

## Object-Oriented Systems as a Developing Factor for Information-Logical Competence of Future Specialists

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**Abstract:** The work describes fundamentals of planning of training on the information technologies facilities in the course of future teacher's professional education in a higher educational institution. Development of science and new technologies, computerization of all industrial, scientific and educational sectors require introduction and creation of new information technologies facilities on the one hand and on the other hand since the specialists experience difficulties connected with application of such technologies a new approach to training of future specialists became a necessity.

**Key words:** Computer model • Information model • Problem-oriented system • Information-logical competence

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### INTRODUCTION

The existing inconsistency between the state-of-the-art information technologies and the level of application of the same for specialist disciplines training caused occurrence of the problem lying in searching out more efficient educational technologies under the current conditions. One of the ways to solve the problem consists in elaboration of a method of training in the object-oriented systems based on the information-logical modeling. An information model is an exact description of a subject matter by means of natural or specific languages, which is supported by sensual or theoretical thinking. A computer model is considered to be a result of consolidation of expertise knowledge of subjects and phenomena presented by the information model [1].

Extensive use of the object-oriented training systems in the educational process is one of the important factors of improvement of professional personnel training system in the higher educational institutions [2]. Notwithstanding the serious investigations held in this field the further elaboration of its theory and methodology is still of rather critical value. At the present time there can be noticed an advancement in creation of educational technologies coincident with the tasks, content and

methods of intensive teaching, as a result the higher educational institutions elaborated great variety of perspective educational technologies allowing to solve efficiently a lot of didactical problems existing nowadays in the higher school and related to training of highly knowledgeable specialists [3].

Usually the software environment operated by a computer user is determined by a complex of constituent software components. As is well known, software includes many certified approved and quite extensively used software components. As a rule each computer is staffed with the software necessary for creation of a professional interface by a user.

### MATERIALS AND METHODS

The software comprises general-purpose components such as operating systems, application programs that enhance the level and improve the quality of the interface. Nevertheless, the problem-oriented systems are the principal constituent components of the software [4]. Each of such systems is designed for handling the tasks belonging to this or that problem domain [5]. Number of problem domains is rather high that's why it is common practice to refer such systems to one of the

most frequently used groups, each of the groups is characterized by a range of specific features and peculiarities.

In general a problem-oriented system is represented by a set of programs meant for solving the tasks of a certain application-oriented type and having a common interface. Adaptation of a particular type of the problem-oriented systems to a certain application domain results in an application-oriented software system having its own users, definite intended purpose and use [6].

**Main Part:** Notwithstanding significant differences between the problem-oriented systems it is possible to define a range of works most frequently implemented by means of such systems as well as the basic functions most characteristic for them. Here follows description of the basic functions: analysis of the communication language phrases; programs generation and synthesis; information structuring, arrangement, storage and search; creation of configuration, versioning, linkage editing; planning and designing of computations; control of execution; optimization of computations; provision of a suitable interface; editing, macroprocessing; expertise; changes logging; group work support; information and reference service [7].

On the basis of the above it is possible to distinguish several most popular types of the problem-oriented systems fitting the mentioned basic functions, namely: program development systems; data base systems; information systems; application program packages; text processors; computer graphic systems; tutorial systems; artificial intelligence systems.

However the results of research showed that introduction of the up-to-date teaching techniques into the educational process in the higher educational institutions was restrained greatly due to insufficiently elaborated didactic fundamentals of such techniques and unavailability of theoretically substantiated practical guidelines for their application in education. Psychological aspects of their introduction are as well insufficiently investigated. At present the pace of teaching techniques improvement anticipates the processes of their apprehension and study from the psychological and pedagogical points of view. To the definite extent, the problem can not be successfully solved because the accumulated experience of their application in the higher educational institutions was not subjected to scientific summarization and theoretical comprehension. This phenomenon is still being treated by way of different approaches, which do not provide

absolute clarity as to its essence and specificity. This means that the possibilities to improve the educational process efficiency inherent to the object-oriented systems application in the teaching practice are by no means used to the full extent.

It is necessary to mention that different people do not have the same degree of awareness of the need to supplement their knowledge. The students are often focused on the pragmatic motives attributed to addressing of specific, contextual problems [8]. Taking into account the above it is of prime importance that special arrangements aimed at encouraging of educational activities, maintaining of a positive motivation to learning, creation of advantageous work routine be provided for in case of use of the object-oriented systems. It is necessary to involve the students in an independent learning activity by simulating field conditions, repeatedly extending possibilities for analysis and synthesis of phenomena and processes. It could be accomplished with computer simulators, databases, electronic textbooks, problem solvers, graphics and text editors etc in the context of the object-oriented systems.

The investigations carried out in some higher educational institutions show that it is computer facilities, which create necessary opportunities for intrinsic motivation to an individual activity during educational process based on information technologies. In this case the students start enjoying the educational process itself irrespective of the outer motivating factors. The possibility to delegate some functions of a teacher to a computer when the educational process is based on the object-oriented systems also is helpful for this aspect. An electronic textbook can also play a role of a coaching teacher, it is able to indicate an error and give a tip of a correct answer; repeat a task again and again; communicate with a user in a "user-friendly" way and provide the same with significant assistance at some definite moment of time.

The results of analysis confirm that the major part of students are well aware of necessity of computers in their future professional activity as early as during the first years of study in a higher educational institution. The educational process in its core becomes more and more similar to the productive labor. This effect gains its special strength when the training tasks solved within the object-oriented systems are connected with the practical activity of a future specialist or are of concern to his/her current educational work. In this case the most efficient method of motivation shall be that in which a teacher would refer to formation of the students' idea of

the role of the subject in their future activities for successful professional tasks solution. In this regard, attention is primarily drawn to proper formation of the students' positive value orientations relative to education, a subject being studied and an educational work as a whole rather than to special selection of instruction material [9].

The object-oriented systems provide the students with clear and adequate information on education progress, maintain their competence and self-confidence thus encouraging inner motivation. Cognitive process is under control of the students, they feel responsible for their own behavior, explain their success by the reasons other than external factors (easy task, luck), but by their own diligence and zeal. Many educational programs implement the principle of motivating the students to search when in case of a wrong solution a computer provides guidance instructions thereby directing the actions of the students. Eventually the efficient educational system ensures the error correction and allows to bring the task solution to a conclusion. Such approach allows eliminating one of the most frequent reasons of negative attitudes towards education, namely failure to complete a training task.

In order to maintain the incentive to learn while using the object-oriented systems it is necessary to provide a gradation of the educational material with due account of the zone of proximal development for the groups of students with different basic training, different skills of performing mental tasks and different level of intellectual development, i.e. a data bank with the tasks of varying difficulty, which provides for more than one method and form of presentation of the same educational material depending on the level of basic knowledge, goals and development of the students is a prerequisite [10].

It should be noted that motivation of the students to use the object-oriented systems during the educational process over the entire period of their study in high school increases from course to course. This statement is evidenced by the results of questioning of the students of South Kazakhstan State University carried out within the framework of the integrated test of the Natural and Pedagogical Sciences Faculty. On the request to select among the twenty proposed variants what problems currently have the greatest impact on their professional development the respondents singled out the problem of training programs creation and their use in the teaching process as one of the most important.

A possibility to manage the cognitive activity process has specific importance for creation of positive motivation to use the object-oriented systems.

Subject to appropriate quality software the object-oriented systems assist in providing real freedom to the students in regard of choice of the training tasks and supplementary information depending on their individual abilities and inclinations. Such tendency towards differentiation and individualization of education enables many more students to gain confidence in academic work, to harmonize the requirements and complexity of the tasks with the level of their facilities and capabilities.

The application of object-oriented courseware is one of the factors of development and individuation of a person's activity strategy, his motivational, personal regulation. Learning activity with their use becomes successful if there exist research efforts, generated by motivational sphere where there is an objective which is achieved through formulating a course of action. Incentives for using object-oriented courseware in higher educational institutions at the present stage of informational and logical expertise development which is characteristic of a future specialist are higher performance, organized nature of work, its intensity, degree of mastery, independence, objective evaluation, disciplined approach, thematic novelty, as well as unusual character of lessons and others.

Using object-oriented systems in educational process in higher education institutions may become fundamental in establishing a principally new mode of education, based on detailed auto-evaluation and motivated self-educating activity of an individual, supported by modern technical aids.

Upgrading informational and logical expertise of teachers under the conditions of informatization in education is essentially based on the principles of modular training. The use of modular approach while elaborating the content of the training course allows differentiating the syllabus due to grouping of modules which ensure that the course is developed in a full, shortened and advanced variant depending on teachers' needs. Criteria and indices describing informational culture level of a teacher are defined in accordance with modern interpretations and address requirements set for informational and logical expertise of a modern educator, that is comprehensive image of informational space in the modern education system, information literacy: mastery

of the techniques necessary to prepare and present the results of academic, experimental and research activity; mastery of application software; ability to master new software (educational) programs and organising educational process with the help of new information technologies: being aware of the facilities offered by new information technologies; ability to use communication services in the education process; ability to adapt and use teaching software taking into account special aspects of the educational process.

At present from the point of view of complying with the above conditions the most promising tools of information technologies are object-oriented courseware. Let us review their modular structure, define their content and instructional functions used while forming informational and logical expertise of a future specialist.

The structure of object-oriented courseware comprises a group of modules which ensure didactic support of the educational process and a module for monitoring and correction of a courseware user's functional state. Let us briefly review the first group of modules, which should consist of the following elements: student module, learning module, training module, educational problem solving module, user's errors module.

The student module is a set of competences, which are responsible for choosing the indices characterizing the initial knowledge level with reference to a specific topic (course, subject); collecting data about the initial knowledge level and assigning a user to a certain category; specifying educational objectives for him; selecting teaching operations according to the adjusted educational objectives and monitoring their achievement.

The learning module includes the following elements: description of the learning levels for the modes of actions stipulated by educational objectives; selecting basic content of the educational subject necessary to achieve an educational objective; selecting the content of additional material which has to be learned to be able to master the basic content of a subject being studied; defining the sequence of operations which ensure mastery of the material and lead to meeting an educational objective; determining indices, allowing to evaluate the level of mastering the educational material and achievement of the educational objective; selecting diagnostic tools to define the indices of achieving an objective; final and in-process monitoring.

The training module contains the following: selecting teaching operations for each step aimed at mastering mode of actions (presentation of theoretic material or a

educational problem); access to a model of solving an educational problem to get a standard solution; determining possible deviations from the standard solution and forecasting the reasons for such deviations; selecting diagnostic tools aiming at exploring the reasons for a student's struggling with the solution of educational problems; selecting secondary operations (subproblems, questions, instructions) to eliminate the reasons of difficulties; performing educational operations and using diagnostic tools; analysing data on training and making changes in the education model.

The educational problem solving module comprises an algorithm which allows solving a problem assigned by using the methods that should be familiar to a student by this moment. In a most general case this algorithm which represents essential mode of actions should comprise the following operators: recognizing a problem situation (analysis of the statement of problem and searching for similar worked problems); elaborating a plan of problem-solving activities and creating a solution algorithm; selection of an off-the-shelf software and solving a problem with its help; verifying if the problem was solved correctly.

The student's error module contains a catalog of his possible errors, rules for hypothesizing and justifying with reference to a student's misconceptions which resulted in the said mistake. This activity is based on the difference between the solutions offered by a student and problem solving procedure in a given subject field.

The described set of modules allows analysing and monitoring a student's progress towards achievement of specific educational objectives at various stages of education.

One of the main stages of the object-oriented design is the stage of selection or customized development of object-oriented courseware or other educational media in compliance with the teaching task to be solved. A wide range of existing courseware does not permit to go into all the specific aspects of this process at large. Though it is necessary to specify general requirements set for object-oriented courseware as instructional system using such means. Using these requirements as a reference enables a teacher to take his bearings and in line with targeted educational objectives select the most suitable variant of development which allows boosting academic activity.

The psychologic and teaching aspects of development and application of object-oriented courseware in higher educational institutions described in the present publication shall help teachers to solve the

tasks of intensifying the academic activity in an efficient way given the present development stage of information technologies applied in education, while implementation of practical recommendations and suggestions will contribute to more effective use of object-oriented courseware in their professional activity [11].

Professional development as a process of students' mastering a branch of study and advancing towards its acme ensures that their personal fulfillment strategy is accomplished in their learning activity. The fact that the students are able to envision the strategy of reaching the acme of professional skills and follow the logic of the route towards that suggests that they should go through a number of stages. Each stage marks their achieving new levels of professional competence, such as formative period (ability to perform job responsibilities independently); ensuring stability at work (secure, timely and high-quality performance); ascent to mastership (creative, efficient work, involving implementation of individual activity strategies) and other.

### CONCLUSION

The task of building up the creative potential of students in higher educational institutions is expressed in the most comprehensive manner in the form of implementing ITO (learning media), dealing with their efficient professional development. At the same time the strategy consists in ensuring various interactions with the environmental factors, intended to ensure both their personal growth and development of new substantial psychological formations, representing different aspects of the conceptual model of a professional. This being said, two key aspects are to be held in mind.

First of all, the students have to understand and come to accept the viewpoint of productive interaction with environment created within ITO, in the first place, by using the conditions, effects and facilities provided by the information environment itself for the purposes of their self-actualization and personal fulfillment. The students can formulate and accept this viewpoint as a result of creative self-regulation as opposed to hazard where they establish a degree in which personal prerequisites to a specific professional activity conform (or do not conform) with in-depth understanding and evaluation of its nature.

In the second place, the students themselves should develop personally serviceable models of a professional and select individually adequate methods and strategies to achieve the objective. The education subjects'

movement in personal, objective and operational contents is directly related to their involvement in the processes of professional and personal identity.

In the same way as hard-copy publications and technical means of mass communication lead to enormous broadening of opportunities for human cognition, recording and transfer of best practices, the computer hardware used within the framework of ITO allows increasing the potential of human reasoning, bring about certain changes in the structure of man's thought.

**Summary:** The undertaken study showed that it is possible to make the use of object-oriented courseware in higher educational institutions more efficient by applying the achievements of modern education to a greater extent, by tailoring academic activities, by intensification of students' cognitive activity, by improving syllabus, by taking into account individual psychophysiologic characteristics and psychologic status of students in a comprehensive way. Object-oriented design based on these assumptions is fundamental to creating educational systems at a totally new level, characterized by their specific objectives, theoretical substantiation, methods of organisation, functioning and evaluation, capable of complying with present-day requirements of social mandate for the training of modern specialists.

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