Integration processes in education and their impact on learning situations

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Abstract. The article deals with the integration processes taking place in education at the present stage; examines the directions of integrative processes, such as the construction of pedagogical phenomena models, their local structures, mechanisms of activity of participants in the pedagogical process and their interaction, structures of components of the education content, functional systems, procedural mechanisms. The essence of the content and formation of the pedagogical component of the worldview as a unity of heterogeneous components, phenomena, is studied. Various components are analyzed from the standpoint of the possibility of occurrence of reasons for their change, expansion, unification, and subsequent inclusion in integrated blocks. This article defines three types of situations that differ in their place in the learning process – starting, current and final, and considers the prerequisites for their emergence and integration. Examples of learning situations in imitation of professional conditions and actions of a navigator, their influence on the formation of their professional qualities are given.

1 Introduction

Global and private processes taking place in the world, including in the field of education, are subject to various changes, among which integration phenomena occupy a significant place. Their presence is a necessary condition for the development of society, and at the same time is one of the components of its existence. Integration is understood as the movement of the pedagogical system towards its greater structural integrity.

Integration avoids discreteness in the acquisition of knowledge and skills and provides an opportunity to develop conditions that contribute to the formation of systemic, holistic scientific knowledge and practical skills, information obtained in various disciplines, contributing to synthesis.

Scientific, technical, and social integration processes affect the activities of specialists, and, consequently, the specialization of their training in universities. For example, in the system of higher technical education, integration manifests itself in the form of expanding the training of engineers of a wide specialization profile.

The reform of higher education is connected with the cardinal expansion of the concept of the fundamental nature of education as a process that gives a holistic vision of nature, man, and society in the context of an interdisciplinary dialogue.

The content of education includes new achievements of science and technology. The formation of the integrity of the knowledge system of specialists is being established, interdisciplinary connections are expanding, new comprehensive training courses are being introduced, the scientific level of generalization of educational material is increasing, integral theories are being introduced into programs, scientific and educational knowledge is being fundamentalized and integrated [1].

The current state of science makes it possible to deepen the analysis of the situation. The simultaneous presentation of information from different subject areas in educational activities creates the conditions for combining them into a single new formation, which is integration.

It is noted that in the process of integrating science and education, it is necessary to “prepare monographs, textbooks, and teaching aids that reveal the content of the latest achievements of science that have a general educational or important applied value … practical interaction of scientists and educators in the implementation of the pedagogical process” [2].

When considering integration phenomena, it is necessary to substantiate: the ratio of normative and creative components; changes in the composition, content, and connections of structural components; the resulting energy potential of the system; the established mutual hierarchical dependence of the components of the structure under consideration and the entire structure formed in the system of a higher rank; the creation of non-equilibrium states of interaction of system elements that generate the driving forces of integration mechanisms.

The following signs of integrative phenomena in the educational process are distinguished:

- the presence of interaction of heterogeneous previously separated elements, which provides for the emergence of qualitatively new states;
the manifestation of a constant change in individual elements and their inclusion in an increasing number of connections, which leads to transformations in the structure, creation of new functions and the emergence of a new integrity;

the presence of a logical and content basis that defines a single foundation for combining heterogeneous elements of knowledge and criteria for the unity of various sets;

the formation of a new structure with relatively separate and subordinate stages that generate qualitative and quantitative shifts in content.

Integration phenomena occur when creating textbooks, educational programs, state education standards, determining the place and role of pedagogical sciences in the system of Human Sciences. They are present in the formation of life experience, aspects of the human personality, professional knowledge, skills and other qualities, in solving educational and cognitive tasks, in the interrelationships of educational and extracurricular activities of students and teachers, in the very dialogical forms of activity in the educational process.

An analysis of the literature on integration processes in education has shown that integration is widely manifested in pedagogical theory and practice. But the study of integration in pedagogical phenomena began relatively recently.

Integration processes in pedagogy include the construction of integral graphs, cognitive, morphological, and procedural structures.

Such directions of integrative processes as the construction of models of pedagogical phenomena, their local structures, mechanisms of activity of participants in the pedagogical process and their interaction, structures of components of the content of education, functional systems, procedural mechanisms are investigated. The essence of the content and formation of the pedagogical component of the worldview as a unity of heterogeneous components, phenomena, is studied.

Pedagogical integration includes the establishment and formation of intrasubject and intersubject connections, the establishment of interactions of social, psychological, and pedagogical objects, actions. The connections of pedagogical actions with the content of all sciences, with phenomena in production, in public practice, educational subjects with the content of professions, the selected content of education with the level of current education of students are established [3].

The technological components of pedagogical integration include: principles of structuring the content of academic subjects, courses, procedural actions, methods and techniques of teaching, education, vocational training, methods of building structural and logical connections, establishing interdisciplinary connections, etc.; methods of integrating diverse phenomena; criteria and mechanisms for evaluating integral structures – systemic, substantive, procedural, organizational, actions of students, actions of teachers, etc.

Attention is paid to the construction of mechanisms of mutual correspondence of rational, moral, and emotional in the activities and behavior of participants in the educational process.

2 Materials and Methods

The integration of learning situations occurring in the education process is due to the need to increase its effectiveness, which should consist in improving the quality of knowledge of students, expanding, and deepening them, and improving the ability to use them. At the same time, we should not forget about the need to eliminate the overload of students, leading to overwork, illness, and a decrease in the effectiveness of training. We see a way out of this contradictory situation in generalization at a higher (relative to the existing) level of content and learning tools. And this is integration, in which a multitude of phenomena, objects, subjects are combined into one that has the property of integrity. In this case, new general patterns come to the fore, and previously known ones turn into special cases and other components of new formations, which are easier to acquire within the framework of a new theory and modified actions.

Integration in the learning process occurs both spontaneously and purposefully. The general reason and purpose of integration processes in the learning situation is to form the readiness of students for work orientation in those situations in which they are included or will be included in their non-educational life, for example, in future professional activities.

The transition of participants in the learning process from a simple learning situation to an integrated one is controversial. On the one hand, a simple learning situation is easier to resolve, on the other hand, “passing” the learning material through simple situations leads to an excessive increase in their number, leading to an overload of students. The enlargement of situations, on the one hand, provides a reduction in the number of cognitive tasks to be solved, on the other hand, an increased volume and complexity of the task to be solved is manifested, which also causes overload. However, in the second case, it is possible to facilitate learning by presenting educational information in a different logic. To do this, the content of the educational material is integrated into blocks presented at a higher abstract, scientific level, but in a presentation understandable to the learners. In this case, a reduction in the overload of students is achieved. The relief is provided by the establishment of a new logic in the theoretical justification of the studied phenomena. To reveal its regularities, it is necessary to study the possibilities of using the dynamic properties of the components of the learning situation to integrate the content and procedural phenomena of learning.

We have identified three types of situations that differ in their place in the learning process – starting, current and final.

The starting situation is formed before the start of the training session – actions consisting in the cognitive
transformation of the subject of study. The current situation exists in the process of performing this transformation – educational cognitive actions and the leading actions of teaching aimed at them, that is, during a training session. The current situation is constantly changing. The final situation is the set of states of education of the students, their motives, needs, and ideas of the teacher about them and the next tasks of learning that have developed by the end of the lesson. This is not only the achieved learning result, but also the basis of the future starting situation, which will finally take shape by the beginning of transformative learning actions at the next training session.

Let us consider the prerequisites for the emergence and integration of starting learning situations.

First, in nature or in production activity, a phenomenon of reality arises that attracts the attention of people. This generates the following natural chain of purposeful transformations.

Description of the phenomenon of reality. This is the comprehension and description of it by specialists. The phenomenon itself is a holistic education, which, as a rule, has a complex structure, the components of which are studied by different specialists, different sciences. The presence of many descriptions of this phenomenon is explained by this fact. These sources of information are designed for specialists, they are not intended for the learning process. Their descriptions concretize the conditions that generate the need to study the phenomenon as a component of the learning situation.

The descriptions of the components of the phenomenon compiled by specialists undergo pedagogical processing, are described in the content of education – textbooks, teaching aids, etc. A set of textbooks, teaching aids and other related materials is a necessary condition for organizing the learning process. It accumulates materials for teaching in different subject areas, each of them is intended for a separate study.

3 Results and Discussion

To consider the integration of situations in the educational process, experimental classes were conducted with students of the specialty “Navigator” at the State Maritime University.

Under normal conditions of training navigators, three departments separately train them to perform actions for driving ships in international territorial waters: “Navigation”, “Ship Handling”, and “Foreign Languages”.

In the classes of the “Navigation” department, the following are studied: route selection and planning; determining the location of the vessel in various ways (using radar, satellite communications and visual observation); selection of landmarks when determining the location of the vessel [4].

When studying theory, cadets take notes on lectures, study relevant normative, international, and methodological literature, manuals, documents.

When studying actions, the skills to interpret the image are formed: determining the parameter (drawings of the earth and plane, dynamic drawings); definitions of concepts: buoy, lighthouse, coastal landmark; characteristics of the lighthouse, sound interpretation of the lighthouse; geometric correspondence (lighthouse, buoy, distance, bearing) [5].

In practical exercises on a real solution to an emerging situation, the following actions were performed: selection of maps, manuals, study of the navigation area using manuals and maps, laying a route on the map; the implementation of the map relief: the selection of graphically distinctive landmarks – lighthouses, capes, islands; allocation of dangers (shoals, underwater reefs, sunken ships); the allocation of prohibited or temporarily prohibited navigation areas (areas of shooting ranges, training exercises by submarines, etc.); mark on the map the bearing and distance of distinctive landmarks.

In the classes of the department “Ship Handling” were studied: anchoring (methods for calculating the length of the anchor chain, considering the current, wind when anchoring); the IRPCS course (International Rules for Preventing Collisions at Sea) – material for reading and memorizing [6]; the use of radar for collision avoidance (radar plotting); relative movement line (RML) and true motion line (TML).

When studying theory, cadets also take notes on lectures, study the relevant normative, international, and methodological literature, manuals, documents.

When studying actions, the following skills are formed: calculation of the anchor chain (using formulas); interpretation of lights, sound signals: giving an appropriate signal, light, sound in a certain maneuvering situation – when turning right (left), when overtaking, when losing control; interpretation of the rules of navigation in confined waters. Turning on and off the instruments, setting and measuring navigation parameters, reading the image on the radar screen. Setting parameters (control, leading, protecting).

The following features of radiotelephone communication at sea were studied in the classes of the department “Foreign Languages”: establishing communication; using message markers; ways to provide information about the location of the vessel; calls to shore stations, other vessels in case of an extraordinary situation [7]. When studying theory, cadets take notes on lecture and practical material, work with tables, methodological literature, and documentation. When studying actions, forming skills, the following are performed: listening and reproducing authentic radiotelephone exchange, using modal verbs when confirming information and orders from coastal stations, pair work on the implementation of situational tasks.

The following actions were performed during practical classes on the actual resolution of the emerging situation: connection to the shore station, request permission to enter the port; provision of information about the vessel (last port of call, next port of destination, type of cargo transported, number of people on board, vessel measurements, etc.); clarification of the anchorage; calling the pilot stations, request for a pilot (specifying the place and time of reception, reporting the
height of the freeboard and the characteristics of the ladder used), etc.

When performing the listed actions in the classes of each department, productive learning situations were created that ensured the emergence and development of integration phenomena, the solution of the proposed educational tasks.

However, the material was absorbed slowly, with difficulty. There was a need for a significant increase in the effectiveness of classes.

### Table 1. Examples of training situations when simulating professional conditions and actions of a navigator.

<table>
<thead>
<tr>
<th>№ item</th>
<th>“Messages of coastal services”, developed jointly by teachers</th>
<th>Training courses in which actions are performed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The content of the messages (pronounced by the English teacher)</td>
<td>Navigation</td>
</tr>
<tr>
<td>1</td>
<td>Vsem sudam v Duvsokom prolive! Eto port-kontrol' Duvra. Navigation warning: in psn Latitude 50 45 N longitude 001 23 E/ There is a vessel not under command. Advice: keep clear of this vessel.</td>
<td>The chief mate clarifies the position of his vessel; determines the place of the vessel that has lost control; takes a maneuver to diverge from this vessel; gives appropriate commands to the helmsman.</td>
</tr>
<tr>
<td>2</td>
<td>Sudno “Khelena”, govorit beregovaya stantsiya porta Singapur. Information: there is a shallow water on your starboard side. Advice: alter your course to port.</td>
<td>The chief mate checks the safety of the proposed action (as quickly as possible), and then gives commands to change the course to the helmsman. The helmsman clearly and loudly repeats and reports on the execution of each command, changes course to the right.</td>
</tr>
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For the purpose of this, further integration of educational situations is undertaken along the path of approaching the studied subjects to real production (professional) reality, in which the actions described above, studied in different departments, are performed together, simultaneously, in organic unity. We have undertaken integrated training sessions of three departments in a specially equipped classroom. This was done to create holistic, understandable ideas about reality and the formation of skills to function freely in it.

The integration of the learning situation began with the formation of its initial state. The navigator operates in difficult conditions that require thorough multidisciplinary knowledge and skills. At the training sessions, conditions were created that were adequate to the professional working environment, which was simulated with the help of special teaching aids [8].

Workplaces for navigators and coastal services were equipped in the classroom. The Navi Trainer Professional 5000 radar navigation simulator was used, equipped with ECDIS Navi-Sailor 4000, which structurally represents fifteen identical “navigation bridges” for training and a central computer with an instructor console [9].

At one training session, tasks of different profiles were solved, which under normal conditions are solved...
separately by teachers of different departments. Table 1 shows examples of learning situations when solving tasks that arose during experimental training sessions when simulating professional conditions and actions of a navigator. The participation of three departments in creating situations and managing the learning actions is reflected. In addition to the descriptions of the actions taking place, the table includes the translation of messages from coastal services. The table reflects messages and actions, the totality of which is an integration unity, a holistic phenomenon of reality from among those for which students are preparing to participate. The table reflects the versatility of the events included in this unity.

The experiment investigated the influence of actions of students in such a complex, integrated situation on the formation of their professional qualities.

4 Conclusion

Based on the results of the experiment, a technology was developed and used in the study for teachers of three different academic disciplines to conduct an integrated training session, including the theory being studied, imitation of a practical professional situation, the use of a radar simulator as a technical training tool, and the establishment of pedagogical feedback adequate to the formation of specific integrative professional skills. Summing up, it should be noted that during the experiment, holistic, understandable ideas about reality, as close as possible to the real one, were created, as well as conditions for the formation of skills and abilities to function freely in it. Increased interest in the learning process, enhanced motivation to master the educational material, had a significant impact on the effectiveness and success of solving professionally oriented tasks.

References