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MODELING THE DESIGN ACTIVITY OF A TEACHER OF TECHNICAL DISCIPLINES

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The article considers the requirements of the modern educational environment to the professional activity of teaching staff and the need to plan their short- and long-term activities. These requirements activate pedagogical design as a type of activities of teaching staff.

Examples of research into this question in works of various scientists are analyzed. Information on various theoretical and practical problems of design as subjects of scientific research is generalized. The skills that future teachers should develop within the training process, which will allow them to carry out design activities and form the basis of design competence, are characterized.

The definitions of the concepts "design activity" by different authors are given and analyzed, among which the concept that is most expedient to the subject of our research is determined. Design activity is claimed to be inherent in any pedagogical worker, regardless of where they work. Characteristics of design activities are considered on the example of a future engineer-teacher, a vocational education teacher of technical disciplines.

The necessity of developing pedagogical design skills of future engineers-teachers, teachers of technical disciplines in a higher education institution is substantiated. Examples of types of projects that can be developed in the system of vocational education are given. The comparative characteristics of pedagogical and didactic projects are carried out. The general structure of an activity of the engineer-teacher on didactic design is given; activity stages and elements of each of the stages are defined. On the basis of the general structure of didactic design activities, modeling of the design activity of the future engineer-teacher, the teacher of technical disciplines of a vocational education institution while designing a didactic project within a technical discipline course defined by the standard of professional education is carried out. The characteristic features of the organization of the educational process on the basis of the standards of vocational education, developed on the basis of the competence approach, are given.

The clearly structured algorithm of the design activity for a didactic project in a technical discipline offered in the article allows adjusting students' activities while performing similar tasks in the course of studying at an education institution and has practical value for teachers of the system of vocational education.

Keywords: engineer-teacher, teacher of technical disciplines, pedagogical design, design activity, structure of the design activity, didactic project, vocational education.

Juergen Koeberlein-Kerler. «Моделювання проєктувальної діяльності викладача технічних дисциплін».

В статті розглянуто вимоги сучасного освітнього середовища до професійної діяльності педагогічних працівників, необхідність планувати свою діяльність на близькі та дальні перспективи. Наведені вимоги активізують такий вид діяльності педагогічних працівників як педагогічне проєктування.

Проаналізовані приклади дослідження цього питання в роботах різних науковців. Узагальнена інформація стосовно різних теоретичних та практичних проблем проєктування, які є предметом наукових досліджень фахівців. Охарактеризовані вміння, які повинні бути сформовані у майбутніх педагогічних працівників під час отримання ними освіти, що дозволять їм здійснювати проєктувальну діяльність та складають основу проєктувальної компетентності.

Наведено та проаналізовано визначення понять «проєктувальна діяльність» різних авторів, з числа яких визначено поняття, що найбільш доцільно підходить до тематики нашого дослідження. Визначено, що проєктувальна діяльність притаманна будь-яким педагогічним працівникам не залежно від місця його роботи. Характеристика проєктувальної діяльності розглянута на прикладі майбутнього інженера-педагога, викладача технічних дисциплін закладу професійної освіти.

Обґрунтовано необхідність моделювання проєктувальної діяльності майбутніх інженерів-педагогів, викладачів технічних дисциплін при виконанні різних видів освітніх проєктів. Наведено приклади видів проєктів, які можуть розроблятися в системі професійної освіти. Здійснено порівняльну характеристику педагогічних та дидактичних проєктів. Наведено загальну структуру діяльності інженера-педагога з дидактичного проєктування, визначено етапи діяльності та елементи кожного з них. На підставі загальної структури діяльності з дидактичного проєктування виконано моделювання проєктувальної діяльності майбутнього інженера-педагога, викладача технічних дисциплін закладу професійної освіти при створенні дидактичного проєкту технічної дисципліни, що визначена стандартом професійної освіти. Наведено характерні особливості організації освітнього процесу на підставі стандартів професійної освіти, що розроблені на підставі компетентнісного підходу.

Визначено, що моделювання проєктувальної діяльності з розробки дидактичного проєкту технічної дисципліни дозволяє скоригувати діяльність здобувача освіти при виконанні подібного роду завдань в процесі навчання в закладі освіти та має практичне значення для педагогів системи професійної освіти.

Ключові слова: інженер-педагог, викладач технічних дисциплін, педагогічне проєктування, проєктувальна діяльність, моделювання проєктувальної діяльності, дидактичний проєкт, професійна освіта.

Problem statement. The accelerated pace of social and economic development of society implies the need for people to focus on the near future, to be able to plan and evaluate life and professional prospects. These trends pose new challenges to education, associated with a qualitative change in the professional activities of modern teachers and relevance of such activities as design, to be able to design not only the pedagogical process itself, but also its outcomes, conditions, and prospects. It is pedagogical design that allows to build the educational process competently in terms pedagogy, technologically, which provides a high level of quality of education [6].

Many scientists have been dealing with the issues of pedagogical design since the 1960s: M. Alekseev, O. Anisimov, Y. Babanskyi, V. Bezrukova, O. Bielova, V. Bepalko, N. Briukhanova, T. Dmytrenko, O. Yeliseienko, V. Zahviazynskyi, H. Kyrylova, V. Kyrychuk, O. Kovalenko, V. Kraievskyi, M. Lazarev, H. Lebedieva, L. Lisina, O. Lytvynenko, B. Likhachov, N. Selivanova, A. Tereshchuk, O. Chernobay, I. Shevchenko, M. Shevchuk, N. Yakovleva and others.

Scientists have identified and formulated theoretical and practical issues of designing pedagogical facilities of different levels, developed theoretical foundations of pedagogical design, recommendations for designing educational systems, determined the role of design in the professional activity of teachers, considered actions that design the educational theme, course, lesson [11].

Thanks to their work, the expressions “design of pedagogical systems, processes and situations”, “design of educational model”, “design of child environment conditions”, “design of education and training”, “design of personality-oriented situation”, “design of the discipline content”, “design of learning technologies”, “designing requirements for the teacher”, “design of personality”, “design of human development”, “design of the learning content”, “design learning”, “design methods”, “design implementation technique” [9] and many others became widespread.

The ability of teachers to plan tasks and trends in their subject, anticipate difficulties in mastering it, find methods and techniques needed to improve teaching, identify the most rational activities of students, adjust their activities based on the reaction of students to new material, to choose innovative routes and technologies form the pedagogical design basis [5].

Analysis of recent research and publications. The formation of pedagogical design, its rapid development, the desire of scientists to emphasize certain features, led to the emergence of different interpretations of the concept of “pedagogical design”. Some of them are provided below.

V. Bezrukova believes that *pedagogical design* is a preliminary development of the main details of future activities of students and teachers [1].

According to N. Borisova, *pedagogical design* is an activity aimed at developing and implementing educational projects [2].

According to I. Shevchenko, *design in education* is a process of creating new forms of community of teachers and students, pedagogical community, new content and technologies of education, new ways and techniques of pedagogical activities and thinking [10].

According to O. Lytvynenko, pedagogical design is finding a way to transition from the real state to the perfect one. It is not just a prediction based on personal experience and intuition only; it is based on the study of the essence of pedagogical patterns, psychological features of personality development, pedagogical research, on the formation of their own pedagogical skills, purposeful development of the ability to interact. In addition, the design depends on the understanding of its logic and the essence of each stage [7].

H. Muraviova considers pedagogical design as a type of professional activity of a teacher, characterized by a set of methods and tools that provide the teacher with a prediction of the technological structure of the educational process and its results [8].

The most thorough research on pedagogical design is as follows:

- N. Briukhanova “Fundamentals of pedagogical design in the engineering and pedagogical education system” [3], which defines the essence of the concept of “pedagogical design”, the role of design in pedagogical theory and practice, design principles in pedagogy, structure of pedagogical design, levels, stages and actions of pedagogical designing, characteristic of the pedagogical design;

- N. Yakovleva “Theoretical and methodological foundations of pedagogical design” [12], which presents the content of pedagogical design, a description of the pedagogical design process and its organizational structure, described the activities of the designing teacher.

Both researchers derived the definition of “pedagogical design” on the basis of analysis of psychological and pedagogical literature, their own practical experience, and systematized information on pedagogical design since the 1960s.

According to N. Yakovleva, pedagogical design is a purposeful activity of a teacher to create a project, which is an innovative model of the pedagogical system, focused on mass use [12].

According to N. Briukhanova, pedagogical design is a mandatory stage of the teacher's activity, which precedes its interaction with learners, and is intended for choosing the most effective solution from a variety of options for this interaction as well as detailed, consistent and sound presentation which embodies the concept of a pedagogical design [3].

In our opinion, the latter statement is more meaningful and summarizes the views of various scholars on pedagogical design. This is the concept we will adhere to in our paper.

Let's consider the components of pedagogical design (pedagogical design activities) of future teachers of technical disciplines. N. Yakovleva [12] considers pedagogical design through such elements as purpose, object, subject, means, methods and results. V. Kozakov identified a more extensive list of components of design activities, adding conditions (environment and means), process and product [10] to the already defined ones. We describe the listed elements of pedagogical design activities.

Acting as an ideal representation of the end result, the purpose is the main prerequisite for the professional activity of a teacher in general and design in particular. The purpose of pedagogical designing is to develop a pedagogical design performed at the level of vocational education, specialty, discipline and topic. The pedagogical design should be presented in the form of a set of documents that cover in detail the content, methods of interaction between the teacher and students, as well as requirements for the organization, functioning and development of pedagogical systems, processes, situations [4, 12].

The object of design is, as a rule, a certain pedagogical structure: technology, method, content of education, curriculum, etc. [12]. In the theory of pedagogical designing, all these and other pedagogical formations to which the designer's activity is directed, as a rule, unite in a pedagogical system (integral unity of all factors promoting achievement of the set purposes of development of a person), pedagogical process (unification of those components that contribute to the development of students and teachers in their direct interaction) and pedagogical situation (as an object of design, it always exists within any pedagogical process and through it within a certain subsystem ; it characterizes the state of the pedagogical process at a certain time and in a certain space) [1].

The object of design, even having an outwardly traditional expression, should be based on a fundamentally new idea. This is due to the fact that the need for pedagogical design arises only when a new opportunity to solve an existing issue is found [12].

The subject of design is a teacher or a group of specialists. Whatever this subject, it should have specific features [4]:

- a) creative thinking and ability to invent;
- b) professionalism and high efficiency;
- c) socially significant value orientations;

d) ability to anticipate the consequences of future changes in reality, implemented in the pedagogical design.

Design methods are quite diverse, as their use depends not only on the problem and the subject of design (objective criteria), but also on the characteristics of the subjects themselves, on the set of methods that specific designers have (subjective criteria). In particular, they include heuristic methods for solving inventive problems, modeling, methods of qualimetry, etc. [4].

The means of design, like any activity, can be divided into material and spiritual ones. The first include legislation, documentation, technical tools, schemes, tables, etc. The second category comprises general means of scientific research, key theoretical provisions of related sciences, etc. [4, 12].

The environment of pedagogical design can be expressed both in the material form (premises), and foreign language, for example, information environment of the person. According to its various characteristics, it can significantly accelerate or slow down the performance of activities [3].

The process of pedagogical design consists of several stages: preparation, development, verification, completion.

At the first stage, contradictions are detected and the purpose of design activities or awareness of the tasks set before the designer is formed, needs and opportunities are compared, determining the order of actions and features of using the necessary tools, etc. [3].

At the second stage, a number of decisions the implementation of which will help eliminate the identified contradictions and improve educational outcomes [3] are substantiated and made.

At the third stage, the design is monitored in how it reveals in practice and to what extent the realities of the educational process are foreseen and taken into account, a corresponding conclusion is made and a decision is made to make certain changes to the project [3].

At the fourth stage, the optimal version of the developed project is designed [3].

The product of design is a pedagogical design, the characteristics of which are given above.

The result of pedagogical design is experimental achievements in performing this activity.

In order to design, the pedagogical process should be presented as an ordered system of its components and the activities of the teacher should be organized to operate these components. Based on forms of systematization and structuring of pedagogical process, the schemes of the organization of educational process which should be considered as forms of designing the

pedagogical process are designed. The design is made taking into account the specifics of the pedagogical process of continuous multilevel professional education in a form that provides the possibility to adequately reflect all the structures that are the subject of design. Invariance is one of the indicators of the design process. Therefore, design can act as something external to the pedagogical variability that it expresses.

The design activity is initiated by the needs of the theory and practice of pedagogy, where the priority issues the solution of which is possible by means of pedagogical design are formulated in a generalized form. Design activity is detailed by its particular executors, i.e. teachers who should be competent in this field of activity (that is they should have design competence).

The study of the teacher's design activity allows to present it at three levels of generalization.

The first level - methodological - includes consideration and substantiation of methodological requirements for design activities; identification of the main goals and objectives of design, arising from the methodological functions of the design process; determination of external and internal factors of its implementation.

The second level - general pedagogical - is associated with the consideration of theoretical provisions of the model of design activities, with the allocation of structural, functional, informational and procedural links, with the definition of methods and means of their implementation.

At the third level - technological - the design process is carried out: purposes, stages, methods and means of design.

We will focus our research on modeling the design activities of the future engineering teacher, teacher of technical disciplines of vocational education. The specificity of the design activities of the future engineering teacher, teacher of technical disciplines is that it can be carried out both in the field of pedagogy and professional training. With this in mind, different types of designs can be identified and the design activities of their executors can be modelled. In our paper, we will focus on modeling the design activities of the future engineering teacher to develop a didactic design of a technical discipline, as it depends on the content and organizational components of the educational process.

Setting objectives. The purpose of the article is to model the design activities of the future engineering teacher, teacher of technical disciplines of vocational education in creating a didactic design of technical discipline.

Presentation of the main material. The above concepts of “pedagogical design” and their analysis allow us to conclude that the pedagogical design can be performed at the level of educational institutions, specialties, education systems and more. Examples of pedagogical designs include the following:

- pedagogical design “Development of a standard of professional (vocational) education in a particular profession” involves developing the content of the standard of professional education, developing and organizing the educational process based thereon, implementing the educational process (experimental implementation of the standard), obtaining results, comparing them with planned ones, making adjustments to the developed design;

- pedagogical design “Introduction of training of skilled workers in the institution of professional (vocational) education in a particular profession” provides for developing documents for the licensing of educational activities, obtaining a license, organizing the educational process, obtaining results, comparing them with planned ones, making adjustments to developed project;

- pedagogical design “Training of skilled workers in the institution of professional

(vocational) education in a particular profession” involves organizing and implementing the educational process, obtaining results, comparing them with the planned ones, making adjustments to the developed project;

- pedagogical project “Training of skilled workers in a particular profession on a dual system of education in a particular institution (vocational) education” involves developing the educational process in a dual form of education, implementing the educational process on this basis, obtaining results, comparing them with planned ones, making adjustments to the developed project.

To implement the above examples of pedagogical projects, namely the organization and implementation of the educational process, the procedure of didactic design should be carried out, i.e. to develop a didactic design at the level of a particular discipline, topic, lesson.

Before characterizing the design activities of the future engineering teacher, teacher of technical disciplines of vocational education to create a didactic design of technical discipline, we present the general structure of the engineering teacher’s activities in terms of didactic design (Fig. 1).

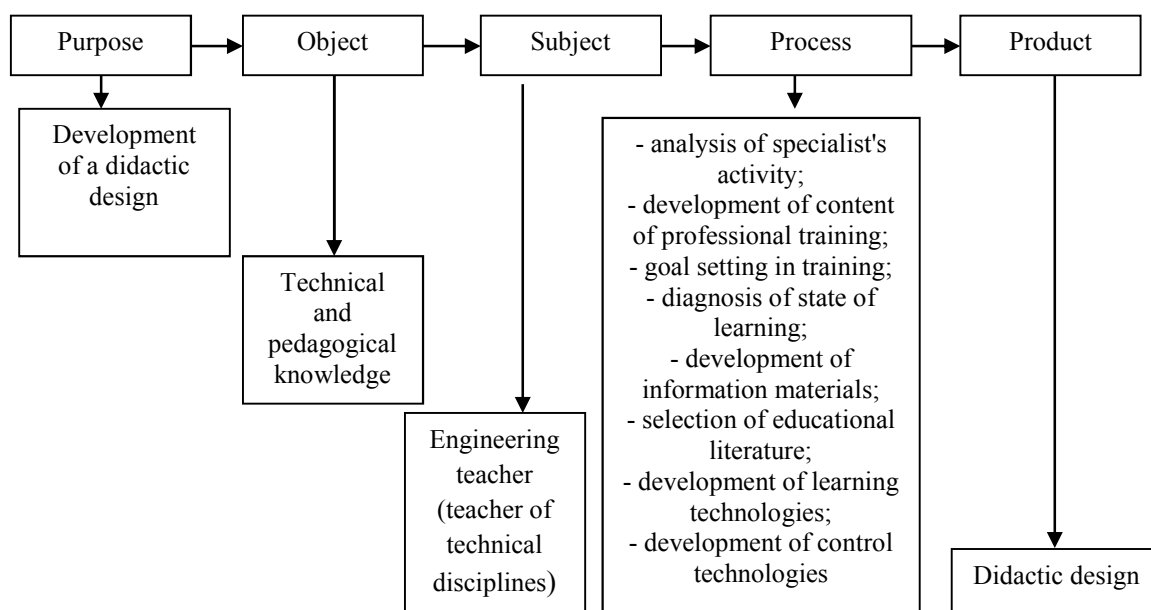


Fig.1. General Structure of Activity of the Engineering Teacher (Teacher of Technical Disciplines) on Didactic Designing

The process of activity of the future engineering teacher in terms of didactic design contains a number of successive stages: preparation, development, verification and completion, the characteristics of which have been given above.

Each stage may consist of certain elements, the list and content of which are determined by a

specific didactic design. As an example, the structure of the design activity of the future engineering teacher, teacher of technical disciplines of the institution of professional training in creating a didactic design of a technical discipline is given.

The ability to develop didactic designs in various disciplines, which are studied by students

in the system of vocational education (the place of future professional activities of engineering teachers), is formed in higher education institutions. Among the disciplines studied in the process of professional and theoretical training in the system of vocational education, the technical ones can be identified, the subject of which is the technique and technological processes. Therefore, in our study, we specify the activities of the future engineering teacher in relation to the development of a didactic design in the technical discipline.

The technical discipline is intended for study by future skilled workers in a certain profession of a certain qualification level, so it should consist of appropriate content, which is divided into separate sections or topics of the curriculum, specified in the topics of separate lessons.

As mentioned above, in order for a specialist to be able to design his/her activity, it should first be modeled. Therefore, we will consider modeling of design activity of the future engineering teacher, teacher of technical disciplines on development of the didactic design of a technical discipline.

Since today the learning process in vocational education institutions takes place according to the standards of both the “first” and “second” generation (on the competence approach), consider the structure of the teacher of technical disciplines to develop a project on technical discipline in each of these cases.

Figure 2 shows the modeling of the engineering teacher (teacher of technical disciplines) to create a didactic design in a

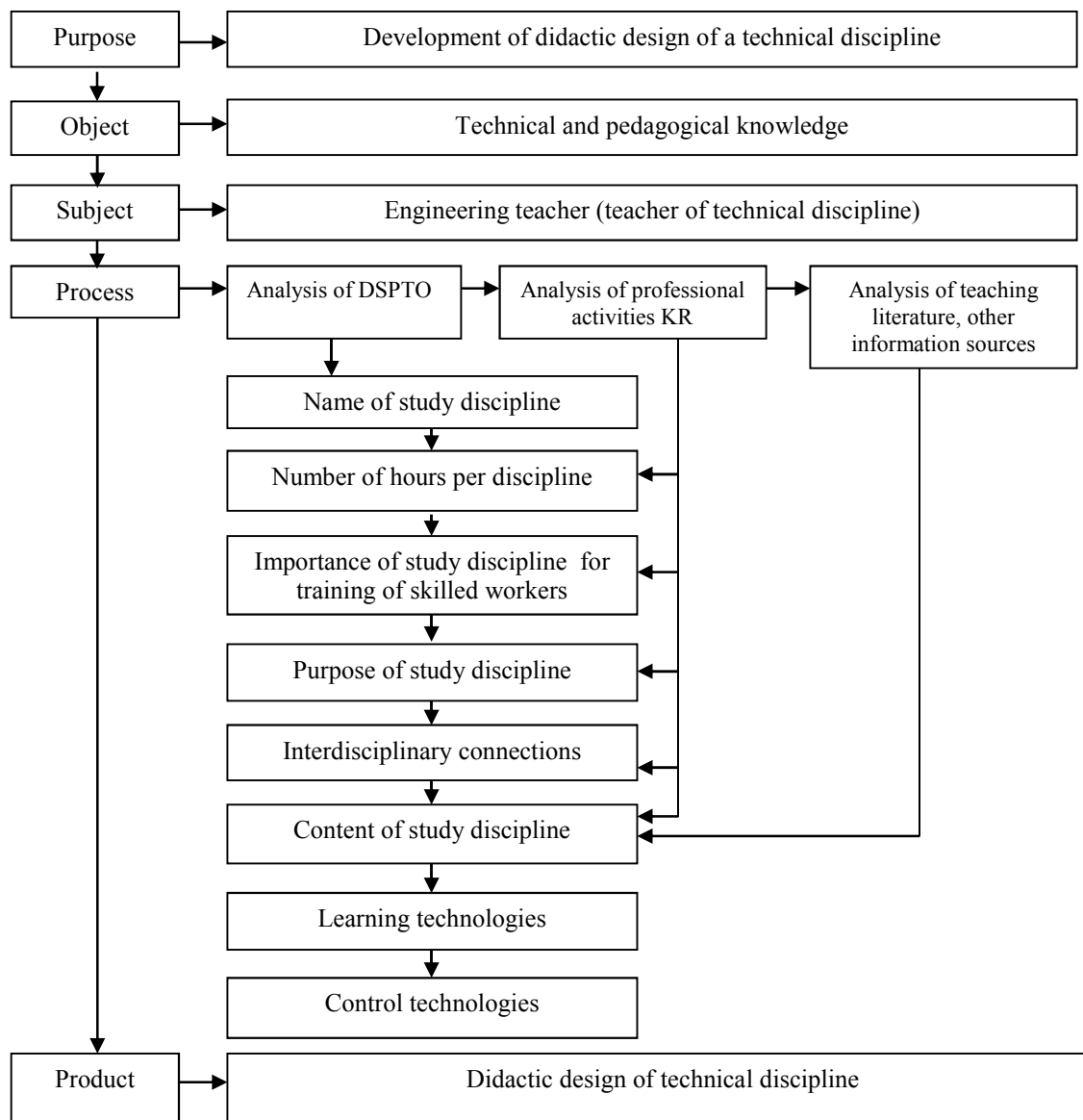


Fig.2. Modeling the Activities of an Engineering Teacher (teacher of technical disciplines) to Create a Didactic Design in a Technical Discipline (Subject to Training According to the Standards of the “first” Generation)

technical discipline (subject to training according to the standards of the “first” generation). In this case, the process of creating a didactic design is based on the analysis of the state standard of professional (vocational) education (DSPTO), the professional activities of skilled workers (KR), educational literature and other sources of information.

The design activity of a teacher of technical disciplines in the system of vocational education takes place according to a similar principle. In order for students in the future to be able to carry out design activities consciously, with the least errors, given certain educational conditions (specifics of the profession for which skilled workers are trained, regulations, contingent of students, special requirements of customers, features of educational process, etc.), in the

process of their training in higher education institutions, the modeling of this type of activity is learnt. Appropriate knowledge of design, skills and abilities of design activities are formed, which ultimately ensures the formation of design competence in students and provides an opportunity for further implementation of their professional and pedagogical activities in vocational education institutions.

Conclusions and prospects for further research. Thus, we have considered and characterized the design activities of the future engineering teacher, teacher of technical disciplines of vocational education in creating a didactic design of a technical discipline. Modeling of design activities was demonstrated on the example of the development of a didactic design of a technical

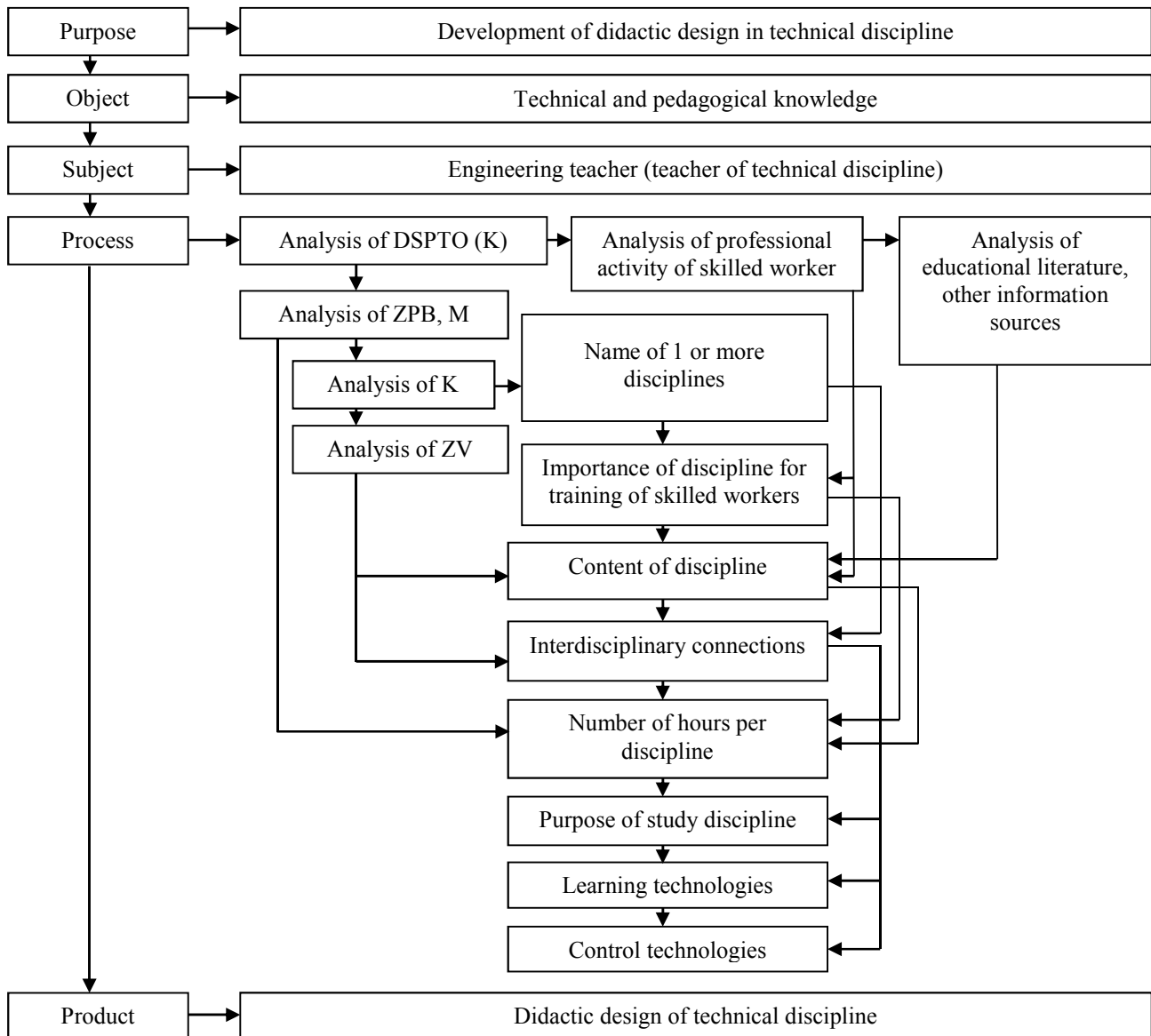


Fig.3. Modeling the Activities of a Future Engineering Teacher (Teacher of Technical Disciplines) to Create a Didactic Design in a Technical Discipline (Subject to Training According to the Standards of the “Second” Generation on a Competency Basis)

discipline under the condition of training on the basis of standards of professional education, developed on the competence approach. A clearly structured algorithm of activities on the development of a didactic design in a technical discipline allows to model activity of the student for the performance of similar tasks in the course of training in an educational institution. This

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information is also useful for working teachers of the vocational education system. The prospect of our further research is to model the design activities of the future engineering teacher from other types of didactic designs: design of a training module (subject to competence training), integrated-thematic design, design of a topic or lesson.

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