who will be able to master the new work conditions. The new profile of graduates will be distinguish by a new knowledge and skills concept based on interdisciplinarity and interdependence of technology and design (engineering design) which is something new not only in Slovenia but also in wider central European region.

When designing the study programme, we were aware that in the future, the textile professionals will need in-depth knowledge and practical experience related to modern computer based information systems for textile applications. More than ever, they will have to master computer programmes for general and textile oriented applications.

The working group was already in the beginning aware the new study programme should be comparable with modern programmes offered by acknowledged European and American textile faculties. Therefore, the curricula and subject structure of comparable programmes [5, 6, 7, 8, 9] were carefully studied before proposing the structure of the new study programme.

Already in the first year of the study, there is obligatory subject Information science and computer systems for textile applications. Within this subject, the students get acquainted with a needed extent of information science theory and applied view of computer-based information systems for textile applications. The subject represents the basis for understanding the subjects related to computer based technologies in forthcoming years of the study. Among others, the contents of the subject include: computer graphics and its use in textile applications, basics of 2D drawing and 3D design, techniques for input and digitalisation of graphical information, as well as characteristics and structure of computer based information systems to support design, construction and production processes for different textile applications. Transferable skills provide the students with the ability to use basic 2D vector and bit-graphics design programmes.

In the second year, the students attend the obligatory subject Computer aided design and production of textiles. Within this subject, the students become acquainted with a whole range of computer-aided technologies. Special attention is given to realised concepts and practical use of specific hardware and software for supporting design, construction and production processes in manufacturing of linear and flat textiles and garments. Transferable skills include the ability to creatively use specific computer programmes for designing textile fabrics and different textile forms.

In the third year of the study, there are additional computer-related subjects that can be selected according to the chosen study course:

- Computer based simulation of textile forms,
- E-business and multimedia in textiles, and
- Computer-aided preparation for clothing production.

Figures 2 and 3 presents the e-catalogue developed by one of the textile students [10] within her seminar work (such topics will be also taught in the frame of the subject E-business and multimedia in textiles).

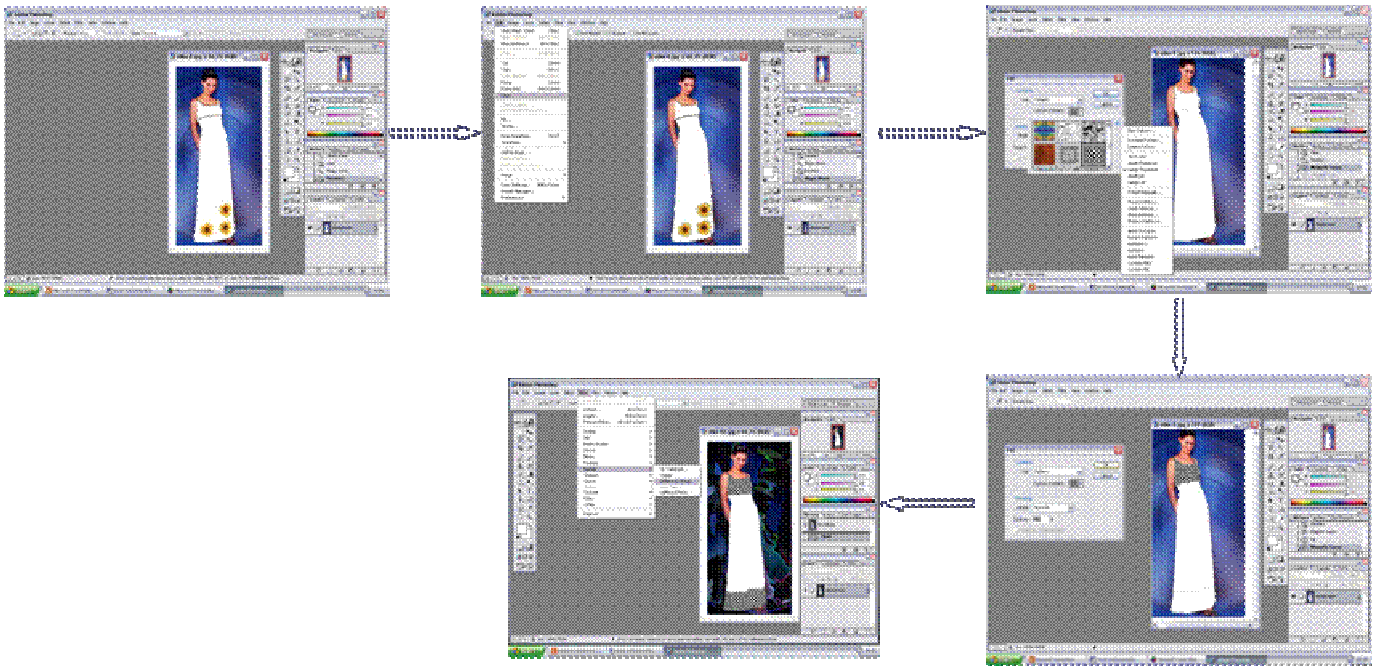

Fig. 2 E-catalogue development stages

Fig. 3 Screenshots from the e-catalogue

3.2 Information Science and Computer Systems Subjects in Graduate Study Programme

The graduate study programme Design and Textile Materials, Figure 4 [1], which takes two years (each having 60 ECTS) has the same names of the two study courses as the undergraduate study programme.

This is understandable since it represents the continuation of the first level of the study. There are two

modules in each study course. The names of modules in the first study course Textile Materials are the same as in undergraduate study. In Engineering Design of Textile Materials the modules are entitled Engineering Design of Textiles, Garments and Interior textiles and Planning and Manufacturing of Textile Products.

In each study course there is a rich offer of optional and credit subjects that can be chosen by students according to their requests and needs. We have assured that there is a set of topical and interesting computer-related subjects, which will enable the graduates to help building and developing the textile information society of the future:

- Presentation techniques and virtual catalogues,
- Computer aided design of woven fabrics,
- Computer aided knitwear design,
- Computer aided pattern design, and
- 3D computer modelling.

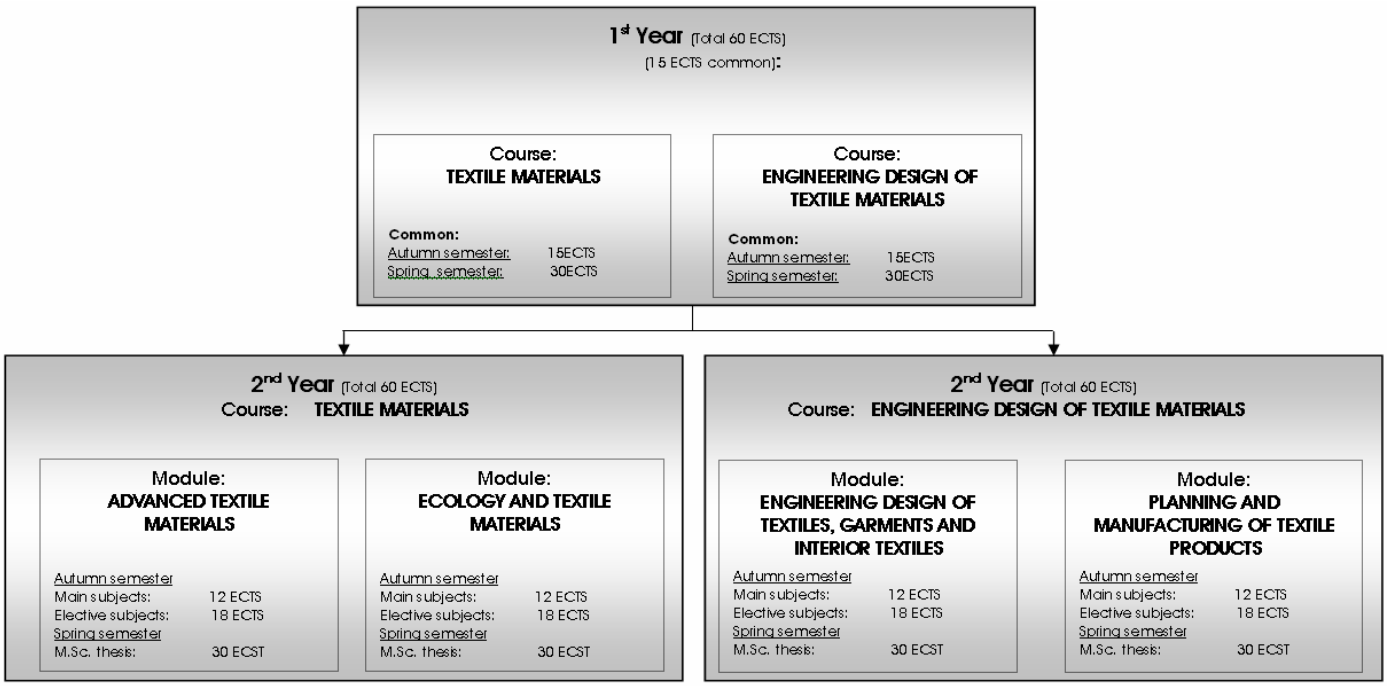

Fig. 4 Graduate study programme structure

The first of the above subjects, Presentation techniques and virtual catalogues, deals also with techniques for realistic visualisation of garments using modern computer graphics and simulation of textile fabrics.

Additionally, some other subjects are partly related to computer science, such as:

- Intelligent textiles,
- Colorimetry and
- Machinery and robotisation.

In-depth understanding and knowledge of information science and computers should enable the graduates to fully exploit the potential of the new generation of computer based information systems for textile applications. They should be able to detect and introduce new computer based technologies in design, construction and production processes. Furthermore, their knowledge must ensure them to become equal partners in multidisciplinary R&D teams for designing and producing usable computer software for different textile applications (where suitable, affordable solutions do not exist). Already in the existing university-level and postgraduate textile study programmes we have encouraged such developments. Many diploma works and M.Sc. dissertations resulted in usable programme packages, such as software for visualisation of the fabric dyeing process. Figure 5 [11] shows a screenshot from the visualization and animation of a High-Temperature (HT) overflow dyeing process for fabric dyeing in a rope form. Screenshot from the computer programme for visualization and animation of the Pad-Batch machine line is presented in Figure 6 [11]. In the new study programme we intend to devote even more attention to such topics and inventive work of the students.

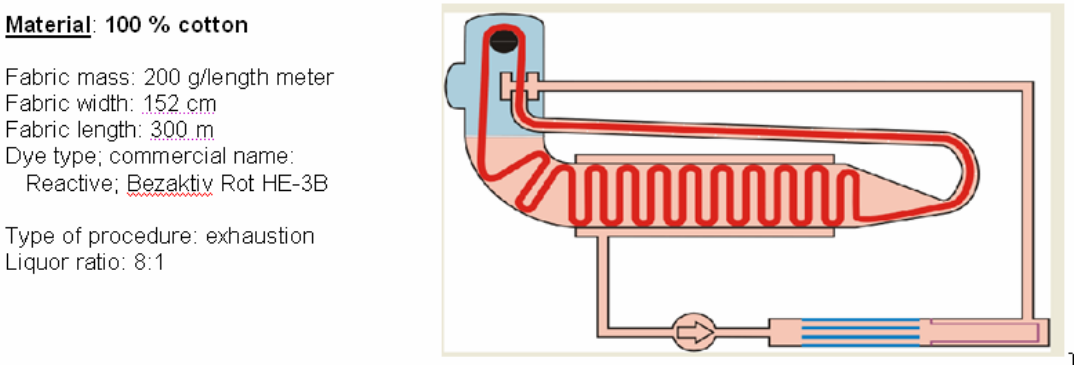

Fig. 5 Screenshot from the programme for visualisation of the HT overflow dyeing machine

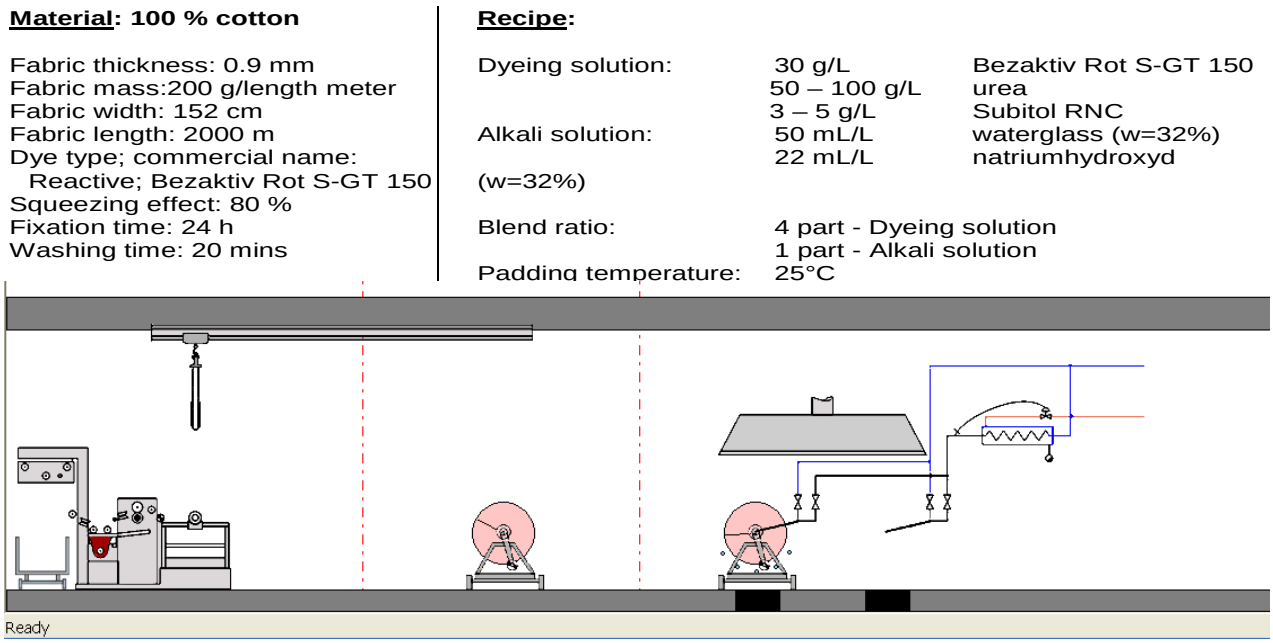

Fig. 6 Visualisation of the Pad-Batch dyeing process line

4 Conclusions

The changing circumstances in textile industry which have been appearing in Europe because of a remarkable globalization in the field of production and marketing make it necessary for the Slovene textile and clothing industry to adapt to the new circumstances in the market. A successful adapting can be realized only by introducing new and modernizing the existing technological processes, by developing innovative, high quality products and acquiring the use of the new knowledge and methods in the field of marketing and logistics. Skilled workers capable of dealing with new materials and technologies, computer science, design, marketing and managing are the basis for such adaptation.

The new undergraduate and graduate textile study programmes Design and Textile Materials will enable education of textile experts who will be able to successfully realize the adapting of the Slovene textile industry to the new conditions in the global market and rise its competence level. A graduate's education in all the presented modules is exactly the one needed by the textile and clothing industry in the re-structuring and adapting phase.

The new study programmes are competitive and comparable with similar EU study programmes; they will be attractive and perspective for future students. The graduates of these programmes will perform an important part in the future of Slovene textile and clothing industry.

Good knowledge and understanding of information science and computer based information systems is indispensable for a success and even for survival of textile and garment manufacture companies. The managements of textile and garment manufacture companies expect from universities and other higher education institutions such graduates who will be able to help them in setting the investment priorities and recognising the latest trends regarding the computer based information systems for modernising different processes within their companies. In this paper, the contribution of the Department of Textiles Maribor to building the textile information society with its new undergraduate and graduate study programmes, prepared according to the Bologna process directives, was presented. When designing the study programme, we were aware that in the future, the textile professionals will need in-depth knowledge and practical experience related to modern computer based information systems. More than ever, they will have to master computer programmes for general and textile oriented applications.

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