

УДК 37.013.74:656.7.022

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## INTERSUBJECT CONNECTIONS IN PROFESSIONAL TRAINING OF AIR TRAFFIC CONTROLLERS

*This article deals with the problem of air traffic controllers' professional training improving, the basis of which is the full use of the feedback results in training taking into account the intersubject connections of professionally oriented disciplines. The analysis of the theoretical foundations of integrated processes to training has been performed. The main principles of intersubject connections concerning their usage in correctional work of air traffic controllers' professional training have been substantiated.*

**Key words:** *air traffic controller, feedback, intersubject connections, correctional work, intersubject integration, professionally oriented disciplines.*

**Formulation of the problem.** The analysis of the aviation incidents occurrence statistics showed that the mistakes in the interaction between aircraft crews and air traffic control (ATC) make up 17,6% of the overall characteristics of aviation incidents and accidents classification due to causal factors. An important factor in this is the insufficient level of professional reliability of knowledge, skills and abilities of air traffic services (ATS), which leads to a decrease in the safety of flights, especially in extreme conditions of flight. Therefore, the need to improve the training of future ATC controllers is unquestionable. An analysis of the up-to-date preparation of future air traffic controllers in Ukraine has shown that there is still a tendency for future specialists to be trained, whose professional level is determined by the system of acquired professional knowledge, skills and abilities that provide targeted pedagogical activity under standard conditions, without taking into account the need for intersubject integration.

**Analysis of recent research and publications.** Modern professional education should ensure that students develop a holistic vision of their future professional activities and systems of qualitatively new integrated knowledge. This is especially true for aviation specialists. This requires the foundation of profession education on the basis of integration. Many important scientific works are devoted to this important issue in pedagogical theory and practice.

The concept of integration is considered by scientists in various aspects, V. V. Levchenko made a generalization of integration research directions in pedagogical science:

1. Philosophical and scientific research studies, which are considered: general theoretical problems of integration; the integration of disciplines and scientific knowledge in certain branches of science; integration in the field of human studies and humanities; integration in the field of interaction of socio-humanitarian and natural science; integration in the field of technical sciences, the interconnection of technical and natural sciences, technical and social sciences.

2. Methodological researches, which are considered: tools of providing pedagogical integration; essentially – categorical characteristics of pedagogical integration; integrative concepts in pedagogical science.

3. Applied research regarding the problems of practical integration [5].

So the works of Z. A. Malkova, N. D. Nikandrov, B. S. Gershunsky and others are devoted to the integration processes in education, which influence the development of pedagogical science,

as well as the integration of its functions. Reflections of integration processes in the study that take place in science are given in the works of A. P. Belyaev, I. D. Zverev, V. N. Maximova and others. Attention was paid to the analysis and determination of objective grounds, factors, essentially categorical characteristics of pedagogical integration in the researches of S. Yu. Burilova., V. I. Zgvyazinsky, G. F. Fedorets. Other researchers also investigated other aspects of integration (Y. S. Tunnikov, Y. I. Dick, A. Y. Danylyuk, A. A. Pinsky, V. V. Usanov, N. E. Kuznetsova, M. Pak, etc.).

The researchers investigate the directions of theoretical and practical basis of integration: methodological substantiation of integration problems; definition of the structure of integrated knowledge; research of systemological aspects of integration; problems of integrative processes in education; development of ways to introduce integration into the educational process; integration of control elements in modular training; integration of theoretical and production aspects of learning; probabilistic-statistical aspects of integration; integration in graduate education; interconnections of integration and differentiation; psychological aspects of integration etc. Leading scientists from these areas of education on the integrative basis are: S. U. Goncharenko, Yu. I. Malyovany, O. V. Sergeyev, I. M. Kozlovskaya, T. M. Usatenko, O. I. Julik, Y. B. Yavorsky, I. M. Bogdanova, L. V. Vychorova, T. O. Gorzii, O. T. Prokaza, E. M. Romanenko, L. I. Dzhulay, T. D. Yakimovich etc.

**The purpose of the article** is to study, analyze the main provisions of intersubject connections in education, as well as to substantiate these provisions for using in the professional training of future air traffic controllers.

**Presentation of the main material.** From the point of view of S.U. Goncharenko a productive learning of knowledge by a student, his intellectual development depends on establishing broad ties between different sections of the course being studied and between different disciplines in general, that is, from the intrasubject and intersubject integration [3]. Integrated learning, in which the material is complemented and repeated in other areas, gives a much better result than traditional study of subjects. An integrated approach contributes to the development of system knowledge, develops the ability to transfer them to other branches.

The concept of intersubject integration is understood by scientists in a broader sense than intersubject connections. Intersubject connections represent a reflection of the subject content of those dialectical interactions that objectively act in nature and are recognized by modern sciences. Integration consolidates not only the interconnection but also interpenetration of separate educational subjects in one another. Intersubject connections represent one of the important psychological and pedagogical conditions for increasing the accessibility and scientific knowledge of learning, its connection with the environment, activating cognitive activity and improving the process of knowledge formation, skills and abilities of students. At the same time, integration contributes to the systematic and holistic knowledge of the world. These general provisions relate to the use of integrative connections in the study of any subject. The basis of integration processes in education is the theory of intersubject connections which is gaining more and more attention in modern didactics.

The problem of intersubject connections was considered from various aspects. So A. V. Usova considers intersubject connections to be a didactic condition for raising the scientific level of knowledge, forming a scientific outlook, developing thinking and creative abilities, and optimizing the learning process [8]. I. D. Zverev deduces problem of intersubject connections from the didactic principle of systemicity [4]. Intersubject connections include the mutual coherence of the education content from different subjects, the construction and selection of material defined by the general objectives of education as well as the optimal consideration of cognitive tasks determined by the specifics of each subject. V. N. Maksimova refers intersubject connections to one of the principles of learning [7]. N. A. Loshkaryova, studying the definition of this concept in pedagogical literature, defines its duality – intersubject connections as a didactic form of reflection in the educational process of objective reality ties and intersubject connections as a pedagogical principle [6]. In addition intersubject connections enhance the interaction of all didactic principles in the learning process subordinating them to solving the problem of forming a holistic knowledge

system [6].

The use of intersubject connections in the lessons allows:

- to increase the motivation of students to study the subject;
- to master the material, to improve the quality of knowledge better;
- to intensify cognitive activity of students at the lessons;
- to facilitate students' understanding of phenomena and processes which are studying;
- to analyze, compare facts from different fields of knowledge;
- to carry out a holistic scientific perception of the surrounding world;
- to realize the educational opportunities of each student fully [4; 7].

I. D. Zverev distinguishes three types of intersubject connections based on the structure of educational subjects and the structure of the learning process, the commonality of which is the basis of this classification:

- content-information links, that is, connections on the content of knowledge;
- operational-activity relations, that is, connections on the basis of educational and cognitive activity and skills of students in studying process;
- organizational-methodical connections, that is, connections on the basis of various methods and organizational forms [5].

Scientists believe that the implementation of intersubject integration should go in the following directions: the study of new material taking into account the content of related subjects, the logic-semantic concept of various areas of scientific knowledge, the content of the curriculum; complex-logical correlation of types and forms of educational, diagnostic and correction-assessment activity; continuous study of the subjects motives dynamics of the educational process [2]. In addition intersubject integration is a prerequisite for the learning process. If intersubject integration is a condition for the implementation of the educational process, the form of integration is intersubject connections [2].

In modern didactics there is no unity in the views concerning the semantics of the concepts of «intrasubject» and «intersubject»; in various scientific studies, these identical concepts are found which, in the general sense, imply the need for interpenetration of the contents of educational subjects in order to achieve the tasks of learning. Thus, some researchers, under intersubject integration, consider the interpenetration of various academic disciplines contents and the creation of a single educational potential through the use of innovative pedagogical methods, tools and organizational forms of learning [9]. At the present stage intersubject integration is impossible without the informatization of education without the use of the modern forms and means of study.

In the study of S.Yu. Burilova it was found that one of the reasons for the inconsistency between the content of professional training and the needs of modern production is a violation of the principle of interdisciplinarity in future professionals training [1]. The lack of well-established connections between subjects leads to the fact that students experience difficulties in transferring objectively sufficient knowledge to solve problems of a new subject.

All these provisions are very important for future air traffic controllers' training.

Modern science and production require high demands on the content of higher education and in particular on the content of higher education of future air traffic controllers. An important condition for the reliable maintenance of air traffic service is the prepared air traffic controllers' readiness to solve problems of professional activity in different conditions of activity. But, as research shows, even graduates with a high level of knowledge develop such kind of readiness after several years of practical activity. This means that there are problems in professional training and there is a gap between the content of professional training and the needs of modern production. One of the reasons for this inconsistency is the inadequate development of interdisciplinarity in future professionals' training. But as you know air traffic services are a comprehensive quality education based on the unification of related professionally oriented subjects elements (Radiotelephony, Air Traffic Control, Professional English Language (Aviation), practical training on ATS simulators). Such a process of merging into a single whole of differentiated elements should lead to new qualitative and potential possibilities of this integrity, as well as changes in the properties of the

elements themselves.

From our point of view in future air traffic controllers' training insufficient attention is paid to the intersubject connections of professionally oriented subjects, there is no close relationship between simulator and theoretical training, the work of teachers of professionally oriented subjects is not well coordinated, and feedback results are not taken into account during training. All these require the introduction of an integrated approach to future air traffic controllers' training. It is well known that wrong or ineffective technology of intersubject connections implementation raises the problem of transferring knowledge because knowledge which is formed in this way can not be integrated into previously existing structures, and lead to memory overload [1]. Such an approach hinders the development of thinking and ultimately reduces the level of a future specialist professional training.

An integrated approach in the training of professionally oriented subjects is defined as the real embodiment of the integration principle in the professional activity of the teacher: a set of tasks, content, forms, methods, techniques, means in the study of interrelated material of related professionally oriented subjects for the creation of system knowledge in the field of air traffic service that affect the formation of professionalism of cadets. In this case the integrated unit and the basis of the interaction of professionally oriented subjects should be the process of radio telephony exchange in air traffic service.

The full operation of intersubject connections in air traffic controllers' training involves the consideration of feedback results through not only the analysis of false actions on the ATS simulators but also the correction of the content of pre-flight training taking into account these errors. Within this controlled system replenishment of terminology, facts and concepts will be carried out to prepare future air traffic controllers for ATS.

One of the components of such a system is the electronic learning device (ELD) from the radio telephony exchange, its content is based on the principles of intersubject integration. It was found that the implementation of intersubject integration should go in the direction of studying the new material taking into account the content of adjacent professionally oriented subjects, the logical-semantic concept of various areas of scientific knowledge, the content of the curriculum; complex-logical correlation of types and forms of educational, diagnostic and correction-assessment activity. ELD on radio telephony exchange just combines the above-mentioned directions, that is: training, control, intersubject connections taking into account feedback results of pre-flight and simulator training.

In order to develop correction training strategies the main errors of the radio telephony exchange of operating air traffic controllers and 3, 4, 5 courses cadets of Kirovohrad Flight Academy of National Aviation University were collected, analyzed and classified while having practical training on the simulators. As it was found out the errors have intersubject character indicating the weakness of existing intersubject connections (Radiotelephony, Air Traffic Control, Professional English Language (Aviation), Practical Training in ATS Simulators), inadequate coordination, inadequate use of feedback results etc. Radiocommunication errors are divided into 7 main groups, namely: understanding the situation, correct use of phraseology, ATS procedure; deviation from the rules of phraseology when making up phrases; incorrect and indistinct phrases pronunciation; the use of outdated phraseology, issuing unnecessary information to the pilot; translation errors; small vocabulary in extreme conditions of activity. According to these groups ELD correction exercises have been developed.

**Conclusions.** The introduction of a managed training system taking into account feedback outcomes is important in terms of the fact that the organization of air traffic is an integrative entity by its very nature. The effectiveness of air traffic controllers' professional activity depends on the possession of profound integrative knowledge from a variety of professionally oriented subjects, readiness for professional activity in different conditions. Thus the constant increase in the amount of information and the limited time of the training, the need for correction training, the intersubject nature of system knowledge of air traffic services require further improvement of future air traffic controllers training.

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### **Міжпредметні зв'язки в професійній підготовці авіадиспетчерів.**

У статті розглянута проблема вдосконалення професійної підготовки авіадиспетчерів, основою розв'язання якої є повноцінне використання результатів зворотного зв'язку в підготовці з урахуванням міжпредметних зв'язків професійно-орієнтованих дисциплін. Проведено аналіз теоретичних засад інтеграційних процесів в навчанні. Обґрунтовано основні положення міжпредметних зв'язків щодо їх використання в корекційних заходах професійної підготовки авіадиспетчерів.

**Ключові слова:** авіадиспетчер, зворотний зв'язок, міжпредметні зв'язки, корекційна робота, міжпредметна інтеграція, професійно-орієнтовані дисципліни.

### **Abstract**

This article deals with the problem of air traffic controllers' professional training improving. The analysis of the aviation incidents occurrence statistics of recent years has been made and the mistakes in the interaction between aircraft crews and air traffic control have been revealed, calculated and shown. The main provisions of intersubject connections in education, as well as substantiations of these provisions for using in the professional training of future air traffic controllers, have been analyzed. The basis of this problem is the full and correct use of the feedback results in training. The intersubject connections of professionally oriented disciplines should be taken into account while working with the feedback results. The problem of intersubject connections has been considered from various aspects and the results of recent researches have been performed. The concept of integration, which has been considered by numerous scientists in various aspects, has been performed. Reflections of integration processes in the study that take place in science have been given. The analysis of the theoretical foundations of integrated processes to training has been performed. It has been proved that the concept of intersubject integration is understood by scientists in a wider sense than intersubject connections. The electronic learning device from the radio telephony exchange, which content is based on the principles of intersubject integration, has been introduced and its advantages have been performed and described. It has been found that the implementation of intersubject integration should go in the direction of studying the new material taking into account the content of adjacent professionally oriented subjects, the logical-semantic concept of various areas of scientific knowledge, the content of the curriculum; complex-logical correlation of types and forms of educational, diagnostic and correction-assessment activity. The necessity of the introduction of an integrated approach to future air traffic controllers' training has been proved and shown. Radiocommunication errors, which could occur during communication between pilots and air traffic controllers, have been divided into groups. The main principles of intersubject connections concerning their usage in correctional work of air traffic controllers' professional training have been substantiated.

*Стаття надійшла до редакції: 14.08.2017 р.*