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Information Streams of Education Content Integrative Designing at a Federal University

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ABSTRACT

Modern university education is aimed to provide a future expert with knowledge and experience of professional activity in the context of information society development and innovative knowledge-intensive production. At the same time information the teacher should be furnished with to implement own designing activity in the context of new education content formation is getting actual. Such designing is gaining an integrative character and becomes essential in the environment of controlled information streams. The paper reveals the phenomenon of education content integrative designing, features and invariant requirements to its content adequate to current trends of university education development, and ensures the unity and specificity of educational, scientific, production and social spheres of education content implementation realized within the selection of a variable logistic trajectory of its designing. The leading approaches to research the ways of integrative designing were system analysis of dynamic information educational environment and modeling of a logistic structure of information streams of educational purpose. The paper reveals the double-circuit organization of data exchange in the course of education content designing within which internal streams provide disciplinary differentiation, and external streams provide integration of disciplines, training profiles and educational structures. The paper develops subject - subject and subject – object exchange of information between educational organizations and society, between governing structures and divisions, between students and teachers in information educational environment of education content integrative designing. The paper proves that integration of information streams is a key idea to solve problems of timely and high-quality integrative designing of innovative education content. Practical significance of materials from the paper is that on the basis of described procedures the realization of developed functions and established interactions can be transferred to links of the information environment, and exchange of information becomes mediated by information resources and agents of educational purpose. The practical importance consists in the detailed and experimentally approved organization of an integration link regulating information exchanges in the course of designing and educational activity of subjects and agents of educational process.

KEYWORDS
Information streams, integrative designing, education content, pedagogical logistics, information educational environment

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The paper reveals the phenomenon of education content integrative designing, features and invariant requirements to its content adequate to current trends of university education development, and ensures the unity and specificity of educational, scientific, production and social spheres of education content implementation realized within the selection of a variable logistic trajectory of its designing.

Introduction

Sources of integrative designing

Education adequate to dynamics of information society and corresponding information environment is a personnel basis of innovative knowledge-intensive production.

Ideas unveiling opportunities and prospects of integrative designing on the basis of information streams find their place in the problem field of pedagogical science. First of all, these are essential provisions of educational logistics (Livshitz, 2006), bases and ways of multi-agent systems application in education (Novikov, 2001), didactic systems of specialists' innovative training in the information area (Vlasova, Kirilova & Curteva, 2016), ways of document flow organization on the basis of information and information streams (Vlasova, Kirilova & Masalimova, 2015), and conditions to create and realize information-education environment (Vlasova, Kirilova & Sabirova, 2015).

We relied on works that expound models of integration processes of educational system and social networks (Batov et al., 2016), mathematical models of information exchanges (Novikov & Chkhartishvili, 2014), and descriptions of integration processes in the area of education content (Blum, Mansour & Morgenstern, 2015), also psychophysiological bases of integration in educational-cognitive activity, features of training in modern educational environment and issues of information-environmental interactions of subjects in educational process.

Methodological bases of education content integrative designing

Education content integrative designing is based on the following methodological principles: leading idea, significant tendencies, modern features of education content integrative designing and requirement to university education content.

The leading idea in the solution of issues of timely and high-quality education content integrative designing is information streams integration.

Current trends of university education are connected with transition in the content of modern education from knowledge accumulation to experience formation of both educational activity and professional activity designing.

The following should be mentioned among the most significant tendencies: need to coordinate education goals and the order for experts' training, search of approaches to design educational activity in the context of integrative information, requirement to supplement available education experience with experience of development and use of mechanisms of innovative educational process designing and need for management of subjects' external and internal interactions in educational process.

Modern features of education content integrative designing can be singled out due to historical works on creative teachers' training (Slastenin, 1975) and modern works on modeling social networks, and information and strategic reflection (Batov et al., 2014); on the analysis of designing experience it is possible to specify features of external and internal contours of modern education content designing.

Prompt growth of information, increase of operational knowledge importance to implement different types of activity, need to adapt education content to processes of

society dynamic development, ensuring educational demands of the population have to be considered from the outside.

Need in systematic correction and increase of professionally significant content complexity, origin of new forms of educational process, diagnostics of individual requirements and monitoring of the information environment have to be regarded from inside.

Education content integrative designing is considered in invariant-level logic that includes: training profile content, academic discipline content and its elucidation in the structure of an educational topic, and informative content of mastered competences.

Basic requirements to university education content should be considered in compliance with them:

- requirement for systemacity (orientation to development and self-development and accounting of information-environmental specificity of system education organization),

- requirement for scientific character (description of structural and procedural characteristics of education content),

- requirement for coherence (development and correction of education content according to the order for training and formation of demanded competences),

- requirement for integrity (accounting of available pedagogical experience of content designing and the possibility to use new experience).

Theoretical bases of integrative designing

Conceptual model of education content integrative designing

The system of methods for education content integrative designing is built on the above described methodological base and in compliance with proposed theoretical bases including: information and logistic approach, requirements for integrative designing, typology of information streams, structure of educational system, external and internal character of information, information environment (Figure 1). Scientific-methodological support of education content integrative designing is: conditions of integrative designing, conditions of integrative designing implementation, levels of education content.

Let us describe below theoretical principles which will be used for further disclosure of a scientific-methodological support of education content integrative designing.

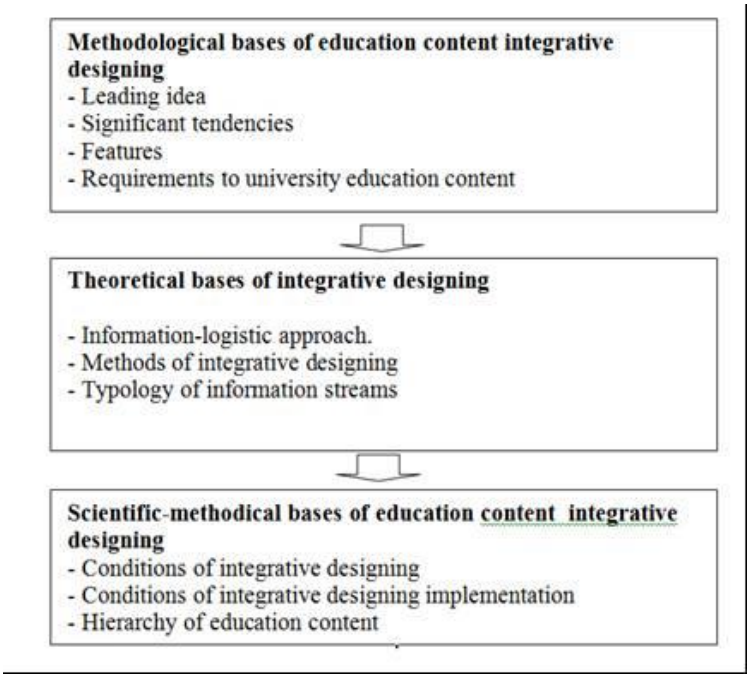

Figure 1. Conceptual model of education content integrative designing

Thus, the statement of the article consistently reveals a conceptual model of education content integrative designing.

Information-logistic approach

Information specificity of this approach is represented in the openness of educational process. Openness is determined by a constant exchange of subjective and objective information between internal components of experts' training system and the outside world.

The logistic specificity of the revealed approach is to consider principles of an activity basis and cognitive advancing, real demand and personality competitiveness, system interactions and environment improvement.

Information-logistic specificity of the approach to education content integrative designing suggests the use of external and internal contours streams relating respectively to innovative and traditional professional and educational infrastructures of university education. This specificity is manifested in variability of education content demanded in changing conditions of information society development and innovative production; future experts work on real and perspective problems of external and internal environment and participate in discussions of real and virtual situations.

Information-logistic approach is detailed in specific models revealing logistic procedures that provide structure-forming directions of integration in the course of education content designing. Four key parameters: level of contents, time, external and internal contour of educational system and structure of information streams are regarded when structure-forming directions of integration are revealed.

Methods of integrative designing

The paper investigates education content integrative designing and suggests an information-logistic approach the basis of which is:

- the unity and specificity of external and internal sides of education content;

- the unity and specificity of an educational, logistic and information orientation of education content designing;

- the unity and specificity of educational, scientific, production and social spheres of education content implementation.

External and internal sides of education content

Correspondingly, ensuring the unity and specificity of external and internal sides of education content on the basis of information streams regulation assumes the use of methods of their integration and differentiation.

Integration of information streams in case of education content designing is caused by its information-environmental specificity. Application of these methods becomes possible, first, considering realized components of educational system and, secondly, taking into account external and internal character of information.

The typology of information streams which is based on activity structure of education content designing as the system including procedures to determine goals, composition and structure, forms and methods, technologies and means of training and control, and also feedback which is based on the use of approaches available in educational practice becomes the basis of differentiation.

Logistic and information orientation of education content designing

Ensuring the unity and specificity of an educational, logistic and information orientation of education content designing is built in the structure of the system of logistic methods and mechanisms based on information streams regulation. These methods have to provide information needs and interests of the personality, and personnel requirements of innovative production. Logistic mechanisms are considered as an integral instrument of information streams management.

The system of methods and mechanisms of information streams logistic regulation provides the technology of education content integrative designing and realizes such basic functions as:

- distinguishing of competences having designing specificity;

- organization of information-environmental interactions defined with dynamic priorities of educational process in view;

- consideration of requirements for education content to update it in due time;

- evaluation of designing results on the basis of a pilot study.

Typology of information streams

The typology of information streams is based on activity structure of education content designing as the system including procedures to determine goals, composition and structure, forms and methods, technologies and means of training and control, and feedback as well, which is based on the use of approaches available in educational practice.

The interrelation and interdependence of education content and systematic nature of its assimilation prove the need of its integrative designing. Use of information streams in the described experience is ordered within the proposed typology which is accompanied with accurate distribution of functions of each of their streams.

The proposed typology of information streams consistently replacing each other and serving education content integrative designing in a higher education institution includes:

- standard,
- cognitive,
- methodical,
- technological,
- regulatory,
- reflexive streams.

The typology of information streams possesses an invariant character concerning the hierarchy of education content levels. Both integration of goals and integration of educational content are traced for the entire set of hierarchies; similarly integration in methodological support and in all other streams designated above is observed. Likewise, the hierarchy of education content levels has an invariant character in relation to the typology of information streams. The hierarchical character of goals description of a training profile which is revealed in academic discipline goals, purposes of an educational topic and, finally, the purposes of the competence to be formed and finds reflection in the hierarchy of standard streams can serve as an illustration.

Thus, integration of designated streams is necessary at all levels of education content. Disclosure of standard information about the content of the forming competence, disclosure of didactic units composition, their methodological and technological support, etc. can illustrate this.

Coordination and synchronization of information is provided in the course of integrative designing corresponding to a certain level of hierarchical education content, i.e. each information stream has to be integrated with all previous streams.

Results

Scientific-methodical principles of education content integrative designing

The research proposes and experimentally proves scientific-methodical foundations of education content integrative designing. Figure 2 presents the scheme of pilot study organization. Independent and dependent variables were defined to organize the pilot study.

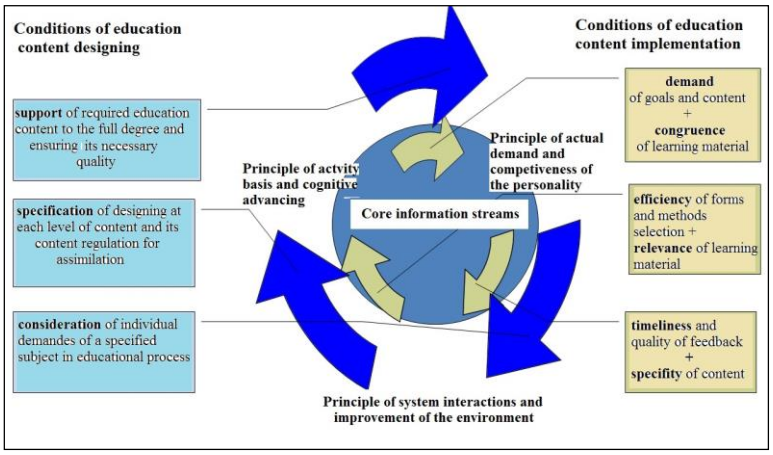

Figure 2. Scheme of the pilot study organization.

The goal of the experiment is to bring about the innovative potential of pedagogical education content integrative designing and to show that integration of information streams makes the foundation for introduction of innovations in educational process.

The main instrument to realize pedagogical education content integrative designing functioning as a part of information-education environment of a higher education institution used in experimental work was the flow chart regulating external and internal streams and the selection of a designing trajectory.

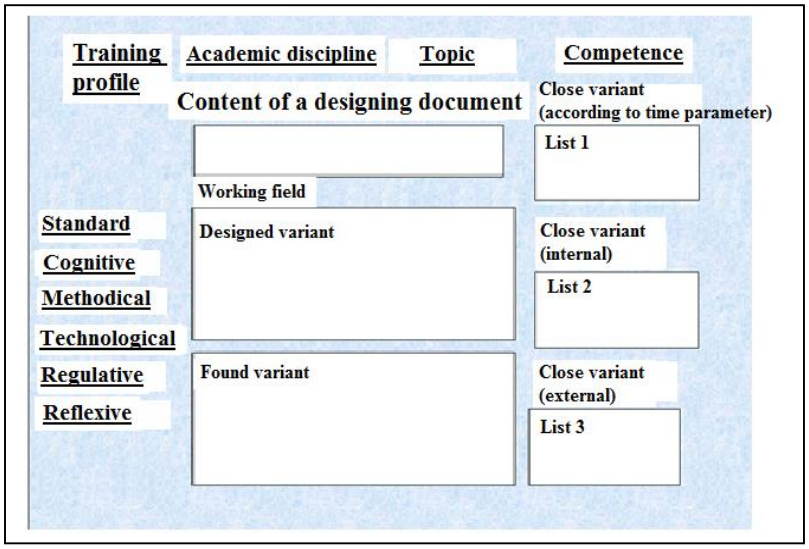

Figure 3. The model of information tool resource to implement pedagogical education content integrative designing

The content and tool supply of external and internal contours of educational process is provided with the informative basis of information-logistic approach.

Conditions of integrative designing

Independent variables presented as a set of conditions of education content integrative designing are specified in the pilot study.

The condition to select an adequate period and term of training is leading and backbone for the experimental work.

Other conditions of integrative designing are divided into groups.

1) The group of conditions that integrates science, education and production includes:

- a condition to ensure the required content of education to the full extent;

- a condition to provide guarantee of its necessary quality.

2) The group of conditions to provide an activity basis and cognitive advancing includes:

- a condition to detail designing at each contents levels (levels of profile training, academic discipline, topic and mastering competences);

- a condition to regulate its quantity necessary for assimilation from the position of reasonable prospects and a zone of near development.

3) The group of conditions to ensure system interactions and improvement of the environment includes:

- a condition to consider individual demands of the specific subject of educational process – including the teacher and the student;

- a condition to follow accurately those standards that regulate educational process.

Conditions of the integrative content implementation

Creation of corresponding changes in the pilot study allowed measuring the level of dependent variables. As those the set of conditions to implement integrative education content divided with their logistic and information specificity in view into two groups was singled out.

1) Conditions having a logistic basis:

- the demand of goals and training content of specialists;

- efficiency of forms and methods selection;

- timeliness and quality of feedback upon implementation of own professional activity designing process.

2) Conditions having information basis:

- coherence of training material content with the algorithm of its statement;

- training material relevance on objective information basis;

- specificity of training profile content to implement own professional activity designing.

Hierarchy of education content

Let's show results of education content integrative designing as a complete interconnected system.

Firstly, it is the content of training profile sets for each educational organization. Secondly, it is a set of academic disciplines content taught by a certain

educational division. And finally, it is a detailed content of conducted training sessions.

Let's call the designated set of levels consistently disclosing the content of each discipline for a certain training profile and each training session for a certain academic disciplines the hierarchy of education content.

The above designated positions specify the education content at each listed levels:

- training profile content,
- academic discipline content,
- training session content.

Information to be provided to subjects of educational process to implement their own designing activity in the context of new education content formation is getting relevant in the course of education content designing. Such designing cannot be carried out without due consideration of information and resources characteristic of other hierarchical levels of education content, other training profiles and similar experience of other educational divisions. Therefore content designing gains an integrative character and becomes actual in the environment of controlled information streams providing subject - subject and subject - object interaction.

Therefore, general and distinguishing content components are traced in some training profiles, in various disciplines and at different sessions. For example, even in close training profiles specific substantial differences are found; on the other hand, common goals, content, forms or training methods are found in multifaceted programs.

At the same time, implementation of education content at all levels should be provided for the set of above specified demands of systemacity, scientific character, coherence and integrity. For example, requirements of systemacity at the level of a training profile reveals system interrelation between academic disciplines, at the level of an academic discipline it sets the sequence of their studying, etc., therefore, system organization of information support providing a certain level of education content is regarded.

Research of innovative education content integrative designing

The use of external and internal streams was tracked in case of education content designing for training profiles having various degree of innovation.

The experiment was conducted from 2011 to 2015. 290 people trained on a pedagogical profile at Kazan Federal University including 120 future teachers of information technologies and 170 future primary school teachers participated in the experiment. Table 1 presents obtained experimental data.

Participants were offered to take part in integrative education content designing.

Let's address the ability of modern university education to realize its mission to provide a future expert with knowledge and experience of professional activity in the context of information society development and innovative knowledge-intensive production. Let's track the role of integrative designing for profiles, disciplines and sessions having a high innovative potential.

Table 1. Use of internal and external streams of information in case of education content designing

Profile	Used streams	Number of preferences on a stream	%
	2011		
Future primary school teacher (88 people)	Internal streams	56	63,6
	External streams	32	36,7
Future teacher of information technologies (78 people)	Internal streams	24	41,4
	External streams	34	58,6
	2015		
Future primary school teacher (82 people)	Internal streams	56	68,3
	External streams	26	31,7
Future teacher of information technologies (62 people)	Internal streams	34	54,8
	External streams	28	45,2

The education content projected by future primary school teachers is more traditional than dynamically improved contents projected by future teachers of information technologies. The comparison of used streams specified that more innovative education content demands the appeal to external experience which can be found when an external contour of designing is used. The experimental work confirmed it (Figure 4).

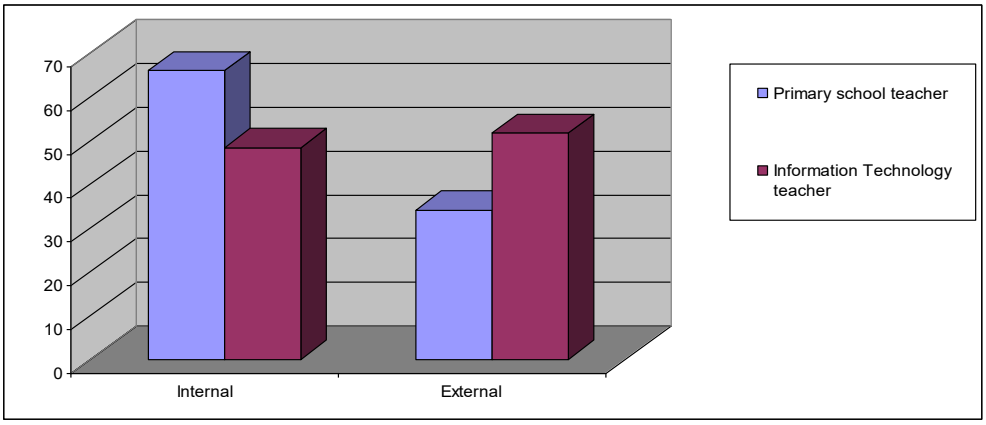

Figure 4. Use of internal and external information streams for various profiles of specialty

Experimental work established that transition to new training standards requires to address external streams as all necessary information cannot yet be created in internal streams. Such situation is observed if to compare the process of designing in 2011 and 2015 (Figure 5).

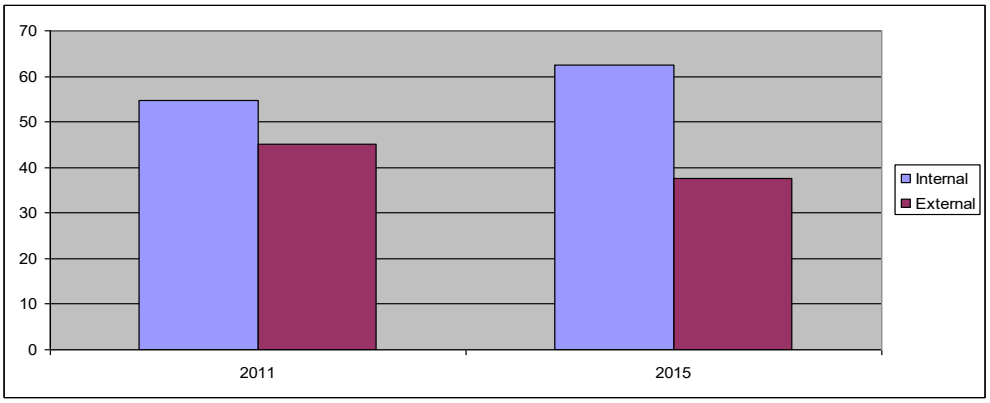

Figure 5. Change of innovative nature of education content designing and use of information streams during different time spans

The subjective and objective innovative component is characteristic of 2011 when education content designing was realized according to new requirements. Therefore, if designing in certain conditions is still provided with personal experience and internal information streams, the process of designing is perceived as innovative. Gradually required experience is accumulated, available information emerges, and the requirement for external information streams use decreases a little. It can be seen if to compare the orientation to internal and external streams in 2011 and 2015. The analysis of the chart confirms that.

Discussion

Ensuring the unity and specificity of educational, scientific, production and social spheres of education content implementation is realized within the selection of a variable logistic designing trajectory:

the trajectory of parallel designing which is based on external integration of horizontal information streams, and is expressed in interaction of relevant divisions of higher education institutions with uniform training profile and enterprises;

the trajectory of consecutive designing which is based on internal integration of vertical information streams, and is expressed in the use of a local network of a higher education institution;

the trajectory of designing through a specially organized auxiliary link based on the integration of information streams of an external and internal contour.

The last trajectory is connected with the association of intellectual potential of a higher education institution around one educational and methodical center capable to become the resource center of information-environmental interaction of all divisions of a higher education institution.

Besides, objective (there is obviously not enough information) or subjective (there is much information but it is difficult to make a choice) shortage of information updates possible integration in the external contour.

In the course of integrative education content designing system interactions and interrelations of information streams functioning in education, production, science and society are reflected.

Conclusion

Thus, structure-forming directions of integrative designing correspond to a consecutive creation of a logical scheme inside a certain level of education content in educational system structure, and innovative orientation supported by the closest according to parameters of temporary characteristics experience and the most useful from the position of effective realization choice of a designing trajectory in a multilayered structure of external environment.

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