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ON-LINE ASSESSMENT FOR COMPUTER AIDED DESIGN IN KNITTING

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***Abstract**: Knitted products hold tremendous potential for providing innovative design solutions for aesthetic and performance challenges in applications such as fashion, medical, geotextiles, military, industrial [1]. Computer Aided Design is a preparatory stage of the patterns, aimed to design the knitting programs in a specific language, readable by the machine. An assessment stage of the knowledge acquired is necessary, in order to indicate the level of the activity deep understanding. The paper presents a set of on-line tests concerning the self-assessment of computer aided design knowledge and pattern design activity.*

***Keywords:** Knitting, computer aided design, pattern station, on-line assessment.*

I. PATTERN DESIGNING IN KNITTING TECHNOLOGY

a. Flat knitting technology

The mechanical interloping of yarn into fabric is one of the most versatile method of manufacturing textile fabrics for a wide range of end-uses, called knitting [1]. Knitted products hold tremendous potential for providing innovative design solutions for aesthetic and performance challenges in applications such as fashion, medical, industry and military apparel [2].

Computerized flat knitting is one of the textile technology used for fabric manufacturing, being characterized by its higher process flexibility and greater fabric structure variety, at low manufacturing costs. In order to outline the unique technical capabilities of electronic flat knitting machines, some products have been selected as being representative for several technical destinations [3], [4] and presented in figures 1-6.

Figure 1. Compression stockings

Figure 2. Orthopedic support

Figure 3. Textile implants

Figure 4. Upholstery fabrics

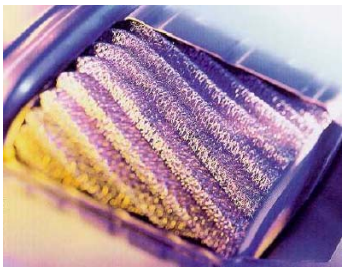

Figure 5. Catalytic elements

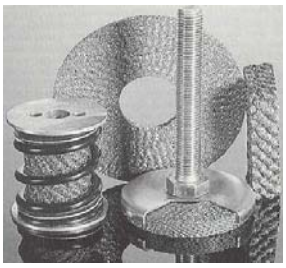

Figure 6. Damping elements

b. **Pattern designing**

Design and production of knitted products, especially for advanced engineered knitted garments, requires a comprehensive system for design and production, supported by a knowledge base system that supports the translation of concept to final product. From fiber characteristics to yarn and complex structures, a finished knitted garment must be carefully engineered to provide the required attributes customized to the activity and to the body shape [2].

Computer Aided Design is a preparatory stage of the patterns, aimed to design the knitting programs in a specific language, readable by the machine. This activity is accomplished today with the help of IT equipment, based on electronic data processing [5]. Generally, the heart of such an equipment is a personal pc, with keyboard, one or two monitors and data storage unit. The world leaders in knitting machine builders have been developed advanced and high specialized software, according to the type of knitting technology. One example is the M1 plus software solution, provided by Stoll Company, designed with two monitors (figure 7), in order to facilitate the two views of the fabric to the users. Technical View contains technical details about machine settings (figure 8) and Fabric View offers a simulation of the real fabric (figure 9).

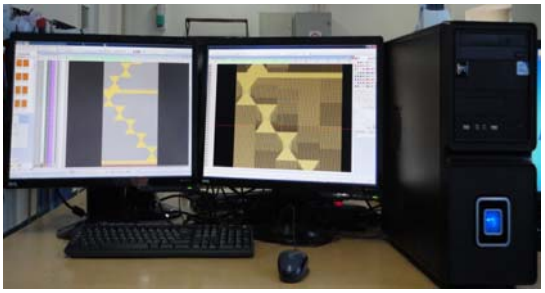

Figure 7. M1 plus software solution

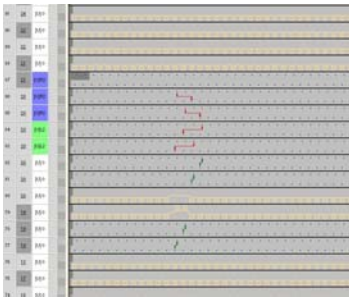

Figure 8. Technical View window of the fabric

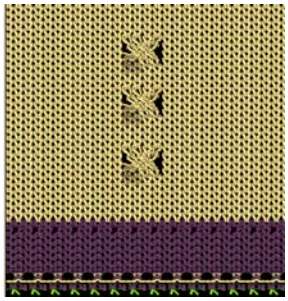

Figure 9. Fabric View window of the fabric

Employing such a specialized software, one can perform various tasks for reaching the objectives of the engineering process of the knitted products:

- Designing the patterns: defining the clothing style, choosing the yarns, drawing the fabric structure;
- Preparation the machine programs, developed in a special language, for flat knitting machines with different gauges and technologies;
- Developing the clothing layout, according to the order sizes;
- Simulating the final product before production;
- Transferring the programs into the machine memory, adjusting the machines parameters and knitting the product.

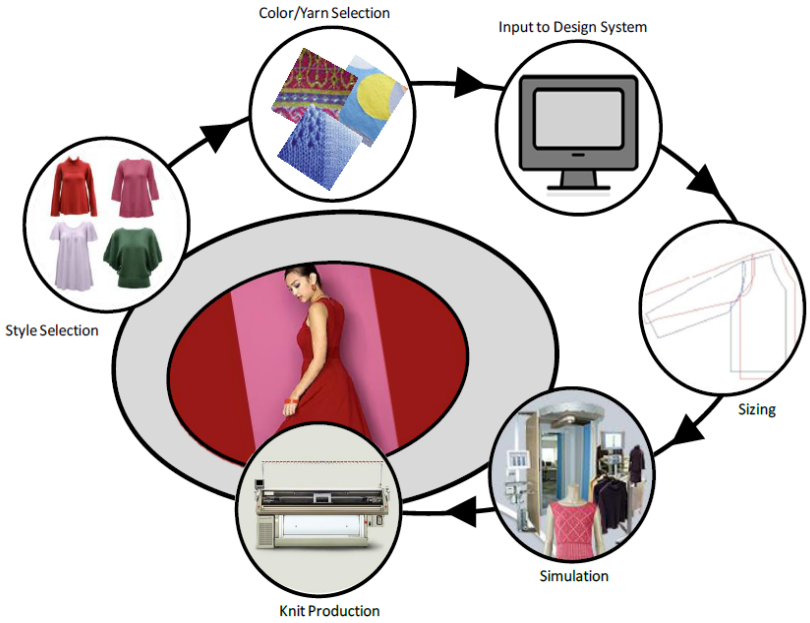

Figure 10. Engineering process of knitted garments [6]

This activity, as an 'intelligence consuming' one, requires cumulative knowledge of knitted fabrics structures, machine mechanisms and computer skills and a lot of training.

II. ON-LINE ASSESSMENT OF CAD KNOWLEDGE

Technological developments in textile technologies have caused changes in didactics and teaching methodology, as traditional forms of material presentation and learning can no longer fight in this technologically oriented structure. Numerous positive characteristics and effects of e-learning, above all place and time independency of teachers and students, can be effectively applied also to textile studies [7], [8].

The CAD course delivered at Faculty of Textiles, Leather and Industrial Management from Iasi, Romania aims at providing strong knowledge concerning the knitting programming and machines running by using advanced software from different companies. Among them, M1 plus from Stoll Company, Germany is available in the latest version, at the student's disposal and it is present in more then half of the knitting companies from domestic market. Considering the complexity of this activity, a sustained training is required concerning the software and the knitting machines. The differences between the students individual learning rhythm clearly stated the idea of independent work and flexibility in learning and assessment. Therefore, the tutor must consider the task of developing alternative teaching and assessment methods, as a pedagogic challenge.

The paper presents a set of on-line tests concerning the self-assessment of computer aided design skills and pattern design activity. The tests were developed by using QuizCreator program, which offers a great flexibility in creating various types of questions, and provides the media area to insert images, audio and video files. The users can initially pass through the tests designed for knowledge setup and then through the ones with a limited time and for knowledge evaluation. They can independently use it at home, without being connected necessarily with the CAD laboratory and the pattern station. The program allows the automatic results sending to the tutor.

The on-line tests are of various types, adapted to the specific subject from the CAD and they are used to evaluate the level of competencies and are available at: www.tricoteex.com [9]. Figure 11 displays a screenshot of one test with multiple-choice questions concerning the identification of some knitted structures, according to their symbolic representation. The users have the possibility of reviewing one

more time the answer, in case of a wrong choice, without being indicated by the pc. At the end of the test one can review the whole test and check the answers, compared to the right ones.

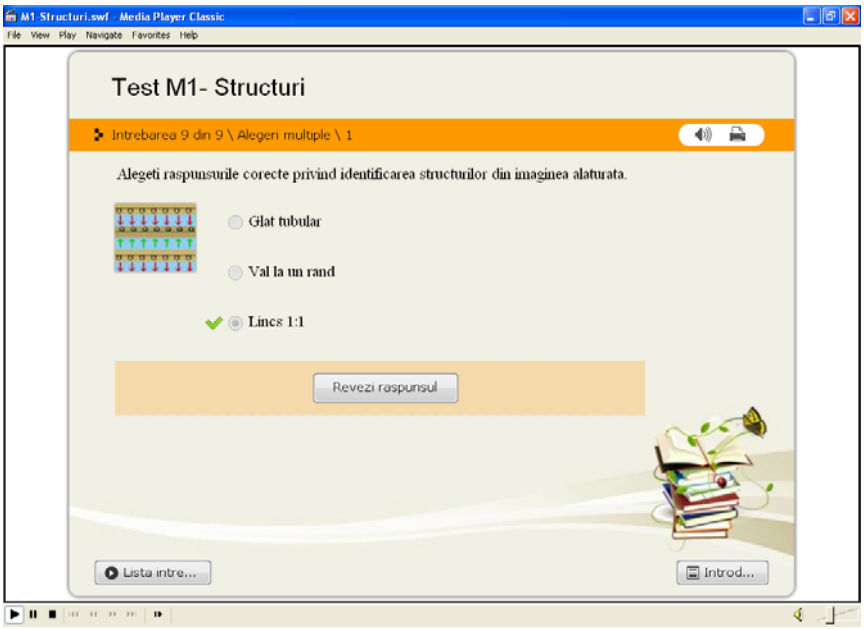

Figure 11. Multiple choice questions test

The type of test presented in figure 12 is a drag-and-drop matching, where the students must match the drawing tools represented on the left side with the actions described on the right side of the screen. The ability of a correct answer is achieved after systematic exercises on using the drawing tools from the software.

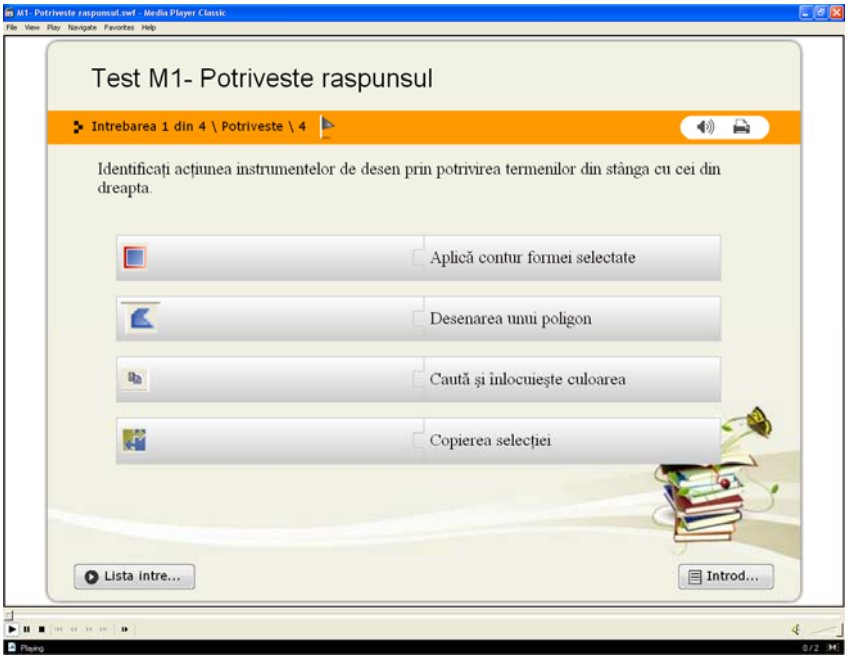

Figure 12. Drag-and-drop matching test

Another type of testing is based on the establishment the right order of some specific actions, indicated in a list. An example has been selected and presented in figure 13. The task of the students is to indicate the correct sequence of the stages concerning the knitting programs design. At a first glance, it might look a simple task but its solving requires a deep knowing of the programming activity itself.

Figure 13. Selecting the right order test

Each test contains a passing score, which indicates a minimum level of knowledge of the subject. Figure 14 exhibits a screen shot from a test result and the final score gathered by the student.

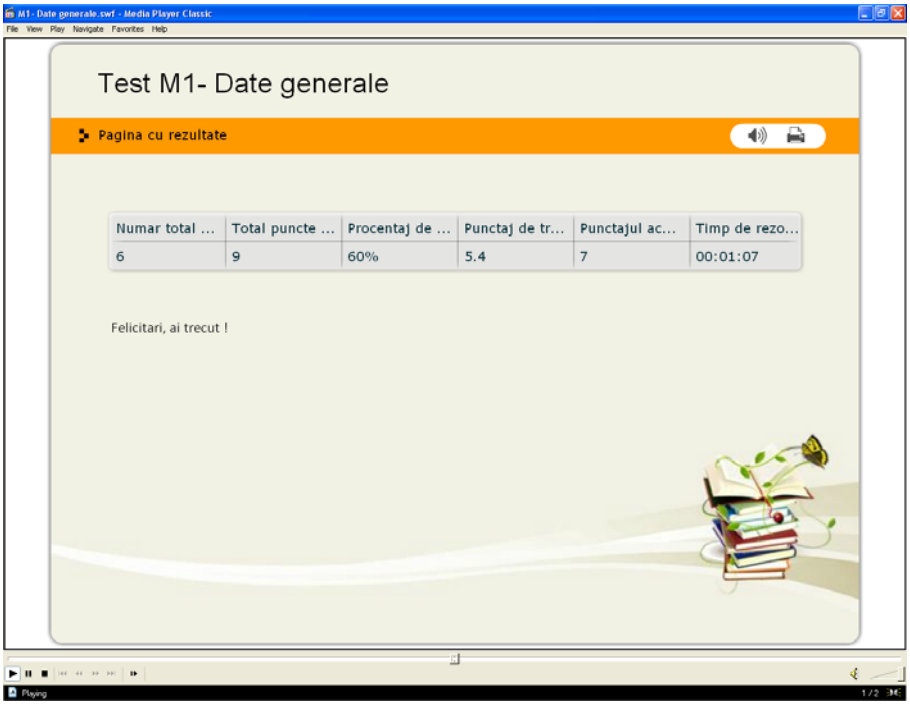

Figure 14. Result of the test

The instant feedback of the result is an advantage for students and offers an objective and clear evaluation of the skills.

III. CONCLUSIONS

1. The CAD for knitting technology course, delivered at Faculty of Textiles, Leather and Industrial Management from Iasi, Romania aims at providing skills concerning the knitting programming and machines running, by employing specialised software, built-up by world leaders in this field.
2. In the context of a rapidly knitting industry development, a high level of skills and competencies are required from the textile engineers, who are graduating these lectures. Therefore, the course tutor must find the best solutions for teaching and evaluating the level of the technical knowledge acquired by the students. Interactive lessons have been introduced to the students, to offering them a sustainable training, independent of CAD laboratory and to improve considerably the tutor activity [10].
3. The next stage was to develop the on-line tests, as practical tools, which serve for self assessment of the level of acquired knowledge in the particular field of programming activity, performed on electronic flat knitting machines.
4. These testing applications are completing the interactive lessons, on which they are based on, and they form a whole system of teaching and evaluation.
5. These tools offer the users the freedom of learning in their own rhythm, to practice and to get an instant feedback of their skills and to quantify their knowledge.
6. The student's positive reaction at this interactive evaluation sustains a further development of the on-line testing.
7. Development of the student's independency from the trainer, in learning and assessment activity, represents a step forward in higher education in one dynamic and demanding field of textiles.

Acknowledgements

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