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IMPLEMENTATION OF GENERALIZATION TECHNOLOGY IN THE PROCESS OF STUDYING THE BASIS OF SCIENTIFIC RESEARCH

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Abstract

The problem of representation of a large number of technical objects and their features on the basis of the generalization process has been investigated. The technology is based on determining the characteristics of objects like function, key constructive components, physical principle of action, parameters and indicators. Selecting of the group`s equipment prototype (typical representative) is based on identified characteristics. The implementation of technology provides a definition of the list of machines and apparatus. The studying of these machines and apparatus in the educational process will allow students to form the ability of carrying out research of all the list of technical objects which are used in the industry. Such approach made it possible to generalize around 105 technical objects and to form 18 typical representatives of these equipment.

UMSETZUNG DER GENERALISIERUNGSTECHNOLOGIE IM PROZESS DER STUDIE DER GRUNDLAGEN DER WISSENSCHAFTLICHEN FORSCHUNG

Das Problem der Darstellung einer Vielzahl technischer Objekte und ihrer Merkmale auf der Basis des Generalisierungsprozesses wurde untersucht. Die Technologie basiert auf der Bestimmung der Eigenschaften von Objekten wie Funktion, konstruktiven Schlüsselkomponenten, physikalischem Wirkprinzip, Parametern und Indikatoren. Die Auswahl des Geräteprototyps der Gruppe (typischer Vertreter) basiert auf identifizierten Merkmalen. Die Implementierung der Technologie liefert eine Definition der Liste der Maschinen und Geräte. Das Studium dieser Maschinen und Geräte im Bildungsprozess wird es den Studenten ermöglichen, die Fähigkeit zu entwickeln, die gesamte Liste der technischen Objekte, die in der Industrie verwendet werden, zu erforschen. Ein solcher Ansatz ermöglichte es, etwa 105 technische Objekte zu verallgemeinern und 18 typische Vertreter dieser Geräte zu bilden.

Keywords:	*Schlüsselwörter:*
Technical object	Technisches Objekt
Generalization technology	Generalisierungstechnik
Typical represented	Typisch dargestellt

Socio-economic changes that take place in modern society carry out direct influence on the system of education and require the new methods of her realization, development and updating. These changes, and also development of scitech, lead to the increase of requirements in relation to quality of preparation of students. Higher requirements are pulled out to preparation of specialists in spheres of industry with a necessity of their further development.

Above-mentioned refreshes oneself basic principles educations in Ukraine, which indicated in laws "About Education", "About higher education", for the National doctrine of development of education : integration of education with science and production, organic combination of education and science, preparation of specialists, apt at creative labour, professional self-development, mastering and introduction of intensive science technologies.

Thus, development of informative society are characterized in such way that by humanity in 2002 18·1018 (18 exabyte) byte was created. For last 5 years it was created more information than for all previous history by humanity. The space of information in the world grows annually on 30%. In average in a year in the world a 2,5·108 byte/is produced for a man [3]. Consequently, priority direction are introductions of technologies, that

allow to decide the problem of presentation and mastering in the process of studying of enormous information content.

The questions of resolving of problem of presentation of plenty of objects and their signs on the base of globalization are shown in works [2; 4]. However the question of generalization of technical objects needs a further study.

For realization of technologies of chemical productions thousands of various equipment is used; the educational process of specialists embraces only their basic standards (about 105 technical objects), and the problem of determination of list of machines and vehicles, research of that in an educational process will allow to the students to form ability to carry out research activity of all list of technical objects that is used in industry of chemical industry, appears thus.

The point of the article is an implementation of technology of presentation of plenty of objects and their signs specification on the basis of generalization. The worked-out technology is based on determination of descriptions of objects: function, key structural elements, physical principle of action, parameters and indexes and, on their basis, establishments of prototype (typical representative) equipment.

As marked already, for realization of technologies of chemical productions tens of thousands of various equipment is used. In the process of studying of specialists on machines and vehicles of chemical productions about 105 technical objects are studied. The problem of determination of list of machines and vehicles, research of that in an educational process will allow to the students to form ability to carry out research activity of all list of technical objects that is used in industry of chemical industry, during the study of discipline of "Basis of scientific researches " the problem of determination of list of machines and vehicles appears, research of that in an educational process will allow to the students to form ability to carry out research activity of all list of technical objects that is used in industry of chemical industry.

To solve the problem represent a large number of objects and their characteristics on the basis of generalization consider a model of the representation of concepts through prototypes, which are presented in [2; 4]. Thus, in the process of learning for an increasing number of objects and their characteristics due to the natural, objectively existing mechanism of minimization of information due to generalization, there is a need for models of representation of concepts through prototypes.

A distinctive feature of this mechanism is to group man-made objects on the necessary signs around special objects, called prototypes. "The prototype is the object which most clearly reflects the structure of the class as a whole, and which can be represented by a set of features that best distinguish this class from other concepts" [4, p. 135]. According to N. Lazarev [2]: "... in the presence of the representation of concepts using a prototype, the concept of identification begins with comparing it with the prototype and then creates its definition as an element of a higher or lower level in the hierarchy of concepts" [2, p. 236].

Thus, establishment of prototypes will provide the increase of efficiency of educational process due to reduction to the amount of time on determination and comparison of elements of knowledge. Realizing model of representation of concepts by means of prototype (typical representative) within the limits of our research, it is necessary to define the prototypes of equipment of chemical productions.

The first stage of work in relation to determination of prototype of equipment is establishment of technical objects of research activity in chemical industry. On the stage of determination of technical objects of research activity in chemical industry it follows to execute such steps:

1) to define the list of physical and chemical processes of chemical industry;
2) to define the list of equipment (machines and vehicles) that will realize the physical and chemical processes of chemical industry.

The analysis of scientific and technical information generators allowed to set that by the technical objects of research activity specialists on machines and vehicles of chemical productions are equipment that provides realization:

– mechanical processes (moving of hard materials, growing of hard materials shallow, classification of materials, dosage and mixing of materials);

– hydromechanical processes (moving of liquids and gases, cleaning of gases, distribution of the liquid heterogeneous systems, interfusion of substances);

– thermal processes (heating and cooling, evaporation, crystallization, artificial cooling);

– mass transfer processes (absorption, extraction, rectification, adsorption, drying).

In further on the basis of analysis of scientific and technical information generators will define the groups of physical and chemical processes, that is included in kinds. Thus, will set that:

– mechanical processes and equipments include for itself such list of groups: moving of hard materials, growing of hard materials shallow, classification (sorting) of materials, dosage and mixing of materials;

– hydromechanical processes and equipments include for itself such list of groups: moving of liquids and gases, division of the liquid heterogeneous systems (defending, filtration, centrifugation), cleaning of gases, interfusion;

– thermal processes and equipments include for itself such list of groups: heating and cooling, evaporation, crystallization, artificial cooling;

– mass processes and equipments include for itself such list of groups: absorption, extraction, rectification, adsorption, desorption

In further by us the formed list of technical objects that is included in every kind. Our next task is: to generalize the certain list of equipment and set the typical standards of technical objects of industry. For generalization of certain list of equipment will use the model of representation of declarative knowledge (1). Thus, as marks M. Lazarev «... declarative knowledge are knowledge about facts and object, that is related to conceptual and representations in memory of man; procedural knowledge are knowledge about that, how to produce those or other actions»[2, p. 182].

On basis [2] for development of model of description of technical object will use the model of representation of declarative knowledge (1) and receive

$$T= (R, S, D, Y) \qquad (1),$$

where T is a technical object;

R is a great number of signs, that describes the function of technical object;

S is a great number of signs, that describes the list of key structural elements of technical object;

D is a great number of signs, that describes physical principle of action of technical object;

Y is a great number of signs, that describes parameters and indexes of technical object.

Realizing a model (1) will conduct analysis of types of equipment, that are typical for the group of equipment; for every technical object will define such descriptions: function, key structural elements, physical principle of action, parameters and indexes. Thus we marked the following:

1) under the function of technical object we understand his setting and description of materials for that him it is expedient to use;

2) under key structural elements we understand the elements of construction, that carry out the physical and chemical process of transformation of substances directly;

3) under physical principle of action we understand essence of physical and chemical process of transformation of substances and co-operations of key structural elements, that provide his realization;

4) under parameters we understand totality of structural and technological factors, that influence on realizations of physical and chemical process of transformation of substances and co-operation of key structural elements, overall sizes;

5) under indexes we understand totality of technological descriptions after that it maybe to estimate efficiency of implementation of physical and chemical process of transformation of substances and co-operation of main structural a technical elements.

On the basis of the got information will define the typical standard of group of equipment. For this purpose will take advantage of interpretation of model (1) and will get the model of description of typical standard of technical objects (2).

Model of description of typical standard of technical objects:

$$Ttype.=\{R_{type}., S_{type}., D_{type}., Y_{type}.\} \qquad (2),$$

where $T_{type}.$ - a technical object is typical for the type of technical objects;

$R_{type}.$ it is a great number of signs, that describes the function of typical standard of types of technical objects;

$S_{type}.$ it is a great number of signs, that describes the list of key structural elements of typical standard of types of technical objects;

$D_{type}.$ it is a great number of signs, that describes physical principle of action of typical representative of types of technical objects;

$Y_{type}.$ it is a great number of signs, that describes parameters and indexes of typical standard of types of technical objects.

For realization of the worked-out technology it follows to work out an algorithm. Algorithm of determination of typical standard of group of equipment:

1) to define the typical technical function of group of equipment (technical function of most standards of group of equipment);

2) to define typical key structural elements for the group of equipment (key structural elements of most standards of group of equipment);

3) to define typical principle of action of group of equipment (principle of action of most standards of group of equipment);

4) to define typical indexes and parameters that characterize work of group of equipment (indexes and parameters of most standards of group of equipment);

5) to choose an equipment that answers certain typical descriptions. Id est, technical function, key structural elements, principle of action, indexes and parameters as equipments answer typical for a group;

6) from the chosen list of typical standards to choose one and admit typical for this group of equipment.

The analysis of scientific and technical literature allowed to us to define the list of technical objects and technologies that are the article of research of future specialists in industry of chemical productions. As maybe to mark, this list consists of 105 types of equipment. Such amount of equipment does impossible realization of process of studies to research each of them. Thus, a problem appears in relation to generalization the brought amount over of equipment and forming of small, but sufficient list of technical objects, that will provide the achievement of aims of studies to bases of scientific researches and will allow quality transference of the got research abilities on other technical objects of chemical technologies. The method of decision of this problem is set studies by means of typical technical object - typical representative of group of equipment.

Will give an example determination of typical representative for the group of equipment for the sake of moving of hard materials. On the first stage will define the list of methods of implementation of process of moving of hard materials (horizontal moving, vertical moving, mixed moving). On the second stage will define the list of equipment that will realize the horizontal (band lamellar, to the scraper, screw and oscillation conveyers), vertical (elevators) and mixed moving (transporter with scrabs, pneumatic transport, hydrotransport). For every type of equipment, process of moving of hard materials, in accordance with a model (2) will define: function, key structural elements, physical principle of action, parameters and indexes of work. On the next stage, carrying out will pair comparison of descriptions of every type of equipment, will set such that performs the function what characteristic for all standards of group of equipment, has key structural elements present in most standards of group of equipment, physical principle of action of typical representative coincides with principle of action of most standards of group of equipment; his work is characterized by basic for the group of equipment parameters and indexes. For the indicated group of equipment as typical by us a scraper conveyer is select. In further, such sequence of executions executable for every group of equipment and will define a typical representative for each of them. The results of determination of typical representative for mechanical processes are driven to the table 1.

№ v.p.	Type of physico-chemical process and equipment	Group of physico-chemical process and equipment	Method of physical-chemical process realization	Typical sample
1.	Mechanical processes	Movement of hard materials	Horizontal movement	Scraper conveyor
			Vertical movement	
			Mixed movement	
		Crushing of solid materials	Large crushing	Cheek crusher
			Medium crushing	
			Fine crushing	
			Fine crushing	
			Fine crushing	
		Material classification	Rattling	Vibrating feeder-clatter
			Hydraulic classification	
			Air separation	
		Dosing and mixing of materials	Loading solid lumps	Weight tape dispenser
			Download and submit materials	

Table 1. Typical standards of equipment of kinds and groups of mechanical processes

The results of determination of typical representative for hydromechanic and thermal processes are shown to the table 2.

№ v.p.	Type of physico-chemical process and equipment	Group of physico-chemical process and equipment	Method of physical-chemical process realization	Typical sample
2.	Hydromechanical processes	Moving liquids and gases	Moving liquids	Centrifugal pump
			Compression of gases	
		Purification of gases	Sedimentation by gravity	Cyclon
			Deposition under the action of inertial forces	
			Filtering	
			Wet cleaning	
			Deposition by electrostatic forces	
		Distribution of liquid inhomogeneous systems	Defending	Centrifuge
			Filtering	
			Centrifugation	
		Mixing	Mechanical mixing	Paddle mixer
3.	Thermal processes	Heating and cooling	Heating	Shell and tube heat exchanger
			Cooling	
		Evaporation	Evaporation with free circulation	Film evaporator
			Evaporation with natural circulation	
			Evaporation with forced circulation	
		Crystallization	Water-cooled crystallization	Cylindrical mold
			Air-cooled crystallization	
			Vacuum crystallization	
		Artificial cooling	Moderate cooling	Compression chiller

Table 2. Typical standards of equipment of kinds and groups of hydromechanical and thermal processes

The presented technology allows to generalize information on 105 technical objects of industry of chemical productions and present them 18 typical representatives. The concrete standard (typical) of equipment is determined through before obtained information on the methods of implementation of this physical and chemical process and list of equipment that is included in the indicated group, functions of all concrete technical objects, list of key structural elements of all concrete technical objects, physical principle of action of all concrete technical objects, parameters and indexes all specific technical.

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