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# FEATURES OF A FORMAL REPRESENTATION OF MULTIFORM PROCESSES IN THE SYSTEMS OF TRAINING, EDUCATION AND PRODUCTION

*The paper proposes a technology for formalizing multiform processes in the systems of training, education and production. One of the important components of the formalization technology is the construction of models of objects of the topical area. The formalization technology being developed consists of three main formalization branches: logical methods of knowledge modeling, heuristic methods and ontological methods. One of the stages of formalization technology is the modeling of processes and phenomena on the basis of a mathematical apparatus. The mathematical interpretation of combining models of related topical area is shown.*

***Keywords:*** *formalization technology, educational processes, topical area, school, college, production, integrated environment.*

## Introduction

The networked educational technologies based on integrated intelligence exist and develop, and for them it is necessary to develop mathematical support. For this purpose, it is proposed to use formalization technology, which differs from the existing in the work [1]. The procedures and methods of ontological modeling [2], heuristic and logistical methods are used in constructing formalization technology.

Based on the use of formal procedures of developing technology the cognitive modelling in gaming learning methods [3] was implemented. A new approach was proposed, ensuring the pupils' conscious choice of the future profession. It lies in organizing on the pages of the profiling departments sites [4] of game models and their implementation in the form of quizzes. The proposed technology for formalizing representation of the integration of schools, colleges and production will allow to structure the models that are applicable in these three systems.

In addition, using a college model of knowledge formed through the training and work programs based on knowledge and skills, a particular enterprise could independently create a mini-curriculum and train specialists for its field on these plans in a remote mode. It can be a bachelor or a master, who has a system of professional knowledge, skills and habits. Also, employers and human resources managers could trace the process of system formation of the professional knowledge among students from the second to the fifth year [5].

## 1. Mathematical interpretation of combining models of related topical areas

The work suggests the formation of core (C) of related topical areas (TA), which will be interpreted by the models of the process inherent in each area. In Fig. 1 the mathematical interpretation of combining models of related topical areas is shown. The first procedure will unite the subject area "School-College", and the second procedure is "College-Production". The construction of related core is confirmed by the realized processes of uniting schools and colleges in the network of websites [3-4] and linking the network of college sites with employers [5].

Here is a generalized scheme of formalization technology. The first stage of the formalization technology being developed the representation of the integration of the school, college and production is the structural and functional analysis of formalized processes, namely the finding of their features, the definition of objects and their types that must to be formalized and the models for them must be constructed. Thus, one of the important components of the technology of formalization is the construction of models of objects of the topical areas. In comparison with the formalization technology proposed in the work [1], the feature of the technology for formalizing the multiform processes in the systems of training, education and production ("School-College-Production") is the use of ontological modeling, since not all processes and phenomena can be represented in the educational system by heuristic and logical methods. The created models of objects of the topical area provide knowledge representation by heuristic, logical and ontological methods as well. In the first case, their components serve to specify the corresponding heuristics in the models of knowledge representation, in the second, their symbols form the alphabet of one of the formal systems (propositional calculus, predicates, formal theories, etc.), and in the third case their components serve to structure and construct connections between the objects under consideration [6].

Consequently, the formalization technology being developed consists of three main formalization branches.

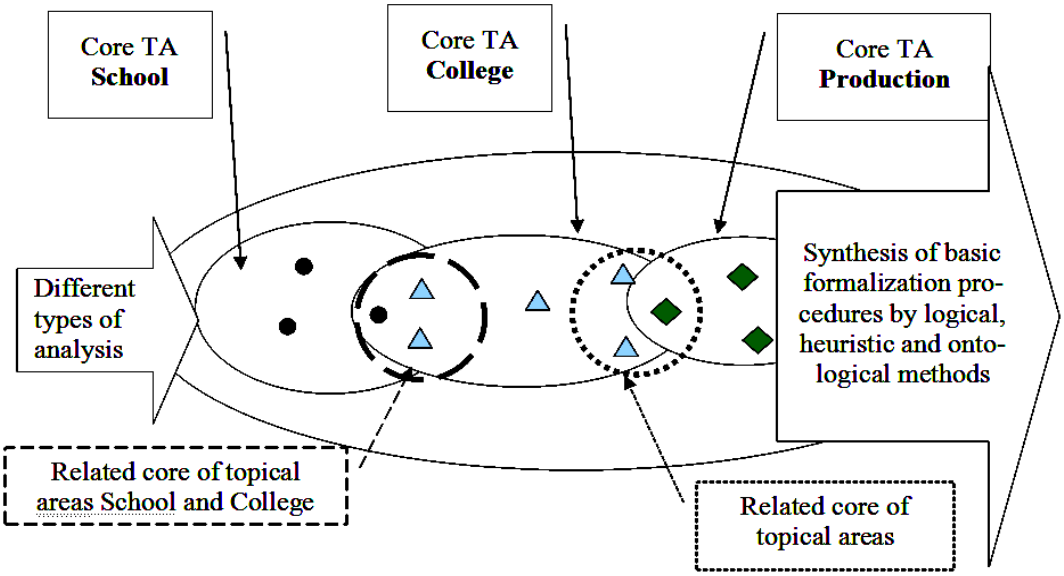


Fig. 1. Mathematical interpretation of combining models of related topical areas

The first branch of formalization technology is the logical methods of knowledge modeling, which are based on formal systems. The second branch consists of heuristic methods, which are based on the representation of knowledge by production systems, semantic networks, frames and other heuristics. The third branch of formalization technology is made up of ontological methods, which are used to structure knowledge about the objects of the investigated area. The use of ontological methods makes it possible to cope with such a difficult task of coordinating conceptual descriptions of information and intellectual resources that are compiled by different specialists. Features of ontological methods are objectivity, universality and integrity [7].

Generalized structure of the main components of the formal representation of knowledge in support of information technology solutions is shown in Fig. 2.

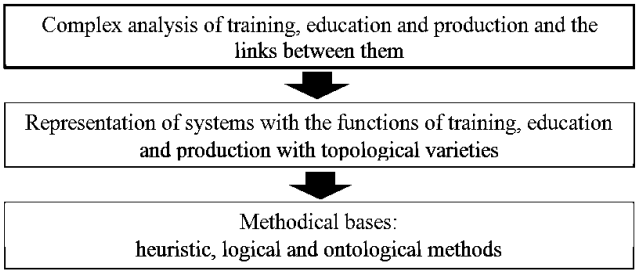


Fig. 2. Generalized structure of the main components of the formal representation of knowledge in support of information technology solutions

## 2. Technology of formalization of the integrated environment "School-College-Production"

The next step in the technology of formalization is the modeling of processes and phenomena on the basis of a mathematical apparatus. In this case, the methods of topology (the theory of categories and functors) are most suitable. The goal of this stage is to create a metamodel that will unite all three formalization branches, in other words, procedures for constructing models of topical areas. As part of the topical area, the core is allocated, which is determined by the research objective and includes some of the most essential for this study of the TA objects and the many links between them. Under the TA in the formalization of the representation of the integration of the school, college and production, one should understand the training, educational and production processes and their state, which is described by the totality of the properties of the constituent objects and the connections between them. The structure of the technology for formalizing the representation of the integration of the school, college and production is presented in the form of a scheme in Fig. 3.

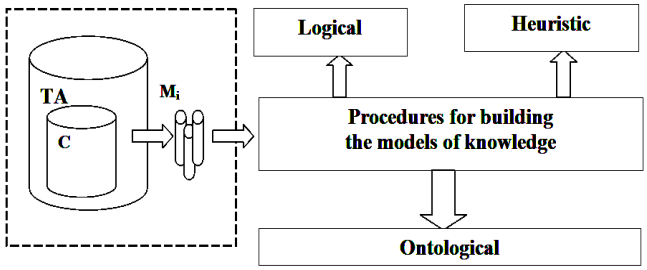


Fig. 3. The generalized scheme of formalization technology of the integrated environment "School-Colege-Production"

It shows the selection from the topical area of its core (C), consisting of individual models

$$Mi,\ i = 1..N,$$

which can be represented by heuristic, logical and ontological methods using appropriate procedures. In the process of realizing the technology of formalization, it is proposed to use a methodological base, the hierarchy of which is shown in Fig. 4.

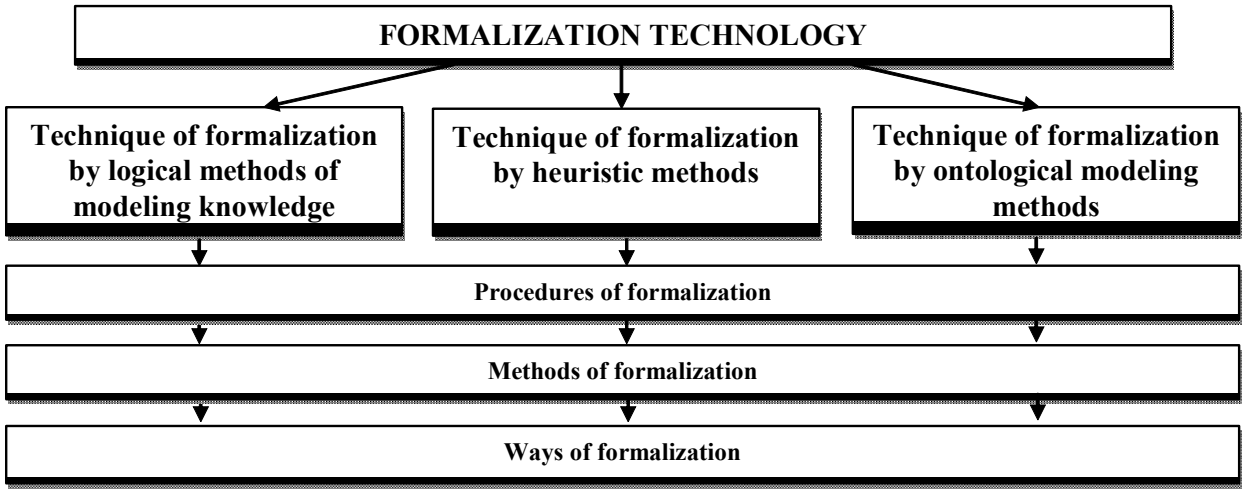


Fig. 4. Hierarchy of methodological basis of formalization technology

## Conclusion

In the work, a formalization technology was proposed. One of the techniques in this technology is ontological modeling, which is used to structure knowledge about investigated area objects and coordination of conceptual descriptions of information and intellectual resources. In addition, a mathematical interpretation of combining models of related topical areas is shown.

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### ОСОБЛИВОСТІ ФОРМАЛЬНОГО ПРЕДСТАВЛЕННЯ РІЗНОМАНІТНИХ ПРОЦЕСІВ В СИСТЕМАХ НАВЧАННЯ, ОСВІТИ І ВИРОБНИЦТВА

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*В роботі запропонована технологія формалізації різноманітних процесів в системах навчання, освіти і виробництва. Однією з важливих складових технології формалізації є побудова моделей об'єктів предметної області. Технологія формалізації, що розробляється в роботі, складається з трьох основних гілок формалізації: логічні методи моделювання знань, евристичні методи і онтологічні методи. Одним з етапів технології формалізації є моделювання процесів і явищ на основі математичного апарату. Показана математична інтерпретація об'єднання моделей суміжних предметних областей.*

***Ключові слова:*** *технологія формалізації, освітні процеси, предметна область, школа, вищий навчальний заклад, виробництво, інтегроване середовище.*

### ОСОБЕННОСТИ ФОРМАЛЬНОГО ПРЕДСТАВЛЕНИЯ МНОГООБРАЗНЫХ ПРОЦЕССОВ В СИСТЕМАХ ОБУЧЕНИЯ, ОБРАЗОВАНИЯ И ПРОИЗВОДСТВА

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*В работе предложена технология формализации многообразных процессов в системах обучения, образования и производства. Одной из важных составляющих технологии формализации является построение моделей объектов предметной области. Разрабатываемая технология формализации состоит из трех основных ветвей формализации: логические методы моделирования знаний, эвристические методы и онтологические методы. Одним из этапов технологии формализации является моделирование процессов и явлений на основе математического аппарата. Показана математическая интерпретация объединения моделей смежных предметных областей.*

***Ключевые слова:*** *технология формализации, образовательные процессы, предметная область, школа, высшее учебное заведение, производство, интегрированная среда.*