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### **Improvement of training content of jewelry design in higher education in accordance with the requirements of production**

**Abstract.** The article investigates the current state of the design training content in higher education. Special attention is paid to the requirements of production, to the stages of project development in the process of design activity of a jewelry artist and their influence on the development of the content of design training. The importance of studying the stages of project development in the conditions of production as an effective tool for the formation of design activity of the future artist-jeweler is emphasized. The main sources of the study of the content of design training are the working programs of disciplines of professional orientation. The results of the study contribute to the understanding of the current state of the educational process and can be used to improve design training in higher education. The conclusion is made about the system-forming role of design in the content of specialized disciplines in higher education.

**Keywords:** jewelry art, jewelry artist, higher education, content of education, content of academic disciplines, training, integrative approach, design, project activity, project development.

Currently innovations in the technological process are an essential element of social and economic development in various industries including jewelry. Innovation is the introduction of new ideas, approaches or methods that contribute to improving the efficiency of production processes.

From an economic point of view innovative technologies are a complex process that includes several stages, mainly investment, development, implementation and achievement of high-quality results. Innovative technologies play a huge role in the development of production and are aimed at the development and improvement of products [19, pp. 39-40].

The development of technological processes in various sectors of the economy is aimed at the development of scientific, technical and personnel potential optimization of production capacities, development of priority industrial additive and subtractive technologies in accordance with the Decree of the President of the Russian Federation "On the Strategy of scientific and technological development of the Russian Federation" the implementation of which is provided by the strategic planning document: The Decree of the Government of the Russian Federation "On the Strategy for the development of additive technologies in the Russian Federation". The relevance of technology development has made it possible with their help to significantly reduce the time from product development to the release of finished

products as well as to manufacture products with improved material properties and complex design which previously could not be produced due to technological limitations [12].

Modern jewelry making is an example of the use of innovations in the production process which contributes to the achievement of two important goals mainly increasing production efficiency and the volume of sales of finished products. The intensity of the implementation of innovative activities directly affects the economic results of the company. Labor productivity increases profits as well as costs are reduced. Moreover, the share of the organization's presence in the market increases [7, p. 8].

There are jewelry companies in Russia that successfully introduce technological innovations into their production. Examples of such enterprises are Jewelry Company Almaz (diamond)-Holding, Bronnitsky Jewelry Factory, LLC Jewelry Dynasty which produce single (exclusive) serial and mass jewelry (both personal and souvenir). At the same time various types of artistic metalworking and jewelry with jewelry stones (inserts) made of precious semi-precious ornamental stones as well as other materials of natural or artificial origin are used [2, p. 10].

Jewelry workshops specializing in individual orders as well as the manufacture of exclusive and exhibition products combine traditional hand-made methods with the use of the latest technologies. This allows you to experiment, fantasize and apply various techniques of artistic metalworking, make non-standard decisions and implement complex author's projects embodying them in the material.

Large enterprises are engaged in serial production which can be small-scale, medium-scale and large-scale depending on the size of the batch of parts. The number of parts in repeated batches can range from tens to thousands of pieces. Serial production is characterized by higher economic indicators due to the use of mechanization tools and an increase in the level of automation.

Mass (in-line) production is the manufacture of products without any special changes in the technological process. For the manufacture of such jewelry special machines are used as well as automatic and semi-automatic machines [8, pp. 469-470].

Jewelers are engaged in the manufacture of jewelry at such enterprises. Jewelers' professional activity must meet the following requirements in accordance with the law on confirming the status of a jeweler Artist "On Amendments to Certain Legislative Acts of the Russian Federation: Federal Law No. 607-F3" [10, p. 7]:

- development of artistic and creative projects of highly artistic traditional applied art and their implementation in the material at a highly professional level of skill using modern technologies of artistic metalworking;
- participation in events such as contests exhibitions forums and scientific conferences dedicated to the development of traditional applied arts.

There are also regulations and rules concerning the process of developing and executing jewelry projects in production in addition to the legally established requirements for the professional activity of an artist-jeweler:

- application of new project development methods in the graphic representation of jewelry;
- formalization of graphic images of the project at the final stages of design;
- construction of three-dimensional computer models to ensure the accuracy and editing of the model at all stages of project development which allows you to create unique design and technological solutions and significantly reduce development time;
- preparation of project documentation;
- the use of traditional manual manufacturing methods using mechanized equipment and technological processes of highly artistic metalworking;
- using methods of additive<sup>28</sup> or subtractive<sup>29</sup> technological processes;
- the use of casting technologies [9, p. 262].

Most of the time is occupied by work related to the development of projects at enterprises specializing in the production of jewelry. The process begins with the formation of the concept of the future jewelry then the actual design activity is carried out and ends with the materialization of the project in the finished product.

Jewelry design is the creative embodiment of scientific and technical achievements in the process of designing and developing artistic and graphic projects for the manufacture of jewelry in the material. Moreover, the stages of project development express the technological sequence of design activities.

The jeweler artist uses knowledge about technology and manufacturing to create a unique artistic piece of jewelry and optimize the use of production resources in the process of designing. The stages of the design activity of the jeweler include the search for an artistically expressive image; the creation of an artistic and graphic image; the preparation of technical specifications; the creation of computer-graphic images of the project at the final stages; the constructive construction of a three-dimensional computer model and the preparation of project documentation.

Thus, the artist implements knowledge about materials modern computer technologies composition and aesthetics of the product integrated into a single system when designing jewelry. This process includes not only the formulation of a specific intellectual task but also its practical implementation.

Project activity is becoming an important means of integrating technology into project creation. Its goal is to improve the design and technological solutions of jewelry taking into account the assortment orientation of production. It should be noted that designing in production conditions is also a creative process that requires constant updating of professional knowledge in accordance with the innovative technologies used in the jewelry manufacturing process at the present time.

The considered rules and conditions for the development of jewelry projects determined the requirements for the stages of project development in the process of the design activity of the jeweler artist. It includes preparation of technical

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<sup>28</sup> Additive technologies (from the English Additive Fabrication) is a generalized name for technologies involving the manufacture of a product according to a digital model by the method of layered addition of material (add) [3, p. 29].

<sup>29</sup> Subtractive technologies are methods in which a product is created by removing material. They include turning and milling, drilling, grinding, etc. [4, p. 30].

specifications; search for an artistically expressive image; creation of a planar artistic and graphic image on paper; three-dimensional computer design of the model; two-dimensional computer graphic representation of the project; as well as the development of project documentation which can be used in the development of jewelry design training content.

Let's determine the content of training in jewelry design in various universities of Russia according to bachelor's degree programs in the field of training 54.03.02 Decorative and applied arts and crafts (artistic metal) [11] for compliance with the requirements for the design activity of an artist-jeweler in production conditions (table 1).

Table 1.

The content of the training that forms the project activity of future jeweler artists

<i>№</i>	<i>Educational institution</i>	<i>The content of design training</i>	
		<i>Name of the discipline</i>	<i>The content of the discipline</i>
1	Higher School of Folk Arts (Academy)	General Composition	General laws of composition [13]
		Technical drawing	Construction of projections of geometric shapes of jewelry on the plane for the image of the projected object [13]
		Technology and Materials Science	The study of manufacturing technologies and properties of materials used for their use in the process of developing a jewelry project [13]
		Designing	An algorithm for designing various jewelry; expressive means by which projects are carried out; work on search sketches for the implementation of a design idea by visual means and methods of design graphics; requirements imposed by production on jewelry projects; ways to achieve personal development and professional growth in project activities [13]
		Jewelry Modeling	Stages of making layouts and models of jewelry projects; technologies for making models and models of jewelry projects [13]
		Gemology	The main properties of jewelry stones (inserts) for their use in the process of developing a jewelry project [13]
		Special technologies in jewelry art	The study of traditional and innovative materials taking into account their formative and functional properties, special technologies for making jewelry, for their use in the process of developing a jewelry project [13]
		Decorative and fine plastic jewelry	Sculptural modeling of the relief or three-dimensional shape of a jewelry project; stylization of sculpture as a creative source

Continuation of the table.

			for creating jewelry projects; concepts and terms of plastic anatomy, features of creating three-dimensional models, shapes of birds, animals, humans and using them in the process of project development [13]
2	Kostroma State University	Modeling and manufacturing of fine plastic jewelry and art products	Techniques for designing, modeling and manufacturing jewelry and art products using traditional and digital technologies; principles of information and communication technologies, artificial intelligence technologies, bibliographic culture, information security [14]
		2D and 3D modeling of jewelry and art products	Information and communication technologies, artificial intelligence technologies, bibliographic culture, information security, ensuring the activities of the design and modeling area of jewelry and art production [14]
		Design and construction of decorative and applied art products	The history and development of the theory of designing decorative and applied art products; rules for designing jewelry and art products; requirements and features of the constructive solution of ergonomics of jewelry in the development of projects [14]
		Modern tools and technologies for designing jewelry and art products of decorative and applied art	Principles of project development for creating physical models of products; rules and methods for developing jewelry projects; fundamentals of technical aesthetics of projects; rules of artistic design and technical modeling; systems, methods and design tools; manufacturing ready-to-implement, ready-made projects (prototypes) and three-dimensional computer models [14]
		Technologies and styles in jewelry and art productions	Development of jewelry designs, their physical models and prototypes for production [14]
		Materials science and production technologies	Features of project development for prototyping; modern equipment and scope of application of additive and subtractive technologies for prototyping a project; features of design documentation and calculation of blanks for foundries [14]
3	FGBOU IN Ural State University of Architecture and Art named after N.S. Alferov	Technical drawing	Fundamentals of technical drawing and graphic culture; features of the purpose of the image and the designation of types, sections, images at the design stages [17]
		Specialized sculpture	Theory and methodology of shaping a projected object for various purposes from plastic materials in decorative and applied

Continuation of the table.

			arts; sequence of technological operations and verification of the results of design activities at each stage of work; fundamentals of economic calculation of an art project [17]
		Modern computer technologies	The role and importance of information and information and communication technologies in project activities; modern information technologies and software tools for solving problems of project activities; the concept of computer graphics; types of computer graphics (raster, vector): their features, advantages and disadvantages; the concept of color in a computer; color models; graphic file formats [17]
		Designing	Methods of analysis and systematization of preparatory material for the design of decorative and applied arts and crafts; fundamentals of theory and methodology of design; fundamentals of economic calculation of an art project [17]
		Materials Science	The use of physical and chemical properties of materials, methods of their processing, technological processes of manual and industrial manufacture and decoration of products in the process of creating a design for a project of decorative and applied arts and crafts [17]

The table does not fully represent the educational institutions of higher education that we have studied which train jeweler artists in the field of jewelry design.

The analysis showed:

- the disciplines that determine the content of design training in higher education institutions are profile-oriented disciplines, i.e. "Technical drawing", "Fundamentals of composition", "Technology and Materials Science", "Special technologies in jewelry", "Gemology", "Modeling", "Decorative plastic of small shapes in jewelry art", "Design";

- the content of profile-oriented disciplines is not related to the content of the discipline "Design" in educational institutions of higher education namely Kostroma State University Stroganov Russian State University of Art and Industry, St. Petersburg State University of Industrial Technologies and Design, Ural State University of Architecture and Art named after N.S. Alferov" [14, 15, 16, 17]. In addition, classes in this discipline study the process of creating an artistic image with a conditional graphic representation of the design of jewelry without taking into account the manufacturing technology in the material. It should be noted that such

projects do not meet the requirements of production because they require reworking of the design and technological solutions which leads to a change in the original artistic image and the original idea of the author. This professional orientation of training fulfills only part of the production requirements for the stages of project development and manufacturing in the material;

- the priority in the content of design training is the interconnection of all profile-oriented disciplines in the higher education institution of the Higher School of Folk Arts (Academy) [13]. Design training is carried out from mastering information about the development of a project to acquiring the skills, to execute a jewelry project in a material which ensures an inextricable link between the design and manufacture of jewelry.

It was determined during the analysis of the content of training of future jewelers in educational institutions of higher education that the content of training in all universities except for the Higher School of Folk Arts (Academy) is a complex of academic disciplines, educational and industrial practices focused on the differentiation of knowledge skills and abilities that form professional project activity. This fact does not allow develop a project model and make jewelry according to the production requirements for the training of bachelor artists who are able to work independently.

In this situation only the integration of the content of such disciplines as "Technical drawing", "General composition", "Technology and Materials Science", "Special technologies in jewelry art", "Gemology", "Modeling", "Decorative plastic of small shapes in jewelry art will provide students with a deep understanding of the design processes and its relationship with the manufacture of jewelry.

It should be noted that scientists D.S. Dronov, N.D. Dronova, E.V. Efremov, M.V. Churakova who study the content of the training of jewelers in professional education in their publications noted the leading importance of the content of professional disciplines in the educational process [5], the inclusion in the design content of the definition of the material and technology that are used for performance of the work [18], differentiation of content in teaching students with different initial artistic training [6]. The study of their scientific works made it possible to understand the essence of integration mechanisms in the development of design training content and their results.

Scientists came to the conclusion (based on the study of the content of design training in various educational institutions and scientific works of scientists) that the educational result of using the integration of the content of professional disciplines and the content of the discipline "Design" is the immersion of students during training not into separate systems of several disciplines ("Composition", "Materials Science", "Technology", "Gemology" and others) and into a new system where its system-forming factor is the content of the discipline "Design". At the same time students form a "system design" of jewelry the components of which are not only constructive and technological solutions, artistic and aesthetic perception but also the connection of the project development process with the manufacture of jewelry in the material [1, p. 3].

By the term "system design" we mean a set of sequential operations related to the search and development of unique constructive and creative design solutions as well as confirmation of the results obtained in the implementation of the project in the material.

Summing up the results of the analysis of the content of design training it should be noted that the process must be the result of integrating the content of a number of disciplines.

Thus, the design of jewelry is the result of mastering a system of theoretical and practical knowledge about materials technology composition and aesthetics of the product and using them in the process of developing a project and hand-making jewelry in the material.

The content of professional disciplines will be constantly updated with the constant change in methods and technologies of jewelry production. Moreover, design activity in production conditions is an artistically expressive embodiment of scientific and technical achievements especially in the process of system design.

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