Pedagogical sciences

UDC 371.214, 378.147

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CURRICULUM OPTIMIZATION ON THE BASIS OF A MULTIDISCIPLINARY APPROACH

Summary. *The aim of the study is to find ways of specialty curriculum optimization on the basis of a multidisciplinary approach. The state of the art is characterized by the lack of well-defined criteria for the synergistic integration of disciplines within the specialty curriculum, which necessitated the solution of the following issues: in relation to which system-forming factor to compare disciplines; how to take into account the indirect contribution of a discipline to achieving the ultimate goal of the student's development; how to measure the efficiency/weight of the discipline in the situation of selection. To deal with these issues, the following methods were used: theoretical analysis of literature; system (quantitative and qualitative) analysis of the National Qualifications Framework, Education Standards, specialty curricula and technical discipline work programs formats and content; activity analysis of the Education Quality*

Guarantors, curriculum developers and lecturers of disciplines on the basis of structured questionnaires. The obtained results were compared with the efficiency of students' training based on the correlation and factor analysis. The study allowed determining the system-forming factor in relation to which the comparison of disciplines is performed in the situation of selection; finding a way of considering the discipline direct and indirect contribution to the development of students' strategic competences; devising a formula for measuring the discipline weight in the context of the specialty curriculum. The study revealed a direct dependence of the discipline weight on the methods of its teaching and the synergistic effect of the student development from the interaction of disciplines selected on the basis of the proposed principles. The application of the obtained results will allow optimizing specialty curricula, which will improve the quality of the education and free up time for students' self-development. The study of the multidisciplinary approach significance has proven its inexhaustibility as a source of new scientific research.

Key words: *curriculum optimization; multidisciplinary approach; situation of selection; quality evaluation; discipline weight.*

Modern education is experiencing a difficult period of a paradigm shift. In an effort to meet the modern world needs, a new generation of curricula is reorienting traditional subject teaching to the comprehensive development of an individual who is able to live efficiently in a dynamic rapidly changing high-tech globalized world. Student-centered education requires the reorganization of the training process, which should simultaneously correspond to human nature, meet the needs of society and continue passing on mankind experience via academic disciplines. This task is multidisciplinary in its essence. Multidisciplinarity is a challenge for Ukrainian education, as well as for the world one. Key words in international scientific publications like "transdisciplinary course", "curricula coherence",

"interdisciplinary/integrated/interstitial curriculum", "transversal competences" prove that Western researchers are one step ahead in studying multidisciplinarity from different entry points.

The main question to answer is: "How to relate the content and the prospects of one discipline to another one in order to ensure quality education?". This question poses the key methodological challenge which deals with the development of tools for describing and evaluating the new forms of curriculum development and implementation when a traditional subject-oriented curriculum is abandoned in favor of multidisciplinary one. Scientists explore integrative goals, using the concept of Bernstein's knowledge structures [1] as well as languages of description to theorize a continuum of approaches to curriculum integration from functional to principled ones. This methodological maneuver is implemented by the mechanism that provides access to the analysis of organizing principles of interdisciplinary curriculum design [2, p. 1068].

The connection between interdisciplinary programs and the so-called power of knowledge is discussed in the 21st century educational discourses. The demands of both knowledge and knowers are brought into balance [3, p. 483]. The real challenge for scientists is the dichotomy of identities diversity and access to the power of knowledge. This dichotomy is solved by devising curricula that are transversal to the disciplines without destroying the boundaries between them. The idea of creating an interstitial curriculum or "connective tissue" between disciplines is put forward [4, p. 25].

The mainstream in understanding curriculum integration promotes it as a solely pedagogical arrangement and blames disciplines for fragmenting learners' experience. At the same time the empirical evidence shows that the question of integration cannot be left to lecturers alone. It is crucial to design a coherent curriculum that supports the teaching-studying-learning process with an appropriately differentiated and integrated structure of subjects [5]. Some cases demonstrate the success story of integrated curricula [6, p. 264; 7, pp. 157-173].

The creation of multidisciplinary curricula is complicated by the unsolved problem of transition to a new generation of curricula, which requires study of the traditional and new curricula compatibility [8, pp. 202-214]. Broad and balanced education is becoming a priority [9, p. 20] as a prelude to an independent choice [10, p. 108]. According to Morgan Plato, education ought to involve "physical training and mental or moral training" because such curricula develop virtues [11, p. 49]. Plato supported a broad and balanced subject-based curriculum which, in pursuit of truth, leads to prosperity because acquaintance with the truth is part and parcel of the good life. However, this is not always the case. With the help of knowledge one can learn how to live a good life in the nonmoral sense [12, p. 51].

All traditional curricula are subject-oriented and indicate the content to be studied. They are based on the intrinsic value of a subject [13, p. 4] but the contribution of subjects is limited. A discipline is studied not for the sake of broader aims but for its own sake [14, p. 30]. There is no logical explanation for the contribution of a discipline to the purpose of life. The study of a discipline as such does not lead directly to personal prosperity, professional success or social employment. The subject curriculum does not inform about professional opportunities and cannot help to get a well-paid job. Awareness of the world is a prerequisite for achieving personal, professional and social aims. One cannot live an independent life without information about the world we live in [15, p. 23].

New curricula are well informed about interaction with the world because without this knowledge it is impossible to achieve aims in it. The content of the subject also informs about the world, some parts of the subject make a specific contribution to a particular aim but learning that fulfills the purpose of the subject is narrower than the content of the subject. Therefore, subjects should provide content that helps to achieve the aims of the curriculum through acquaintance with the world. This is a prerequisite for the development of target

competences in a specially organized activity. Life goals and subject curricula can coexist. Areas of learning and experience in general can provide rich content to achieve a broad goal, to be consistent, to use a distinctive way of thinking and to maintain an "identifiable core of disciplinary and instrumental knowledge" [9, p. 38]. The line of subjects can go along the line of broader aims of education due to multidisciplinary curriculum if disciplines are united by content that contributes to the achievement of broader aims [8, pp. 202-214]. If subject curricula are complemented by target activities, the subject becomes a prerequisite for life success [8, pp. 202-214].

The connection between the curriculum and the life goals clarifies HOW and WHY to teach. To achieve these goals, it is necessary to organize the target activities. Students must understand the meaning of the subject for their lives in terms of interaction with the world. New curricula should introduce personal aims in education and focus on the target development of actual features. Modelling and training the efficient behavior can be a solution. But learning process itself can develop necessary features even better than techniques because it is supposed to provide these features through lecturers as educators [8, pp. 202-214].

Relieving the tension between the traditional and the new curriculum is possible by overcoming the narrow professional orientation on the basis of the freedom of choice from a wide balanced set of disciplines in the format of multidisciplinary curricula. However, the optimal time and set of disciplines remain in question. In order to link different disciplines into a synergistic system, it is necessary to find a system-forming factor. Modern educational programs are centered on the student, whose cognitive and personal development is reflected in the competences. Yet, the selection of competences repeats the infamous story of the "bag of virtues" where everyone has their own understanding of what is necessary. Therefore, in order to obtain clear guidelines for the system integration of disciplines, it is necessary to identify

strategic goals in terms of competences. Most European curricula are focused on 4 strategic goals – students should be: 1) ambitious capable learners who are ready to learn throughout their lives; 2) healthy, confident individuals who are ready to lead fulfilling lives as valued members of society; 3) enterprising creative contributors who are ready to play a full part in life and work; 4) ethical, informed citizens who are ready to be citizens of their country and the world [9, p. 31]. That is, young people should be able to lead fulfilling personal, civic and professional life, for which the curriculum must develop an ambitious, capable, healthy, confident, enterprising individual [8, pp. 202-214].

In most modern university curricula qualities are specified as a description of the expected cognitive and personal virtues of the graduate [16]. It includes: 1) perfect mastery of the discipline that means breadth and depth of knowledge of one or more disciplines and their application in real-world context; discipline-specific skills and attributes; understanding disciplinary epistemology and methodology; awareness of current research in the discipline; ability to undertake research and enquiry within the discipline; autonomous learning within the discipline; 2) skills in research and enquiry that means ability to learn through research and enquiry; ability to plan, undertake and present research as appropriate to the discipline; ability to consume and evaluate research critically; 3) personal effectiveness and self-awareness – ability to communicate effectively in an increasingly digital world for a variety of purposes and audiences, and through a range of appropriate media; ability to articulate what and how they have learned, awareness of their strengths and areas to develop, and commitment to learning and reflection; desire for self-improvement; personal self-awareness and reflection, self-efficacy, intellectual curiosity, adaptability, resilience and commitment to lifelong learning; 4) global engagement and multicultural awareness that means intercultural competence and global outlook; social and civic responsibility; ability to collaborate

effectively and adapt to different work or study contexts; appreciation of multiple perspectives and valuing diversity [16].

One who is well acquainted with the National Qualifications Framework [17] and Standards of Specialties [18] easily recognizes the goals of cognitive and personal development of Ukrainian higher education in terms of knowledge, skills, communication and self-development which are reflected in integrated, special and general competences [19]. This is not surprising. The reform of Ukrainian education is inspired by integration into the European education space.

If we focus on the final requirements, the multidisciplinary curriculum [16] should be: 1) discipline based to enable the acquisition of deep knowledge in combination with the skills development; 2) research based to engage students in research throughout studies, to inform about current research within disciplines, to engage in research discussions, to present results in collaboration with the community of scholars; 3) diverse and inclusive to represent the world we live in and to meet the needs through the acquisition of disciplines, recognizing the contribution and influence of different groups; 4) global to understand disciplines and their application as well as to develop intercultural competences considering global perspectives; 5) contextual to gain an understanding how knowledge/skills can be applied to real world problems and to develop critical perspectives on current thinking and practice by drawing on theories and wider research.

Thus, the main theme in modern scientific discourse on the curriculum design and optimization is "bridging the gap" between innovative student-oriented and traditional subject-oriented training. As wittily noted by White: "During the transformation new patterns have been overlaid on old but the old shine through" [20, p. 179]. This is also characteristic of Ukrainian education which has an ambivalent tendency for preservation and development. On the one hand, how to give up heritage that has been tested and worked for many years?

On the other hand, how to survive ignoring the demands of the new time? To develop while preserving the experience is possible if we find links between the modern model that is focused on the development of students' multidisciplinary competences and subjects that are designed to develop more specific knowledge, skills and abilities. Methods of educational activities and creative use of the subject content are determinative.

The search for national literature that directly explores the topic of curricula optimization on the basis of a multidisciplinary approach has yielded almost nothing despite the great practical relevance of the problem. Indirect contribution to the solution of the problem was given by the literature related to: the Ukrainian education competitiveness in the global dimension [21, pp. 24-42], the National educational standards [22, p. 8; 23, pp. 205-210], the University curricula [24], the University complex evolution [25, pp. 293-306], the inadmissibility of curriculum existence to provide exclusively workload [24]. The strategy of values co-creation, which uses social media platforms as a meeting place for students, lecturers and employers, is the most interesting in the context of multidisciplinarity [26, pp. 228-240]. Attention is focused on the analysis of existing media for communication with stakeholders, which is successfully used in business when interacting with customers. This strategy has perspective for multidisciplinary team interaction while developing training courses. In general, the state of the art with the implementation of a multidisciplinary approach remains insufficiently studied. An innovative approach is required. This approach deals with curricula optimization through multidisciplinary system links.

Aim and Hypothesis. We put forward a hypothesis concerning the curricula quality optimization on the basis of interdisciplinary links considering disciplines developmental capacity for achieving a strategic goal within National/European Qualification Framework (NQF/EQF) and Higher Education Standards (HES). The strategic goal deals with the development of

NQF/EQF/HES competences (integrated, general and specific), hereinafter referred to as "Strategic Competences" (SC). To test the hypothesis, it is necessary to answer the following questions: 1) How to identify the correspondence between discipline and SC? 2) How to consider the discipline significance in the development of SC? 3) How to measure the discipline contribution to the development of SC? So, the aim of our research is to bridge the gap between competence-oriented and discipline-oriented approaches.

Methods.

Research Modal/Design. Quantitative, qualitative and mixed research methods were used to solve the problems and to achieve the aim of the research. They include: theoretical and methodological analysis; data systematization and generalization; longitudinal psycho-pedagogical experiment under condition of real University training; statistical data processing including correlation analysis and analysis of variance with subsequent qualitative interpretation and content generalization.

Sample/Participants. The total number of testees who took part in the experiment covered 300 Bachelor, Master, PhD students and lecturers from 5 UA and 15 EU Universities aged 17 to 55 years. The experimental study took place within 4 pilot phases and 3 summer schools of international projects on human resources management (Tempus-Tacis CD JEP-24150-2003 "HUREMA"); urban and region sustainable development (№ 530197-TEMPUS-1-2012-IT- TEMPUS-JPCR, № 543651- TEMPUS-1-2013-1-AT-TEMPUS-JPCR); university start-up development (№ 530349- TEMPUS-1-2012-FR-TEMPUS-JPHES). The projects (2013-2020) were aimed at creating curricula and evaluating their efficiency. Kharkiv National University of Civil Engineering and Architecture (KNUCEA) was the basic research center where evaluation took place.

Instruments and Procedure. Diagnosis of the competence development level was carried out on the basis of traditional (Cattell and Leary

questionnaires, content-analyses, tests,) as well as original methods and measuring tools of Eco-Humanistic Technology of Self-Development [27] such as Cognitive Mapping Technique [27, pp. 288-298]; Integrated Development Matrix [27, pp. 377-382]; Individual Development Matrix [27, pp. 299-307]; Learning Diary Matrix [27, pp. 383-386]; Learning History Matrix [27, pp. 370-376]; Test-Questionnaire of Metacharacteristics of Personal Development [27, pp. 342-369].

The following steps of research were implemented: 1) system analysis of the formats and content of the National Qualifications Framework [17], Education Standards [18], Curricula and Work Programs of technical disciplines; 2) activity study of the Guarantors, working groups members and lecturers of disciplines on the basis of structured questionnaires; 3) comparison of the results obtained with the results of students training efficiency within longitudinal psycho-pedagogical experiment under condition of real University training (KNUCEA).

Data Analysis. There are the following stages of data analysis: 1) correlations analyses of students' cognitive and personality metacharacteristics within intrapersonal and interpersonal relations; 2) factorization – grouping the studied indicators by the factor analysis method; 3) establishing causal relationships in the framework of a training experiment – manipulation of factors caused by traditional, developmental, metacognitive, eco-humanistic and multidisciplinary training; 4) obtaining primary data – indicators of individual sense-cognitive scheme complexity; solving problem efficiency in accordance with the criteria of completeness, velocity and accuracy; professional, social, existential meta-senses; meta-abilities such as decision-making, synergetic interaction, self-development; meta-qualities such as objectivity, proactivity, autonomy, responsibility, empathy, creativity, flexibility; 5) scaling (STEN Scale); 6) developing individual and group profiles; 7) establishing the validity of conclusions (analysis of variance, determination of statistical differences by

Student's t-test). Statistical data processing and graphical presentation of the results were carried out on the basis of the software package STATISTICA 10.0 and SPSS 17.0.

Ethical issues. Research was approved by the KNUCEA Ethics Committee. For longitudinal training experiment the informed consent of the participants was obtained. They were informed about the confidentiality of the personal data integrity with no other consequences on their status.

Results. The results of the research confirmed the hypothesis concerning perspective of curriculum qualitative optimization through organization of interdisciplinary system links, taking into account the discipline developmental significance in the context of strategic aim achievement in the format of NQF/EQR/HES. Hypothesis testing answered 3 questions:

Question 1: "How to identify the coherence between discipline and SC?" Comparison and matching competences developed by the discipline with NQF/EQF/HES SC is possible within 5 strategic directions of student personality development/self-development in terms of integrated, cognitive, communicative, developmental and practical competences. For comparison it is necessary to formulate the goals of the discipline in terms of developmental activities that are structured in the logic of NQF/EQF/HES;

Question 2: "How to consider the discipline significance in the development of SC?" It is necessary to determine the discipline weight (W^d) for the development of NQF/EQF/HES competences that requires considering the coefficients of SC (K^c) and discipline (K^d) significance. The last depends on its role:

- discipline as a goal (A) - Kd = 5;
- discipline as a condition (C) for the SC development - Kd = 4;
- discipline as a direct means (M) of SC development - Kd = 3;
- discipline as an indirect means (I) of SC development - Kd = 3;
- discipline as an empowerment (P) for the SC development - Kd = 1.

The coefficient of SC significance (K^c) depends on the curriculum context. If we focus on NQF, then the generalized K^c will be as follows: integral competences (I^c) - K^c = 5; cognitive competences (C^c) - K^c = 4; practical competences (P^c) - K^c = 3; communicative competences (M^c) - K^c = 4; developmental competences (D^c) - C^c = 5. This distribution is justified by the level of system influence and competences dependence on each other: integral competences cover all other ones in general, developmental competences are condition for their development; cognitive and communicative competences are basic for development, but practical competences have specifically narrow area of system influence;

Question 3: "How to measure the discipline contribution to the development of SC?" Measuring discipline contribution to the SC development is possible by using Matrix consisting of 2 panels (see Fig. 1):

Code	SC – strategic competences K^c – coefficient of significance	Bachelor						Master						PhD					
		DC discipline competences	W^d– discipline weight					DC discipline competences	W^d– discipline weight					DC discipline competences	W^d– discipline weight				
			1	2	3	4	5		1	2	3	4	5		1	2	3	4	5
1	Integral K^c 5	1.1/1.2/1.3	3		1	3	1	1.1/1.2/1.3	3		1	3	1	1.1/1.2/1.3	3		1	3	1
2	Cognitive K^c 4	2.1/2.2/2.3	2	1	2		3	2.1/2.2/2.3	2		3			2.1/2.2/2.3	2		2		3
3	Practical K^c 3	3.1/3.2	1	1		1		3.1/3.2	1	1		1		3.1/3.2	1	1		1	
4	Communicative K^c4	4.1/4.2/4.3	2		3	2	3	4.1/4.2/4.3	2		3	2		4.1/4.2/4.3	2		3	2	3
5	Developmental K^c 5	5.1	1	1				5.1	1	1				5.1	1	1			
Discipline weight result		Bachelor course	W^d = 0,372					Master course	W^d = 0,256					PhD course	W^d = 0,304				

Code	K^d = discipline significance coefficient					List of activities for the development of strategic competencies within discipline
	A	D	M	C	P	
	5	3	2	4	1	
1.1				v	v	Development of the ability to work in an international context (international projects / mobility programs / summer schools)
1.2				v	v	Development of the ability to select, manage and work in an international multidisciplinary team (reality / simulations)
1.3	v	v		v	v	Development of the ability to apply for participation in an international project / mobility program / training / research
2.1	v	v			v	Development of the ability to search / interpret information in world sources for professional / scientific / educational goals
2.2	v	v			v	Development of cognitive ability for generalization by excreting sense units in the corresponding foreign language content
2.3	v		v			Development of critical thinking through verbalization of internal speech by linguistic means according to the purpose
3.1				v	v	Development of the required general competencies within the framework of interactive European trainings
3.2			v			Development of the required general and special competencies through tasks and content of foreign language courses
4.1	v	v			v	Development of the ability to communicate orally/in writing, taking into account the purpose, target reader/listener, conditions;
4.2	v	v		v	v	Development of the ability to present results to the international community in the formats of articles/presentations/monographs
4.3	v	v		v		Development of the ability to lead a discussion at the international level, taking into account cross-cultural features
5.1			v		v	Development of the ability to self-development within the subject activity (eco-humanistic technology of self-development)

Fig. 1. Matrix for calculating discipline weight in the SC development Legend:

A – aim, D – direct way, M – mediated way, C – condition, P – potential

Source: developed by authors

- **Strategic Competences Panel** (SCP) displays: 1) competence code; 2) directions of SC development with coefficient of their significance (K^c); 4) Discipline Competences (DC) codes in accordance with the directions for each educational level; 5) discipline weight (W^d) calculated in accordance with DC role;

- **Discipline's Competences Panel** (DCP) displays: 1) discipline developmental activity code; 2) roles for calculating discipline significance coefficient (K^d); 3) list of discipline activities for SC development.

Discipline weight (W^d) is calculated for each of the three educational levels in the context of discipline's capacity for SC development. The weight measurement area is located directly opposite the SC according to the three educational levels. The procedure for calculating the weight is carried out automatically after entering the code of Discipline Competence (DC) opposite the SC it contributes. The calculation is fine-tuned by introducing coefficient (K^c) of SC significance (1 to 5) and the coefficient (K^d) of DC significance (1 to 5) for the development of SC in the context of the specialty. A simple Excel program allows calculating the weight of the discipline (W^d) to decide on its selection and workload distribution.

The statistics. The statistics supported the answers received. A special study examined various disciplines to calculate their weight in the context of the SC development. Statistical processing revealed a significant correlation at a high 1% level between the weight of the discipline and the degree of its functionality/ fundamentality. Such disciplines provide a broad base for the development of target competences far beyond the specific discipline, which is a significant advantage in a situation of uncertainty. For example, physics (W^d = 0.128), determining the scientific paradigm of research methodology for all sciences, forms the theoretical thinking of the scientist, which is reflected in critical thinking and ability to discuss in a language understandable to all scientists. Mathematics (W^d = 0.212) is not only a universal scientific measuring apparatus in any field, but it also develops logical thinking, which is the key to successful activity in any field. Information Technology (W^d = 0.233) provides practical power to mathematical knowledge through technological implementation. There is a significant positive correlation (0.784) between the efficiency of mastering these disciplines and the efficiency of cognitive (0.567)

and developmental (0.421) competences development, and, as a consequence, the integral competences development (0.494). Fundamentality, which has always been a qualitative feature of Ukrainian education, is becoming relevant under condition of ambiguity. It is modernized in the metacognitive approach and requires rethinking of academic disciplines in terms of knowledge about cognition, about oneself, and about the discipline, which increases significantly the developmental effect in the process of mastering the discipline. This approach provides self-development under situation of uncertainty that is characteristic of modern life.

The study identified multifunctional disciplines that are important for the development of integral, general and professional competences at all levels of education. This is, first of all, "Foreign language", which showed the highest weight in the context of SC development at the levels of Bachelor (W^d = 0.372), Master (W^d = 0.256) and PhD (W^d = 0.304). For comparison, specialty disciplines showed weight at the levels of Bachelor (W^d = 0,095-0,034), Master (W^d = 0,069-0,027) and PhD (W^d = 0,075-0,038), and practical skills trainings at the levels of Bachelor (W^d = 0,023- 0.015), Master (W^d = 0.017-0.006) and PhD (W^d = 0.010-0.007). It should be noted that such indicators show not so much the importance as the degree of multidisciplinary impact.

Within "Foreign language" discipline not only professional competences but also integral and general ones are developed. At certain levels foreign language in addition to the goal itself can be:

- a condition for full-fledged activity in the international context;
- an opportunity to participate in developmental practices and trainings of a high level of quality (including online mode) for the purposeful development of practical skills and abilities;
- a direct means of information retrieval, communication (presentations, discussions), verbalization of thinking; in-depth study of target content or indirect means of self-development.

Without foreign language it is impossible to develop the key ability to work in an international context, to participate in international projects/mobility /summer schools, the basic requirement for which is knowledge of foreign language at B2 level. Foreign language-mediated activities provide a higher level and quality of development. The inseparable connection between thinking and speech has been scientifically proven. It is possible to verbalize the thought only through speech means, therefore development of thinking can be carried out purposefully through development of ability to make out a thought, taking into account the purpose, the target recipient, the task and conditions for its exteriorization. Moreover, only within this discipline verbal resources are purposefully provided for the design of a thought.

Focused research revealed the following activities within the "Foreign Language" discipline, which are related to the strategic competences of the NQF:

1. **Integral competences**:

1.1. Development of the ability to work in an international context through participation in international mobility projects/programs/summer schools;

1.2. Development of the ability to select, manage and work in an international multidisciplinary team of real projects and simulations;

1.3. Development of the ability to apply for participation in an international project/mobility program/ receiving an international scholarship for study/research;

2. **Cognitive competences**:

2.1. Development of the ability to search and interpret information in world sources through the tasks of scanning/skimming/analytical reading and listening to solve professional, educational and research problems;

2.2. Development of cognitive abilities through determining meaning units in foreign language content;

2.3. Development of critical thinking through the tasks of internal speech verbalization on the basis of appropriate linguistic resources that shape opinion, reasoning, assumptions, probability, agreement, disagreement, concession, approval, disapproval, neutral attitude, dissatisfaction; determination of priorities/ preferences/wishes; formulation/analysis of goals/causes/consequences; comparison, opposition, formulation of differences/advantages/disadvantages; decisions, choices and reasons; formulation/acceptance/rejection of the proposal, counterarguments; formulation of results/consequences; recommendations, advice.

3. **Practical competences**:

3.1. Development of general and special competences within the framework of interactive European trainings: 1) developmental competences including: understanding one's own experience; knowledge of self-development mechanisms; an ability to learn, to set strategic and intermediate goals, self-evaluation, time management skills; 2) communicative competences including: knowledge of one's own social support network; an ability to express oneself and receive feedback, to redirect communication or conflict into the constructive direction, to stay confident and convincing, to use typology, to manage stress, to work in a team; 3) professional competences including: self-assessment of professional competence and development, the choice of professional development strategy, an ability to master the profession (cognitive actions), to solve professional problems (training actions), to apply professional knowledge (practical actions).

3.2. Development of general/special competences through tasks/content of foreign language courses.

4. **Communicative competences**:

4.1. Development of the ability to communicate through the task of composing written/oral messages, taking into account the purpose, target reader/listener and the available conditions;

4.2. Development of the ability to present the results of work to the international academic and professional community in the formats of articles, presentations, monographs;

4.3. Development of the ability to discuss, taking into account cultural features within the practice and simulations that teach: to form impressions, to express opinions, to reason, to make assumptions, to express probabilities; to ask an opinion, to agree/disagree/give in; to express approval/disapproval/neutral attitude/dissatisfaction; to determine priorities/preferences/wishes for the future; to formulate a goal, to express a reason; to analyze the cause and effect; to equalize, to contrast, to formulate differences/advantages /disadvantages; to propose solutions, to inform about the choice and reasons; to make/accept/refuse the offer, to give counterarguments; to report results/consequences; to recommend, to give advice.

5. **Developmental competences**:

5.1. Development of the ability to self-development within the subject activity, modelling real conditions of everydayness (Eco-Humanistic Technology of Self-Development);

5.2. All competences that are formed through cognitive/practical activities are developmental.

Analysis of work programs in the "Foreign language" discipline of high efficiency, which measured the growth of indicators (△) based on a comparison of the starting (ES) and final (ER) levels, showed:

- the level of development of the cognitive scheme complexity - ER = 0.79 (ES = 0.37, △ = 0.42);
- efficiency of problem solving (velocity, accuracy, completeness) - ER = 0.69 (ES = 0.35, △ = 0.34);
- level of meta-sense development: professional sense - ER = 0.69 (ES = 0.32, △= 0.37), social sense - ER = 0.67 (ES = 0.43, △= 0.24), existential sense - ER = 0.65 (ES = 0.42, △= 0.23);

- level of meta-abilities development: decision-making - ER=0.64 (ES=0.39, △=0.25), communication - ER=0.65 (ES=0.39, △=0.26), self-development - ER 0.69 (ES=0.38, △=0.31);
- level of meta-qualities development: objectivity - ER = 0.79 (ES = 0.41, △= 0.38), proactivity - ER = 0.70 (ES = 0.36, △= 0.34), autonomy - ER = 0.67 (ES = 0.33, △= 0.34), responsibility - ER = 0.58 (ES = 0.38, △= 0.20), creativity - ER = 0.62 = 0.35, △= 0.27), flexibility - ER = 0.57 (ES = 0.34, △= 0.23), empathy - ER = 0.55 (ES = 0.35, △= 0 , 20).

System analysis of the actual formats and content of 25 curricula of economic, construction and architectural profile showed that 67% of curricula have lost touch with the strategic competences of the NQF; 52% of curricula do not have a relevant link between the strategic competences and the disciplines that these competences are able to develop; 78% of curricula lack educational materials adequate to the goals of strategic competences development. System analysis of 33 work programs of technical disciplines revealed the lack of a format in which the direct compliance of educational activities with SC is established. In the description of the methodology there are no methods for the development of strategic competences. The results of analyzing actions of the Guarantors, members of working groups and lecturers of disciplines on the basis of structured questionnaires showed that 87% of respondents lack understanding of patterns and mechanisms of competence formation; 72% are characterized by a narrow understanding of developmental activities; 78% lack competence in psychological and pedagogical issues.

Thus, comparison of disciplines in the situation of selection is possible by expressing discipline goals in terms of strategic directions of student's personality development. It is optimal to focus on 5 types of SC – integral, cognitive, practical, communicative and developmental ones. Each discipline contributes to the development of SC as a goal, as a direct or indirect means, as a condition and as an empowerment. To calculate the weight of the discipline,

the coefficient of discipline significance is identified depending on its role in the SC development and the SC coefficient significance. Measuring the contribution of the discipline to the development of SC is possible with the help of a matrix that allows transforming the goals of the discipline (formulated in terms of developmental actions) into specific numerical data measuring the weight of the discipline in the context of the specialty curriculum. Purposeful research revealed the dependence of the discipline weight on: 1) the coverage of the discipline which is conditioned by its functionality/fundamentality and gives an advantage in a situation of ambiguity; 2) teaching methods with the highest effect of Eco-Humanistic approach; 3) psycho-pedagogical competence of course developers and lecturers. The following negative effects were revealed: 1) loss of focus on the SC of the NQF in the process of their specification in educational standards, specialty curricula and work programs; 2) blocking the development of SC due to the discipline inconsistency or limited ability through teaching methods; 3) narrow professional understanding of developmental activities. It is revealed a synergistic effect of the students' development caused by interaction of the disciplines included in the curriculum on the basis of the proposed selection principles.

Discussion. Decision-making in a situation of ambiguity requires at least a strategic focus on the ultimate goal and, as a maximum, the presence of a measurement scale for comparison and selection of the most efficient solution.

Statement of the problem. The main problem in the design of specialties curricula (SPC) is the lack of clear criteria for the selection of disciplines that ensure its implementation and the distribution of workload between disciplines within the curriculum. Preliminary research of existing curricula has shown that making decision concerning discipline selection is intuitive. It is not based on objective performance indicators, but on purely formal characteristics of curriculum, on developers' personal experience and subjective ideas or on purely vital needs to "inflate" the workload to save the stuff. In "Matrix of

curriculum competences compliance with the discipline" and "Matrix of providing curriculum results by relevant discipline" the reason for discipline choice cannot be identified.

The second problem arises from the first one. It is related to the choice of the system-forming factor for comparing and choosing disciplines. The Discipline Work Program (DWP) completes a full planning cycle of the entire educational process. National Qualifications Framework (NQF) sets out strategic guidance in the context of the target area in the Specialty Educational Standards (SES) format. SES are specified in "Specialty Curriculum" (SPC) in the context of the policies and capacities of each university. DWP is a final point of the cycle that represents the actual developmental environment. This environment is crucial because student interacts with it directly. It is this interaction that determines the quality of student's development.

The DWP implicitly contains the goals of the NQF, SES and SC. Unfortunately, interpretive "noise interference" stands in the way to transformation. NQF goals concretization in different contexts of SES and SC leads to the loss of hereditary connection with NQF at the level of DWP. To avoid losses and to measure the overall contribution of the discipline to the efficiency of student's development, it is necessary to reconnect the DWP with the system-forming NQF. It is possible by aligning the discipline contribution with the context of specialty. Fine-tuning of discipline is needed. It is based on distinguishing discipline contribution as a goal, as a direct or indirect means, as a condition or empowerment for competences development.

Review of methodology. To solve the research problems the following methods were used: theoretical analysis of the literature; system (quantitative and qualitative) analysis of formats and content of the National Qualifications Framework, Specialty Educational Standards, Specialty Curricula and Discipline Work Programs. At the same time, the actions of the Guarantors of education quality, curriculum developers' groups and lecturers of disciplines were studied

on the basis of structured questionnaires. The obtained results were compared with the efficiency of students training within longitudinal psycho-pedagogical experiment under condition of real university education. Methods of statistical data processing were used as well (correlation and analysis of variance with qualitative interpretation and generalization of the content).

Summary of the main results. The research achieved its goal. It has found the ways of SPC optimization on the basis of clear criteria for synergistic integration of disciplines within the specialty curriculum. The following criteria were identified: 1) direct cohesion of the discipline with SC developmental goal. It was established by transforming discipline goals into terms of developmental actions, that were structured in the logic of NQF competence strategic directions development; 2) the discipline significance in combination with the significance of SC that this discipline is able to develop. Direct and indirect contribution of the discipline was taking into account; 3) the discipline weight measured by a matrix tool that combines indicators of SC with indicators of discipline.

Research revealed positive and negative factors of the discipline influence on the efficiency of the SC development. Positive factors include: 1) coverage/fundamentality of the discipline that gives advantages in a situation of ambiguity; 2) an innovative methodological approach to teaching a discipline. Eco-Humanistic and Metacognitive approaches in the context of SC development/self-development proved the most efficient; 3) psycho-pedagogical competence of the Guarantors, curriculum developers, as well as course lecturers. Negative factors include: 1) loss of SC as goals in the process of their specification in SES, SPS and DWP; 2) lack of SC development due to inconsistency of discipline or methods of teaching; 3) narrow (restricted by specialty) approach to the development of SC.

The synergistic effect of development was revealed as a result of interaction of the curricula disciplines that were selected due to their significance in the SC development.

The innovative approach to SPC optimization opens perspectives for a multidisciplinary approach, when multidisciplinarity operates not only within a specific course of study, but also within the entire curriculum.

Reference to previous experimental studies. Previous experimental research was related to the study of students' cognitive and personality development patterns under conditions of HEI training while studying a particular discipline. As a result, Eco-Humanistic Technology of Self-Development – EHTSD was created [27]. Within EHTSD training is focused not on the discipline and not on the student, but on the interaction between them. The training environment simulates natural condition of self-development of an individual on the basis of psychological mechanisms ("integrity of internal and external activities", "intention to balance sense – resources – conditions"; "dependence of the developmental efficiency on the existential orientation and strategic goals"). EHTSD proved to be the most efficient in comparison with the traditional, developmental and metacognitive training. A synergistic effect of self-development was revealed [28 p. 157]. Measuring techniques and instruments were created to confirm scientifically the obtained results.

The findings of the study were used in four European projects aimed at designing multidisciplinary curricula of human resources development (Tempus-Tacis CD JEP-24150-2003 "HUREMA") city and region sustainable development (№ 530197-TEMPUS-1-2012-IT-TEMPUS-JPCR; № 543651-TEMPUS-1-2013-1-AT-TEMPUS-JPCR), University start-up development (№ 530349- TEMPUS-1-2012-FR-TEMPUS-JPHES). To evaluate the efficiency of project curricula special measurement tools were created.

The experience gained in research within international multidisciplinary teamwork helped to carry out qualitative and quantitative analysis of the developmental potential of NQF, SES, SPS and DWP. As a result, the direct dependence of the education quality on the multidisciplinary balance of selected disciplines with considering their developmental potential in the context of

educational level aims and target specialty was revealed, which, in turn, necessitated the creation of weight measurement of each discipline.

Discussion of the results. It is characteristic of education and science to divide verbally what is inseparable existentially. If education is centered on the student as a personality, their integrity and uniqueness must be taken into account. No matter how much we plan to develop knowledge, skills and abilities, they are acquired by one person. The "meeting" and integration of all educational intentions takes place in the mind of a learner. It is there that the seperate disciplines come together in a unique cognitive scheme that is naturally multidisciplinary. Therefore, multidisciplinarity is not only a need of the time, but also a natural characteristic of the student cognitive scheme. If teaching is designed to promote the system development of the individual, a multidisciplinary approach should be carried out not so much at the level of the total set of disciplines, but at the organization of optimal links between disciplines within curriculum. A solution requires methodology that allows achieving truly synergistic multidisciplinarity on a scientifically sound and practically appropriate basis.

Recommendations for educators. The implementation of the obtained results will allow optimizing curricula on the basis of clear criteria for selecting disciplines with the help of a matrix tool. It was created with consideration of real needs and opportunities of the educational process. Its use is a prerequisite for improving the quality of training.

Implications for research and practice. The implementation of the results opens the possibility of a scientific approach to decision-making on the optimal selection of disciplines based on quantitative and qualitative analysis of their ability to meet the needs of students' system (cognitive and personal) development. The created tool expands research opportunities aimed at creating high-quality multidisciplinary curricula and enriches practice with an innovative

and accessible to every educator approach to measuring the quality of the discipline.

Suggestions for further research. The multidisciplinary approach is an inexhaustible source of new scientific studies. The subject of training develops herself/himself through the creation of new links in personal sense-cognitive scheme that is multidisciplinary by its nature. The learning environment that simulates the real world is inevitably becoming multidisciplinary. Development, as a result of the interaction of the learner with the learning environment, requires the study of this developmental process patterns. A characteristic feature of this pattern is multidisciplinarity. The key word of this kind of research is the optimal cohesion.

Limitations. Limitations of study were related to the data collection: the lack of necessary educational standards that were in the process of being created; absence of free access to the array of work programs; insufficient financial resources for access to databases of international publications.

Conclusions. The results of the study proved that modern Guarantors of education quality do not have clear criteria for evaluating the efficiency of academic disciplines for optimal quality implementation of curricula. As a result, there is a lack of sound, balanced and objective selection and distribution of workload between disciplines, which, in turn, raises the problem of integrity and conflict situations. The solution concerns the use of a multidisciplinary approach and the introduction of such a basic measure of efficiency as the discipline weight.

A multidisciplinary approach involves a problem of connection and continuity between levels of education provided by a wide variety of disciplines. This problem is solved by creating initial strategic orientation in the educational process that provides organization of an optimal system of training when the result of the previous activity becomes means of the next activity implementation. This kind of transforming a goal/result into a means requires

the academic disciplines teaching in terms of subject actions aimed at developing relevant competences. The European/National Qualifications Framework is an ideal system-forming factor which summarizes the ultimate goal as a strategic orientation for the optimal education process.

To achieve full compliance of the discipline with the qualification framework, competences should be divided into integral, cognitive, practical, communicative and developmental. This allows connecting discipline to the target competence directly and to measure its weight within the level of education. The Guarantors will have a reliable criterion for the selection of disciplines and the distribution of workload between them.

A multidisciplinary system approach allows optimizing curricula and preventing non-targeted or repetitive actions. It will not only contribute to the balance of curricula, but also provide a synergistic effect of the interaction of disciplines aimed at developing one competence from different points of entry. As a result, it will improve the quality of curricula and will stimulate the development of the methodology of academic disciplines in the context of modern requirements for the development of competences.

Further research can contribute to increasing the developmental effect of each discipline by tuning it in the context of the development of strategic competences.

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