**UKRAINIAN JOURNAL OF EDUCATIONAL RESEARCH**

**Vol. 2, No. 1, 2017**

Sc. D. (Pedagogical Sciences) **IRYNA KOZLOVSKA**
Lviv Polytechnic National University,
12, S. Bandera Str., Lviv, 79013, Ukraine,
E-mail: ink55@i.ua

Ph. D. (Pedagogical Sciences) **LYUBOV DOLNIKOVA**
Lviv Polytechnic National University,
12, S. Bandera Str., Lviv, 79013, Ukraine,
E-mail: dolnikova_lubov@ukr.net

Ph. D. (Pedagogical Sciences) **OLENA FUCHYLA**
Lviv Polytechnic National University,
12, S. Bandera Str., Lviv, 79013, Ukraine,
E-mail: helenfuchila@gmail.com

# DETERMINATION OF INTEGRATION LEVELS IN THE PROCESS OF THE CONTENT OF STUDYING FORMATION: META-SUBJECT APPROACH



*In the article, the modern approaches to developing and determining the levels of integration in pedagogical science concerning higher education are thoroughly analyzed and generalized. As a result, it is confirmed that the thorough study of determining levels of integration was conducted by Chapaev (1998). The attempts to determine the levels of integration were made by such scientists as Akhlybynskyi (1984), Tiunnykov (1988), Paveltsyh (1989), Rozov (1989), Berulava (1998), V. Kraevskyi & Khutorskoi (2003), Pulbere (2004), Kozlovskyi (2014), etc. The classification of integration levels in the frame of educational integrology is presented and proved, the levels being differentiated by various features, namely, by the number of elements, by the extent of interconnection between the elements, by the nature of the integrated elements. General and partial approaches to the creation of the content of meta-subjects at higher educational establishments are analyzed. The definition of meta-subject is given and the prospects of the development of the content and the introduction of the meta-subject in the higher educational establishment are determined.*

***Key words:*** *integration, integration levels, integration criteria, educational integrology, meta-subject.*

**Introduction**

For being competitive and mobile on the labour market a modern student should be able to analyze great amounts of information, argue taking professional decisions, think systematically, creatively solving professional tasks according to the market requirements. A modern employer waits not only for a well-educated specialist but also for a professional having necessary competences and being able to acquire new knowledge based on the previous one gained at the university. For realizing this task, it is necessary and efficient to take an integrative approach to the selection of the training content and, as a result, form the qualitative systematically realized knowledge, which, in turn, will ensure the qualitative training of the graduate of the higher educational establishment.

The development of theoretical and methodological basis of integrative teaching in the higher

educational establishments is widely discussed by scientists. The question of the levels of integration in the process of students' training and including meta-subjects created on the basis of integrative approach into syllabi is debatable and needs the authoring interpretation. Effective introduction of the integrative approach is impossible without precise determining of the levels of integration, which should reflect the degree of its application, development or importance, which is a difficult and versatile process. The opinions of the scientists about the problem of determination and application of the integration levels are very interesting and often controversial, what has conditioned the choice of the research theme.

**The aim of the study**

The aim of the proposed paper is to generalize the developments on determining the levels of integration in pedagogical science, to prove the authors' classification of integration levels in the frame of the educational integrology and approaches to forming the content of meta-subjects taking into account the integration levels.

**Theoretical framework and research methods**

Carrying out the research, the authors have used such theoretical methods as induction and deduction for creating their hypothesis on the basis of the analysis conducted. Then they have applied methodological synthesis for creating the theoretical basis for new levels of subject integration. Practical research methods, such as explanation, evaluation, comparison, correlation and prediction, have been used in the process of creating the authoring system of the levels of integration for forming meta-subjects.

Based on the performed analysis of the literature sources, we can state that the levels of integration should reflect the degree of its extent, development or importance, which is a very complex and versatile process. So, Paveltsyh (1989) states that the term "extent of integration", "extent of integratedness", "level of integratedness" should be differentiated only "in the case, when it is known how this degree or that level can be determined. And even if we have such a scale of evaluation, it cannot be overestimated, since while developing the system, old criteria can happen to be lost and new ones appear in the forefront" (p. 31). Mentioned levels can also be found in the works devoted to the problems of pedagogical integration.

Today, many and various reasons for determining the levels of integration are provided in the pedagogic scientific literature. For example, Akhlybynskyi (1984) singles out three levels of integration. At the first one, the formation of the interrelation between previously relatively independent phenomena and objects is set; at the second one essential interrelations determining and changing the functioning of the phenomena and processes being integrated are established; the third level is characterized by the appearance of new qualitative aspects belonging to some integrity.

In our opinion, such a division is similar to the system approach and does not show important peculiarities of integration.

Tiunnykov (1988) also separates three levels of integration in pedagogic processes and characterizes them as follows. A *low* level is the level of modernization, where changes in the initial content of the subject and training process are episodical; a ***middle*** one is the level of appearing of some equilibrium between the aims and tasks in the system previously formed, namely, forming complexes; a ***high*** level is the synthesis of new holistic formation, where the process of integration is accompanied by the thorough restructuring of the content previously formed and the synthesis of absolutely new didactical content. The advantage of this approach is the attempt to keep to one criterion, which is determined by the author as "increase in cooperation".

However, we consider the treatment of the synthesis as the level of integration to be quite incorrect since the synthesis is a considerably different phenomenon. It runs together with the analysis, but the dialectical pair for integration is differentiation, so, in our opinion, these notions should not be considered to be identical.

Rozov (1989) identifies four main levels of the integration of scientific cognition: *intra-disciplinary, interdisciplinary, supra-disciplinary and trans-disciplinary integration*. The author treats the intra-disciplinary integration in the frame of certain sciences with the use of the methods and results from the other sciences. Interdisciplinary integration is considered to be the integration of the scientific notions, theories and methods used in different fields of science, which leads to creating the complex allied sciences erasing the artificial boundaries between sciences. Supra-disciplinary integration is shown as the integration of the higher level of community-based on the generalization and extrapolation of the ideas and principles to new classes of objects; trans-disciplinary one is seen as the integration of scientific notions, theories and methods in philosophical concepts. We consider this approach to be rather one-sided, since it does not differentiate the kinds and levels of integration, and the unique features of the division are absent.

Pulbere and Hukalenko (2004) differentiate several levels of integration: inter-organizational (teaching and methodological association of higher

educational establishments); regional (teaching, scientific and production complexes); conceptual (the integration of humanitarian and polytechnic concepts); interdisciplinary (interdisciplinary connections); intra-disciplinary (the integration of forms, methods and the means of training).

In our opinion, this approach combines forms, kinds, levels and methodological aspects of integration. At the same time, its advantage is the attempt to reduce the scale, which brings this classification closer to the notion of integration scale, which is also considered by Tiunnykov (1988), but not together with the levels of integration.

According to Berulava (1998), the integration has several levels of realization depending on integration factors: the level of *interconnections between subjects* is characterized by the absence of the integration of the forms of training lessons and intervisual connections are only partly implemented into the educational content through the change of its structure; *the level of didactic synthesis*, whose basis consists of general objects, cooperation of subjects studied in their boundaries; *level of integrity* finishes the formation of the new integrate discipline which has its own subject of studying.

This approach has one and essential drawback: in our opinion, it violates the laws of formal logics and contradicts generally accepted philosophical concepts. First, it is the presence of the organizational component and the direct connection of the phenomenon with the forms and methods of integration, as well as the declaration of the synthesis as the level of integration. Let us also note that integrity is the indicator, but not a level of integration. At the same time, Berulava's (1998) approach has the advantage of determining the *system creating the factor of the integration.*

Krayevskyi and Khutorskoi (2003) also consider three levels of integration: at the first level, the content of education in its normative form is fixed in the form of before-subject minimum, and the content of education is considered in progress, in the process of formation; at the second level the content is developed, which in static can be named as general subject level and which is developed, as a rule, before the formation of the specific subject content, which can be considered as the content model, specified at the next levels.

At the third level, the content of certain educational branches and subjects is developed and general theoretical conception is created. Simultaneously, minimum of educational content is obtained, which, being still general, but already pedagogically interpreted, is the first step to the specification of aims of general education. Moreover, this minimum can be called over-subjective or meta-subjective. Such an approach is quite interesting and perspective, though it generally concerns the structuring of the content of education at general educational organizations.

Among numerous developments concerning the levels of integration, Chapaev (1998) is the only author who suggests the *indices* of the separation of the integration levels. For example, the levels of integration of pedagogical and technical knowledge are separated according to such indices as the *extent of coverage* of some gnoseological space by the discipline (the level of non-pedagogical disciplines, the level of vocational pedagogical disciplines, the level of general pedagogical disciplines etc.); the *extent of including* of the production and technical component into the content of scientific gnoseological system of pedagogy of technical vocational training (analogue, situational and content containing); *the extent of intensity* of the pedagogical component in professional pedagogical texts (demonstrative level, methodological level, separately didactical level etc.); the *extent of integrity* of the inner organization of the pedagogical integration of a given kind.

Based on the carried out analysis of the scientific approaches to determining the levels of integration, we are going to consider in more detail the invariant levels of pedagogical integration, namely, methodological, theoretical and practical ones.

The methodological level is related to the unification of notions and universalization of methods. From the pedagogical point of view, the methodological synthesis is explained as the integration performed "at the level of laws, regularities and concepts of the development of personality" (Yakovlev, 1980, p. 18). However, if the first definition requires additions, the second one needs clarification and generalization. These conditions are met in the characteristic of the methodological level of integration proposed by Yudin (1981), who defines the given level as the interconnection of knowledge "performed at the expense of transferring methods, concepts and ontological notions from one group of sciences to the others" (Yudin, 1981, p. 188). Solving the problems of methodological synthesis, it is not possible to neglect the fact of aggravation of contradictions between the disciplines while they are considered to be system-creating factors of the synthesis of scientific knowledge.

The theoretical level of the pedagogical integration is in the first place the synthesis of the theoretical concepts, theories and systems. The practical synthesis is directly related to the applied needs of the pedagogical practice and is fulfiled at the level of the pedagogical activity itself.

We consider such an approach to determining the levels of integration to be the most complete. Let us note that Chapaev (1998), connecting the notions of the synthesis and integration, nevertheless, does not mix them or replaces one with another.

**Results**

Generalizing the above mentioned and basing on our own developments on this subjectmatter (Kozlovskyi & Kozlovska, 2014; Kozlovska, 1999), we propose the following approach to determining the levels of integration in didactics, in particular, in the didactics of higher education. The determination of the levels of integration corresponds to the operation of dividing the notion in formal logics and requires the precise separation of the criterion for performing the division. In our opinion, such criteria should be the *number of elements* being integrated; the *extent of interconnection* between the integration elements; the *nature of the integration elements*. Proceeding from this choice of criteria, we can single out three variants of determining the levels of integration.

*Determining the levels of integration according to the number of elements being integrated:* the first level is *micro-integration* (at a small number of elements); the second level is *mesa integration* (at the optimal number of elements); the third level is *macro-integration* (at a considerable amount of elements requiring their additional grouping).

During the integration of knowledge into systems or curricula, we first differentiate the level of integration: if there are few elements, *micro-integration* with weak indicators of the integration result takes place. In much the same way, at the level of *macro-integration* (when the number of elements is too large) the newly created integrative system is threatened with disintegration. These extreme cases are sometimes useful, but only for short-term didactic purposes.

A stable integrative system is created only when the number of elements is optimal at the level of *mesa integration*. This number should be big enough for providing new quality as a result of integration and, at the same time, not too big for preventing disintegration processes inside the integrated object. This approach is based on the synergetic ideas, described, in particular, in Khaken's (1985) works, who recognizes such levels of system description as microscopic, mesoscopic and macroscopic (Khaken, 1985, p. 45–47).

*Microscopic description* concerns certain elements. In our opinion, in didactic systems, this level corresponds, firstly, with separate techniques and secondly, with certain aspects of the educational process (the analysis of the forms of a training organization, the use of technical means of training etc.).

At the *mesoscopic level*, the system is considered as the assembly of elements, whose general dimensions far exceed the distances between separate elements, but are small in comparison with the characteristic dimensions of correspondent macrostructures. This level allows introducing the notions, which describe the assembly as a whole but become senseless for the separate elements. From our point of view, at the mesoscopic level, the didactic systems are described by using inter-subjective relations, by forming through general scientific and specific notions etc. Supra-subject structures appear and correlation qualities become significant at this level.

At the macroscopic level, the formation of the correlative systems is described, and the main set of instruments for their creation is integration as the highest form of cooperation, which predicts the appearance of new qualities in the systems and, at the same time, provides the maintenance of the individual characteristics of its elements.

Therefore, at the micro-level, the specific aspects of knowledge and some fragments of training topics are formed, at mesa level it is suitable to integrate modules, the chapters of training topics, small training courses; at the macro level, big complex systems having temporary application in the training process are integrated. Let us notice that this division is natural, not artificial since the number of elements is one of the substantial features at determining the levels of integration.

*Determining the levels of integration according to the extent of interconnection between elements being integrated*: the first level represents *intersubjective relations* (minimum evident interconnections); the second level is the *system integration* (optimal essential interconnections which cause the formation of integrative systems, in particular, integrative courses); the third level is the *meta-integration* (grouping elements into subsystems with strong connections and, thereafter, grouping these subsystems into a meta-system with optimal connections, which proves the notion of *meta-subject*).

Let us note here Khutorskoi's statement about the relatively new didactic notion "meta-subject". If the traditional notion "intersubject relations" is used, the inner logic of the students' progress gets broken, since their perception develops according to unitary fundamental objects, but not to different studying courses. *Stable subject structures* are necessary, which allow system planning and creating the process of studying. Applying the term "integrated course" for disciplines being created is inaccurate since it usually means the interconnected unity of traditional disciplines. We have here the different level of creating the content

of education, namely, the *meta-level*. For solving this problem, the notion of training meta-subject has been introduced, which is considered as the subject built the educational structure, whose content is based on the system of fundamental educational objects. The essence and peculiarity of meta-subjects is determined by the more flexible system of creating their content, which makes it possible to rebuild them based on new meta-subject structures. They can be the part of the structure of an ordinary training course, and can have a status of meta-subject topic or chapter" (Khutorskoi, 2001, p. 207).

In our opinion, the meta-subject can be the didactic realization of the system of integrated knowledge, since it is a much wider and more flexible notion than subject and integrated courses. Variance in the integrative courses, integrative training systems or integrative training problems completely fits in with this level of integration, which often is optimal for educational systems.

At the level of metaintegration, weak relations between big units of knowledge and, at the same time, strong relations inside these units resemble solid body with a high order of the particle location. The fully determined shape and volume of each unit, as in the model of the solid body, allows simultaneous use of the advantages of previous levels: to freely allocate integrated units inside the meta-subjects (as for intersubject relations) and provide the sufficient force of cooperation inside the units for knowledge systematization.

For example, some sciences, as physics or biology, can be treated as meta-subject, metascience consisting from several disciplines: physics consists of mechanics, thermodynamics, optics etc. and biology of botany, zoology, cytology etc. The connections between disciplines (units) are not very strong, but inside them, the system integration of content exists. Such sciences can be called metascientific disciplines. Among them (and, accordingly, among training meta-subjects) two main kinds can be determined, namely, natural and artificial. Natural metascientific disciplines, having appeared according to the main idea of metascience, are physics, chemistry, mathematics or biology. Artificial meta-sciences appear for solving some particular problems at the certain stage of development and the most often are realized as so-called hybrid sciences.

*Determining the levels of integration according to the nature of elements being integrated*: the first level is corpuscular integration (the elements have distinct limits or meanings and interact as particles); the second level is wave integration (the elements do not have distinct limits and interact according to the laws of wave superposition).

Let us note that the principle of system quantization is the fundamental rule in the theory of compression of training information. On its basis such theories as the theory of content generalization, the theory of enlargement of didactic units, the concept of knowledge engineering etc. are developed. Moreover, taking into account this information allows us to determine two fundamental notions of didactics, namely, knowledge and information, which are often mixed, particularly at the level of methodological developments, where the term "to impart knowledge" is used. We consider it to be incorrect because knowledge cannot be imparted, as it is the personal acquisition of a certain person. Therefore, the only thing that can be imparted in this case is information structured in a particular way. Information is supposed to consist of a sort of particles, or imaginary corpuscles, which are stored and added in the human brain. Knowledge, however, is like waves. Its parts can superimpose, permeate one another, they interact and are added by the principle resembling the wave superposition. For educational integrology, it is crucially important that information is somehow limited, and when it reaches some critical threshold, it becomes less effective even being structured. Knowledge has not limits, because it can organize and restructure itself according to the particular purpose. In addition, as it has happened in physics, where the dual concept has won stating that the light is a corpuscle and a wave simultaneously, such a corpuscle and wave approach is suitable for the process of integration. It means that *this or that kind of structure of the integration elements can prevail under certain given conditions.*

Nowadays, meta-subjects are not common enough, since such courses are still being developed and tested.

**Conclusions**

As it has been stated above, the metasubject approach allows providing the optimal correlation between knowledge on disciplines being integrated within the particular meta-subject on the basis of taking into account the levels of integration and the places of the integrated disciplines in the structural and logical scheme of training specialists. While determining the levels of integration in modern didactics, it is important firstly to separate the criterion and then to meet the rules of formal logics concerning the division of the extent and the content of the notion.

Prospect directions of research could be the justification of criteria and indices of the mentioned levels of integration, as well as the analysis of possibilities of the existence of complex levels of integration, which are the assembly of simpler levels.

With the use of the results obtained the development of basic methodological recommendations for creating meta-subjects from the low credit disciplines at higher educational establishments.

## References


[1] Akhlybynskyi, B. A. (1984). Katehoryalnyi aspekt poniatyia intehratsii [Categorial aspect of the notion of integration]. In A. A. Korolkov & Y. A. Maizel (Eds.), *Dialektika kak osnova integratsiyi nauchnogo znaniya* (pp. 50–60). Leningrad, USSR: LGU.

[2] Berulava, M. N. (1998). *Teoreticheskye osnovy intehratsii obrazovaniia* [Theoretical basics of educational untegration]. Moscow, Russian Federation: Sovershenstvo.

[3] Chapaev, N. (1998). *Struktura i sodierzhaniye teoretiko-metodologicheskoho obespiecheniya pedahohicheskoi integratsii* [Structure and content of theoretical and methodological provision of pedagogical integration] (Doctoral thesis, Ural state professional pedagogical university, Ekaterinburh, Russian Federation). Retrieved from http://www.dissercat.com/content/teoretiko-metodologicheskie-osnovy-pedagogicheskoi-integratsii

[4] Khaken, H. (1985). *Synerhetyka: Yerarkhyy neustoichyvostei v samoorhanyzuiushchykhsia systemakh y ustroistvakh* [Synergy: hierarchies of instabilities in self-organizing systems and devices]. Moscow, USSR: Mir.

[5] Khutorskoi, A. V. (2001). *Sovremennaia didaktika* [Modern didactics]. Sank-Peterburg, Russian Federation: Pitier.

[6] Kozlovskyi, Yu., & Kozlovska, I. (2014). Vyznachennia rivniv intehratsii znan yak dydaktychna problema edukatsiinoi intehrolohii [Determining the levels of knowledge integration as the problem of educational integrology]. *Mizhnarodnyi naukovyi visnyk, 2* (9), 35–45.

[7] Kozlovska, I. (1999). *Teoretyko-metodolohichni aspekty intehratsii znan uchniv profesiino-tekhnichnoi shkoly (dydaktychni osnovy)* [Theoretical and methodological aspects of the integration of students' knowledge at technical vocational school]. Lviv, Ukraine: Svit.

[8] Kraevskyi, V., & Khutorskoi, A. (2003). Predmetnoe s obshchepredmetnoe v obrazovatelnykh standartakh [Subject and general approach in educational standards]. *Pedagogika, 2*, 3–10.

[9] *Metodolohicheskie problemы vzaimodeistviia obshchestvennykh, estestvennykh i tekhnicheskikh nauk*. (1981). [Methodological problems of interaction of social, natural and technical sciences]. Moscow, USSR: Nauka.

[10] Paveltsyh, H. (1989). Intehratsiia – differentsiatsiia – prohress [Integration – differentiation – progress]. In Rozov M. A. (Ed.), *Integrativnyje tendentsiji v sovremiennom mirie i sotsialnyj progress* (pp. 27–42). Moscow, USSR: Izdatelstvo moskovskoho universiteta.

[11] Pulbere, A., Hukalenko, O., & Ustimenko, S. (2004). Intehrirovannye tekhnolohii [Integrated technologies]. *Vysshee obrazovanie v Rossii, 1,* 123–124.

[12] Rozov, M. A. (1989). Protsessy i mekhanizmy integratsii v razvitii nauk [Processes and mechanisms of integration in the development of sciences]. In Rozov, M. A. (Ed.), *Integrativnyje tendentsiyi v sovriemiennom mirie i sotsialnyj progress* (pp. 135–164). Moscow, USSR: MGU.

[13] Tiunnykov, Yu. (1988). *Metodika vyiavleniiia i opisaniia integrativnych protsessov v uchebno-vospitatelnoi rabote SPTU* [The method of determining and description of the integrative processes in training and education activities of technical vocational school]. Moscow, USSR: APN SSSR.

[14] Yudin, B. H. (1981). Metodologicheskaia kharakteristika protsessov vzaimodeistviia v nauke [Methodological description of the processes of interaction in science]. In Smirnov, P. V. & Yudin, B. H., *Metodolohicheskie problemy vzaimodeistviia obshchestvennyh, yestestvennyh i tehnicheskih nauk* ***(pp.*** 45–49). Moscow, USSR: Nauka,.

[15] Yakovlev, I. (1980). *Integrativnye protsessy v vysshei shkole* [Integrative processes in higher education]. Lieningrad, USSR: LGU.