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# Didactic Content of Constructively-Projective Function of Students Learning: the Extrapolation in Information Technology

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**ABSTRACT**

The relevance of the study is conditioned by a radical impact on the learning process of the university by information technology, which put start a new phase in its transformation. According to experts at the present time the main factor of efficiency of university's activity becomes the expansion of students' learning activities, realized on the basis of new technologies in educational environments which they create with the changed learning functions. In the prevailing socio - pedagogical conditions the earlier priority educational - cognitive function fades into the background, giving way to a constructively – projective one, performing the role of not only the means of instruction and formation of students' creative work competences, but also of didactic conditions for extrapolation of changed functions of training in information technology. In this regard, the focus in this article is devoted to the establishment of the theoretical - methodical approach to projecting of the structure and content of constructively-projective function of students' learning as a didactic direction of educational process's transformations in university, extrapolated for the implementation of information technologies. The leading method of research is the pedagogical modeling, allowing justifying of theoretical and practical effectiveness of the structure and content of constructively- projective learning function of student, extrapolated in the implementation of information technology in the educational process. The article presents the discourse of the concept "constructive - projective function of students' learning"; based on the results of the study the didactic structure and content of constructive-projective function of students' learning is justified, which is extrapolated on the target, content, procedure and evaluation components of the modified functions of information technology; practice - oriented approaches of extrapolation of constructively - orienting function on the model of a specialist is established; the effectiveness of the identified structure and content of the functions using the quality criteria of information technologies is proved: conceptuality, integrity diagnostic ability, predictability, controllability, efficiency, reproducibility, creativity are proved. Presented in the paper results of the study can be useful for the practice of teachers, managers, trainers, facilitators of universities.

**KEYWORDS**

Constructive - projective function, information technology, educational process, didactic transformation, extrapolation, projecting method

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## Introduction

### *The relevance of research*

The intensive introduction of information technologies in educational process of university creates objective conditions for its systemic transformations. The primary objective of these reforms becomes restart functions of the educational process: from educational - cognitive to constructively - projective, performing the role of not only means of students' teaching and creative work competencies' formation, but also didactic conditions for extrapolation of changed functions of training in information technology. This trend is observed in the majority of studies on actual problems of didactics (Novikov, 2006; Khutorskoy, 2001; Choshanov, 2013; D`Angelo, 2007; Mitra, 2005; Ruthven, 2002; Kalimullin & Islamova, 2016). The study found that interest in the restart of training functions in university is conditioned by the re-interpretation of the traditional didactics and search for modern approaches to the development on the basis of its e-didactics (didactics of "e - Learning»), in which the constructive – projective is a core function. It was revealed that in the traditional didactics the constructively – projective function is based on the profession-graphic approach (Kuzmina, 1979; Slastenin & Podymova, 1997) in accordance with the requirements of the professional model in three ways: 1) professional level of young specialist (profession-gram); 2) his personality qualities (techno-gram); 3) the willingness of the individual to the professional activities (techno-gram). In accordance with these requirements the content filling of constructive function by components of projecting activity is carried out: 1) constructive - target activities: involves the analysis of requirements for training, competences and projecting on this basis of purposes of the training, development and education in the process of studying academic subjects; 2) constructive - content activities involves the selection and projecting of the content of educational material; 3) constructive - procedural activity involves the projecting of forms, methods and means of education, the structure and sequence of actions of the teacher and students, as well as the projecting of the resource base of training, selection and construction of manuals, technical equipment, laboratory equipment, cabinets, etc .; 4) constructive - evaluation activity involves projecting of an effective system of monitoring and evaluation of students' educational activity. In modern conditions of the dominance of information technology in the educational process of university the constructively - projecting function is characterized by the orientation not only on the implementation of modified qualification requirements of the university graduate's model: "the expert - researcher – designer-constructor," but firstly and foremost on the extrapolation of didactic components of modified function for information technology with the use of multimedia within the boundaries of the real learning process. In this regard, the focus in this article is devoted to the establishment of the theoretical - methodical approach to the projecting of the structure and content of constructively-projective function of student's learning as a didactic direction of transformations of university educational process, extrapolated for the implementation of information technologies. To this end, the paper presents the discourse of the concept "constructive - projective function of students' learning"; didactic structure and content of constructively-projective function of students' learning is justified, extrapolated to the target, content, procedure and evaluation components of the modified function of

information technology; practice - oriented approaches of extrapolation of constructively - orienting function on the model of a specialist are established; the effectiveness of the identified structure and content of the function using the quality criteria of information technology is proved: conceptuality, integrity diagnostic ability, predictability, controllability, efficiency, reproducibility, creativity.

## Literature review

### *The evolution of the content "constructive - projective function of students' learning"*

The study finds that the interest in constructively – projective function of students' training is manifested at all stages of socio - pedagogical transformations of university and is determined by the requirements' projecting to a specialist and their compliance with the educational process, the content of curricula, programs, technology of training. In this regard, a special role belongs to research the Russian scientist N.F. Talyzina (1975). According to her concept, the first step of transition of educational - cognitive function to constructively – projective one is the definition of typical professional tasks projected for future activities. Typical tasks have inherent hierarchy, which are simultaneously a hierarchy of objectives of constructively – projective function: 1) the upper level – these are the tasks of the century, which are determined by the nature of the historical epoch, the solution of which is the right and duty of every person, regardless of a particular profession; 2) second level are economic objectives which should be able to solve every modern specialist; 3) the third level - professional tasks. These tasks in the most general form for any specialty practically are expressed in a constructive – projective function, oriented on sustainable competences of projecting, construction and implementation of the results in this area of knowledge or activity. On the basis of objectives' hierarchy of constructively – projective functions proposed by N.F. Talyzina (1975), in the course of this research the approaches to professional's training who is able to work in the new information environment, with high demands to the reboot of constructively - projective function of activity are justified: analytical and organizational in the sphere of information resources; projecting and engineering in the field of information technology; constructing of new, rethinking of the content of educational material; projecting in the field of forecasts of future activities; selection of alternatives in the projecting and construction of their own educational strategies, career; planning for their own life and others. It is proved that in the didactic structure of the modern educational process, this function is extrapolated on the projecting of information technology in general, as well as on its specific elements' construction: objectives, content, process and information resources.

### *The difference between the views of the scientists on the research problem*

The first attempts to apply informational (technology) approach to university didactics began to be undertaken in 90 years in the European countries on the example of the didactics of mathematics (Douady, 1997; Artigue & Perrin-Glorian, 1991; Artigue, 1992). In these studies, particular attention is paid to the constructive – projective function of students' training, which is seen

as a condition for implementation by a teacher of the sequence of didactic actions to implement the training project with the students. Somewhat different these processes are considered by K. Ruthven (2002). He argues that the didactic content of the educational process, including the content of constructively-projective function, is none other than the precise projecting of the students' training process, which can then be played back at another point of time and space when there is predetermined conditions' implementation. This approach coincides with the definition of educational technology by Russian scientists V.P. Bespal'ko (1995) and M.V. Klarin (2002): technology is the object of the projecting teaching and subject of restart its changed functions. In the works of other Russian authors (Yepisheva, 2003, Zagvyazinsky, 2001; Isaev, 2001; Logvinov, 2005; Polat, 2000; Erdniyev, 1992; Zizek, 1996; Yakimanskaya, 2000) the results are presented of investigation of the problem of extrapolation constructively – projective function of students' training in information technology, educational trends of functions' reboot in educational university process, depending on the level of elaboration of information technology. During the study of alternative points of view on the problem of new generation of specialists' training it is found that the restart of information technology on the basis of the didactic content of constructively-projective function of university students' training meets the imperatives of modern educational policies of the university.

## Results

### *The structure and content of constructively-projective function of students' training*

The origins of ideas about rethinking the traditional structure of university students' training functions (training, organization, communication, learning tools) are in the works of J. Dewey (1997), A.N. Leont'ev (1977), B. Bloom (2000), who proved a psychological demand by the person of the following fields of application of acquired knowledge: acquisition of knowledge (knowledge), understanding of knowledge (comprehension), application of knowledge (application), analysis of knowledge (analysis), generalization (synthesis), assessment (evaluation). In these areas of application of knowledge a specific role by the authors is assigned to constructively - projective learning function, which is characterized by identical constructive or projective sense. The practical usefulness of this taxonomy is widely applied in modern conditions of an intensification of information technology. The study finds that high-priority requirement for professionals in the labor market is recognized maturity of constructively – projective function, the structure and the contents of which correspond to the knowledge-based activities:

- target activities (analysis of activities' problems, the requirements to the competences and projecting on this basis of flexible adaptation to the changing conditions of study and work, self-reliance and self-organization in learning and practical activity; scientifically reasonable use of formed competences in creative activities; professional use of information resources, improving of knowledge about new technologies, sources of information resources, electronic and digital technologies, etc.).;

- content activities (selection and projecting of the information's content, competent processing of the information received, formed ability to systematize

the facts needed to solve technological problems, analyze them, hypothesizing for solving problems, carrying out generalizations, comparisons with similar or alternative solutions; formulation of reasoned conclusions on the application of the received results for new challenges;

- procedural activity (projecting and implementation of creative work based on matrices of connection of individual requirements of qualifying characteristics (tasks and functions of constructively - projecting activity) disciplines' blocks (humanitarian, professional, special), as well as interdisciplinary relationships (inter-courses, interdisciplinary, at the level of specific intra-subject topics or sections, individual projects, electives, etc.).;

- evaluation activities (an effective system of monitoring and evaluation of educational activity of students). The starting material for the realization of such estimation technology is educational - methodical case, which has information about a problem in the content of the subject. The students thoroughly analyze and discuss the problem, substantiate its decision, involving independent experts through media technologies (email, chat, video blog, Skype). The study proves that in the process of analyzing and searching for optimal solutions not only professionally - significant competences of the person are projected (achievement motivation, critical attitude, corporative culture and responsibility), but there is a process of extrapolation constructively - projective function on the functions of information technologies, transforming them into a didactic condition for students' training.

## *Constructively - projective function in the structure of the model of the future specialist*

Established hierarchy of training functions in the educational activity of the majority of universities by inertia is determined by the dominance of the traditional priorities, as evidenced by the continuing tendency of the system's projecting: specialist's educational model - a model of specialist's training - predictive model of activity.

1. Model of a specialist. It is proved that in real educational practice of universities functions often are not reflective or they are replaced by reference on general, vague goals, such as - "to provide fundamental training in a particular area." "In addition, the general objectives of content of training or education are stated, a list of competences is offered that meet the criteria: to know, to be able to do, to own. V.P. Bespal'ko (1995), such a way of describing the function called a diagnostic mission of objective. To remove the existing contradictions, he developed a high-quality scale for assessment of the levels of knowledge and abilities of students, depending on what kind of activities they can provide: 1) the recognition of information; 2) reproduction of information; 3) commission of the productive activities on assimilated algorithm (reproductive activities); 4) the implementation of productive activities on the basis of self-constructed program (creative activity). Such an operational way to create goals requires possession of a special methodology. The set of final goals - a list of tasks that a specialist must be able to solve at the end of training in university didactics is defined as a model of a professional.

2. Model of future specialist's training. It is found that the specialist's model itself is not a psychological - pedagogical tool. It is based on job description, in which the system of requirements to the professionals is fixed involved in the

labor niche in the production system. It describes the purpose and general nature of the activity of a specialist, it is enumerated what he must know, to be able to do, what personal qualities should he possess. Professional's model becomes thus a tool for solving psycho - pedagogical problems when based on it a model of future professional's training is constructed, which reflects the projection of the requirements to a specialist on the requirements of the educational process's organization, to the content of curricula, programs and learning technologies. According to N.F. Talyzina (1975), the transition from specialist's models to the model of its training depends fully on the typical tasks of the future professional activity, having their own hierarchy, which determines the hierarchy of higher education's functions. These are: 1) the problems of the century; 2) economic objectives; 3) the professional tasks.

3. The predictive model of activity of a specialist. It is created as a pedagogical mechanism to "reboot" of student learning functions. Its effectiveness is proved on the following grounds: a specialist's activity model is rapidly becoming obsolete. It is found that the development of the productive areas is ahead of specialists' training in university. We need new approaches for the removal of such contradictions. The growing role of constructive - projective function is radically changes the traditional model of a specialist and creates the preconditions for the development of predictive models of activity of a specialist, which specifies the list of subjects of all cycles of disciplines to be studied, number of hours, the study format, technology, the criteria, detailed curricula of specific disciplines and others. On the realization stage of the predictive model of a specialist's activity the final "output" targets of higher education, intermediate or auxiliary, dominant in the formulation of substantive goals are tested. Separate items are making different contributions to the final goal. Therefore, it is necessary to project an integrated system of the final and intermediate objectives - from the professional's model to the private purposes of separate topics. On the basis of this system the structure of subjects is created to be studied in professionals' training for a particular specialty.

## *Extrapolation of constructively - projective function on information technology*

The research proves that the most productive ones, allowing to characterize not only quantitative but also qualitative parameters of the process of extrapolation of constructive-projective function of university students' training on the implementation of information technology are three groups of criteria. The first group - the criteria for technology assessment at the projecting stage: the possibility of separating the learning process into interconnected procedures, steps, operations; algorithmic nature; technological sequence of operations and procedures; controllability of the learning process. The second group - technology assessment criteria at the stage of implementation: assessment of learning content; evaluation of the use of teaching methods; evaluation of the used teaching and information tools; assessment of the organization of training. The third group - the criteria of the effectiveness of the learning outcomes: the assimilation of knowledge, depth, consistency, awareness, the volume of assimilated knowledge, the speed of assimilation of educational material; maturity of the oriented basis of activity: the accuracy of the students' making of educational - instructive card; completeness of the information provided in the card by students; self-completion in cards' filling; formation of professional

abilities and skills: workflow orientation, rationality, organization of work and the workplace; autonomy at work; compliance with safety regulations and training of professional work; the applicability of theoretical knowledge in the performance of tasks; the use of electronic, digital, computer technology; the rational in projecting of information technology; time used to perform tasks.

The efficiency of the established criteria in the selection process of information technology is proved: 1) target orientation technology of constructively - projective function on information technology; 2) technology of taking into account the specifics of the constructively - projective function in the content of the material being studied; 3) the technology of implementation of constructive – projective function in personalization and differentiation of training; 4) technology of scientific - methodical readiness formation of the teacher to extrapolate constructively - projective function; 5) technology for implementation of constructively – projective function of the resource support in the educational process.

## Discussion

The results of this study confirm the problem's relevance of extrapolating of constructively – projective function of learning of the university students in information technology, its theoretical and practical importance to rethink the didactic content, scientific - methodical and resource support for the educational process. The study confirmed the assumption of authoritative scholars (D`Angelo, 2007; Mitra, 2005; Ruthven, 2002; Bespal'ko, 1995; Zagvyazinsky, 2001; Choshanov, 2013; Erdniyev, 1992) that constructively - projective function is a highly precise projecting of students' learning process, is the object of study projecting and the subject of its changed functions' restart when the predetermined conditions' implementation. It is found that the process of extrapolation of constructively - projective functions in information technology is conditioned by the intensification of the latter, which determine the change of all training functions. The efficiency of the use of constructively-projective function is proved in the process of rethinking both categories of didactics and models of training of students - the future experts of high-tech industry. Scientifically proved and experimentally confirmed that constructive - projective function is an effective didactic condition for changing of target, content, process and evaluation components of information technology. Theoretical - methodical base for use of constructively - projective function of university students' training as a didactic condition for extrapolation in information technology to rethink their basic functions are proved and confirmed by the results of experimental studies using the criteria of the quality of information technologies: conceptuality, integrity diagnostic nature, predictability, controllability, efficiency , reproducibility, creativity (see Table 1).

**Table 1.** Dynamics of extrapolation of constructively - projective function in information technology of university students' training (using the 5-point rating scale).

| Quality criteria of information technology. | Quality indicators of information technology | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | target | | content | | process - technological | | resource | |
| | The start of the experi | The end of the experi | The start of the experim | The end of the experim ent | The start of the experim | The end of the experim ent | The start of the experim | The end of the experi |

| | ment | ment | ent | | ent | | ent | ment |
|---|---|---|---|---|---|---|---|---|
| Conceptual | 1,3 | 2,5 | 2,8 | 3,9 | 1,8 | 2,5 | 2,1 | 4,0 |
| Integrity | 1,5 | 2,5 | 1,5 | 3,2 | 2,0 | 2,9 | 2,9 | 4,7 |
| Diagnostic nature. | 1, 5 | 2,7 | 1,7 | 2,9 | 2,9 | 3,6 | 3,0 | 4,7 |
| Predictive | 1,7 | 2,5 | 1,8 | 2,7 | 1.5 | 2,9 | 3,0 | 4,3 |
| Controllability | 1,4 | 2,6 | 1,5 | 2,6 | 1,3 | 2,9 | 3,4 | 4,5 |
| Efficiency | 1,6 | 2,4 | 1,4 | 2,8 | 1,6 | 3,0 | 3,6 | 6,5 |
| Reproducibility | 1,4 | 2,6 | 1,3 | 2,5 | 1,5 | 3,0 | 3,7 | 6,0 |
| Creativity | 1,5 | 2,8 | 1,4 | 2,0 | 1,7 | 3,7 | 3,6 | 6,8 |

## Conclusion

The study confirms the theoretical and practical significance of the problem of extrapolation of didactic content of constructively – projective function of students' training in information technology of university training process. With this purpose, the paper presents the discourse of the concept "constructive – projective function of students' training"; justifies didactic structure and content of constructively-projective function of student' training, extrapolated in the target, content, process and evaluation components of the modified function of information technology; establishes practice - oriented approaches of extrapolation of constructively - orienting function on the model of a specialist; proves the effectiveness of the identified structure and content of the function using the quality criteria of information technologies: conceptuality, integrity diagnostic nature, predictability, controllability, efficiency, reproducibility, creativity. This problem as a research direction is not exhausted by the solution of the stated goals and objectives. Important significance for the theory and practice of university educational process has a deeper and more detailed study of the ratio of didactic components of educational technologies with resource sources of electronic technologies; planning of university educational process, which goes beyond the boundaries of the objective content of students' training; projecting of new models of teachers' and students' activities; implementation of multidisciplinary technologies based on digital resources.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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