On the use of information technologies in the training of specialists in the textile industry

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Abstract. The article analyzes the features of the use of information technologies in the development of disciplines by design engineers studying the issues of materials science and the manufacture of products from textile industry materials. Depending on the tasks being solved by design engineers of the textile industry, it is advisable to introduce the following information products into the educational process: to determine the structural characteristics of textile industry materials and evaluate their utilitarian properties-Microsoft Excel spreadsheets and applied author's programs, to analyze regulatory requirements - the Microsoft Access database. The use of the proposed training technology will significantly improve the quality of training and information culture of textile industry specialists.

1. Introduction
In the context of the introduction of digitalization in the light industry, the requirements for training graduates in the fashion industry are increasing. A modern specialist should not only know the information and digital technologies used in the industry, but also possess the skills of their application [1-2]. At the same time, various means of information and computer technologies are used in education, depending on their role [3-4].

Depending on the module being studied, various information technologies can be used in the training of design engineers of the garment industry. Special attention should be paid to practical training. To form digital competencies, it is necessary to use applied and professional software products in the learning process. The least difficulties in the introduction of information technologies arise when studying the disciplines of the design unit, since there is a sufficient number of both domestic and foreign computer-aided design (CAD) systems of clothing that can be used in the practical training of design engineers [5-6]. When studying the disciplines of the design block, there is also a wide selection of software products [7-8]. The greatest problem of using information technologies for practical training arises when mastering disciplines that study the issues of materials science in the production of light industry products. There are no professional software products developed for this block. This paper offers approaches to the development and implementation of computer technologies in the practical development of the principles of confection of materials. The materials selection stage itself is a multi-stage process, during which the requirements and indicators of materials are analyzed, as well as the study, determination, and calculation of their characteristics. The process of analysis itself and the formation of requirements for materials based on it is quite difficult to formalize. Accordingly, there is a need to find approaches to solve this problem. Thus, this work, aimed at developing ways to informatize the professional training of design engineers when mastering the stage of confection of materials for light industry products, is relevant.
2. Materials and methods
The choice of materials for light industry products is an engineering and scientific task, on the competent solution of which the further choice of a design and technological solution largely depends. The author has developed a method of practical training of design engineers in the field of light industry when mastering the process of selecting materials using various software products. The proposed means for implementing this approach are shown in figure 1.

At the same time, in the process of training light industry engineers, both special programs created using programming languages and basic Microsoft Access, Microsoft Excel are used. This approach will allow graduates to form a confident knowledge of various information technologies, depending on the tasks being solved. The proposed training method involves the use of software products, taking into account the performed stage of choosing the material for the product.

3. Results
At the first stage, it is necessary to analyze the requirements for materials, depending on the purpose of the product. The requirements for aesthetic, economic, ergonomic, operational properties, as well as harmlessness and environmental friendliness are analyzed. For this stage, the analysis of the indicators of materials that are contained in the regulatory and technical documentation, in the reference literature is carried out. The search for the necessary information takes some time. To systematize this information, a database using Microsoft Access has been developed (figure 2), containing regulatory requirements for the following indicators: breathability, vapor permeability, hygroscopicity, abrasion resistance, stiffness, shrinkage, thermal conductivity, and others. Using this database, at the first stage, the desired properties of the designed product are predicted.

At the next stage, the technical characteristics of the materials selected in accordance with the established requirements are evaluated. Various software products are used to calculate the structural characteristics of materials. To determine the above indicators, use the Microsoft Excel spreadsheet editor. Figure 3 shows a fragment of the formation of the calculation of the parameters of knitted fabrics in the formula mode.
Figure 2. Fragment of the database of normative indicators of materials.

Figure 3. Fragment of the calculation of the structural characteristics of materials.

At the same time, students enter the values they obtained experimentally in columns 3, 4, 6, 7, 10 (highlighted in blue). In columns 5, 8, 9, 11-15, the structural characteristics are calculated automatically in accordance with the specified formulas (highlighted in orange). When you hover the mouse cursor over the corresponding indicator, a pop-up window appears, which contains its description and the method of determining it. Thus, when performing the calculation practical part, students have the opportunity to consolidate their theoretical knowledge about the determined values.

Also for this purpose, when training design engineers, an application software product developed by the author in the Delphi language is used, which allows automatically determining structural characteristics. In addition, the program has a database used for this calculation: the density of the fiber-forming polymer, the average density of threads and fabrics. The student has the opportunity in this program to form and view a library of materials with structural characteristics and visualization of samples [9].

Based on the calculations made, at the next stage of mastering the process of confection of materials, the utilitarian properties are evaluated and an approximate calculation of the thermal insulation ability of the garment package is made. Information technologies are also used for practical training at this stage. As in the previous stage, the use of Microsoft Excel is suitable for carrying out
the necessary calculations. Figure 4 shows a fragment of the evaluation of utilitarian properties in the
formula mode.

|                         | Evaluation of the utilitarian properties of the garment package |
|-------------------------|---------------------------------------------------------------|
| Name of the layer       | Coefficient of thermal conductivity, k W/(m°C)                |
|                         | Thermal resistance of the layer, W/(m²·°C)                    |
|                         | Percentage of layer                                          | Total porosity, % | Surface porosity, % |
| Main material           | 0.006104                                                     | 0.059            | -83/C5             | 81*1/87            | 86.3             | 23.4             |
| Lining                  | 0.00002                                                      | 0.041            | -84/C4             | 88*1/87            | 97.4             | 00.61            |
| Padding                 | 0.00012                                                      | 0.059            | -85/C5             | 89*1/87            | 95.2             | 79.17            |
| Air layer               | 0.00612                                                      | 0.02             | -86/C6             | -87*1/87           | 100              | 100              |

Figure 4. Fragment of the evaluation of utilitarian properties of materials.

At this stage of training, the author also uses the application program "Thermal Calculation"
developed by the author in the AutoCAD graphical environment using the built-in AutoLISP
programming language, which allows forming a package of materials in an automated mode, taking
into account the heat-protective properties of clothing, as well as automatically checking the

correctness of the selection of a package of materials [10]. The uniqueness of this software product

lies in the fact that it uses a combination of reference and information and calculation tools of

information and computer technologies. So, the program has a database of physical characteristics of

various types of materials created using Microsoft Access. During practical training on the formation

of an optimal package of materials in this program, students have the opportunity to select parameters

from the database, enter the values necessary for the thermal calculation of a package of clothing in an

interactive mode, depending on the conditions of its operation, automatically calculate the values of

thermal resistance in various parts of the human body, as well as the thermal resistance of the thermal

conductivity of individual layers and the package of materials as a whole, evaluate the correctness of

the formed package by analyzing the error values obtained.

4. Discussion

The use of information technologies at the stage of the learning process of the principles of confection

of materials is implemented in the following areas: effective use of standard software tools Microsoft

Access, Microsoft Excel; development and implementation of proprietary software products in the

educational process. This technique has shown its effectiveness in the training of design engineers.

The practical application of Microsoft Access increases the efficiency of working with reference and

regulatory and technical documentation by using the reference and information system of textile

materials developed in this program. Microsoft Excel spreadsheets not only automate calculations at

the confection stage, but also are an effective tool for modeling. By changing the values of the source

data, you can observe the change in the calculated parameters and analyze the result. The exclusivity

of the developed methodology in the practical development of disciplines studying the issues of

materials science and confection of materials using information technologies is the use of author's

applied software products in the learning process. These programs are unique and implement
calculation methods used specifically for solving engineering and technical problems of confection of

materials for light industry products.

5. Conclusion

Thus, the paper proposes a methodology for training design engineers in the practical development of

the stages of confection of materials for light industry products using information technologies.

Depending on the tasks to be solved, information products have been developed and introduced into

the educational process at each stage: for the analysis of regulatory requirements - Microsoft Access;

for determining the structural characteristics of materials and evaluating their utilitarian properties -

Microsoft Excel, as well as applied author's programs. The use of this technology in the training

process will allow you to prepare a competitive specialist in the field of light industry who owns

modern computer technologies.
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