

METHODS OF EVALUATION OF THE LATEST EDUCATIONAL TECHNOLOGIES: MARKETING ASPECT

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Abstract

Modern studies aimed at searching the ways to improve the effectiveness of future social sphere specialists professional training, suggests the need to take into account various factors in assessing the effectiveness of educational technologies and methods. Instead, theorists and methodologists of education often ignore the issues of evaluating the effectiveness of educational technologies created and proposed for use, without taking into account the methodological level and personal positions of practitioners who will apply them. Accordingly, our research is a search for ways to solve the problem of providing the practice of future social sphere specialists professional training with scientifically sound and empirically tested modern educational technologies. The aim of the article is the description of evaluation the latest educational technologies of future social sphere specialists bilingual training on the basis of existing methods of evaluating effectiveness with the maximum exclusion of the human factor.

The article presents the method of evaluation of the latest educational technologies on the example of social sphere specialists' bilingual professional training. The technique of evaluating the effectiveness of the technology of future social sphere specialists' professional training on a bilingual basis according to the following parameters is presented: level

of students' knowledge of professional subjects (cognitive-operational component); level of students' language competence (professional-communicative component); level of students' motivation to study (motivational component); level of students' reflection (reflexive component); intensity of tasks completing during the bilingual cases solving; activity during the cases completing within the bilingual learning; and ethics of leading the discussion during the completion the bilingual cases. The criteria for evaluating each parameter are described. The algorithm of step-by-step application of the Delphi method and the analytic hierarchy process for expert evaluation of the effectiveness of the latest educational technologies by theorists (teachers) and practitioners (employers) is described. Decision-making on the level of technology efficiency is based on the analysis of a significant number of formalized and non-formalized factors, the impact of which is not described by analytical dependencies. It allows us to empirically determine and mathematically confirm the effectiveness of the technology impact on the results of future professionals training.

We have substantiated the possibility of evaluating the future social sphere specialists' bilingual professional training using the Delphi method. It was clarified the advantages of the specified method that allows to come

to a conclusion about efficiency of future social sphere specialists' bilingual professional training, taking into account the conclusions of the main experts: teachers and employers (AHP technique). The structured assessment of the level of bilingual competence of future social sphere specialists is presented in the unity of cognitive-operational, professional-communicative, motivational and reflexive components. Evaluation is implemented on the basis of studying the level of students' knowledge of professional subjects (α_1), their communicative competence (α_2), the motivation to bilingual education (α_3), the level of students' reflection (α_4), the intensity of tasks completing (α_5), personal activity during completing bilingual tasks (α_6) and ethical principles of dialogical teaching methods (α_7).

An integrated assessment and selection of the most appropriate option for assessing the bilingual training of future social sphere specialists was determined. It is established that the most adequate option for assessing the level of students' professional training within the bilingual education is satisfactory. Among the prospects for further studies of bilingual training, we see the development and applying innovative teaching methods.

Key words: *Educational technologies, Efficiency assessment, Evaluation, Bilingual professional training, Delphi method, Analytic hierarchy process, Marketing.*

1. Introduction

The geopolitical processes of the last decade have led to transformations in all spheres of our country's life, including educational. The range of requirements for training a modern specialist has significantly expanded and in addition to professionalism in the specialty began to include necessary for a modern specialist soft skills, such as: flexibility in decision making, willingness to continuous self-improvement and professional mobility in a multilingual European space.

Thus, modern societies require fully educated specialists, consequently, the development of general and special competencies is an integral part of the study programmes [7].

Ukraine has ratified the main European educational documents, joined the Bologna Declaration; the basic life competencies defined in these documents also determined the requirement for proper mastery of a professional foreign language and bilingual training of specialists, which contributes to their status in the European labor market. Competence is also necessary for the development of innovations and the economy [8, 14, and 15]. Bilingual competence of specialists after

graduation is an indicator of their competitiveness in a globalized professional environment, under the influence of multicultural processes, in the real and virtual world of professions, in conditions of pandemic threats [20].

In response to these challenges, the domestic scientific and pedagogical community began to develop concepts for updating the educational structure, the introduction of new technologies for training, one of which may be considered training of future professionals on a bilingual basis (i.e. teaching students both native and foreign languages).

Foreign language in the context of global integration, labor migration, the so-called "erasure" of professional, communication, national borders has acquired the status of professionally important political, social, economic communicative component of education.

Similar processes are taking place in the field of future social workers training who can use not only native but also foreign languages in the process of professional activity: providing professional assistance to multilingual clients, exchange of professional experience, participation in international projects, providing scientific activities, opportunities to exchange necessary information within the world community of social sphere professionals.

As a large number of new technologies have recently appeared, there is a problem of evaluating their effectiveness, given the high energy, time and resource consumptions associated with their development and implementation in the educational process by teaching staff, choosing among them the most effective and at the same time increasing the workload, and thus complicating the learning process for students [2, 18, and 19]. Therefore, we consider it appropriate to introduce into the educational process only those new technologies, which effectiveness are proven experimentally and are quite high compared to classical ones.

The analysis of the studied phenomenon requires in addition to developing methodological, theoretical and technological bases of bilingual education, working out methods for evaluating the effectiveness of new educational technology, especially taking into account the latest educational information technology developments in Ukraine and the world.

Therefore, the aim of the article is the description of evaluation the latest educational technologies of future social sphere specialists bilingual training on the basis of existing methods of evaluating effectiveness with the maximum exclusion of the human factor.

Modern studies aimed at searching the ways to improve the effectiveness of future social sphere specialists professional training, suggests the need to take into account various factors in assessing the effectiveness of educational technologies, innovations and methods [9, 13, 17]. In particular, the analysis of textbooks for bachelors of social work conducted by a group of scientists shows that educators use simplified cases, devoid of diversity in the presentation of social work clients, the depth and complexity of social and psychological problems of these clients, as well as information about personal qualities of social workers, which, in fact, distances life and experience from learning process [1, 3].

The application of the latest technologies, in particular case studies, in the professional training of future social sphere specialists is controversial in world scientific thought. Because social work deals with the extremely painful challenges of social life, it seems unethical and ineffective to use only one or more approaches to case analysis. Gilgun proves this thesis in her study, noting both the potentials and dangers of applying individualized research in the social sphere [6].

Another team of researchers proposed criteria for evaluating the quality of case studies, including: transferability external validity, credibility/internal validity, confirmability/construct validity, and dependability/reliability [10].

That is, practitioners do not pay attention to the significant and long-term efforts of scientists in search, reflection, discussion, methodologies and conditions of application the new educational technologies. Instead, theorists and methodologists of education often ignore the issues of evaluating the effectiveness of educational technologies created and proposed for use, without taking into account the methodological level and personal positions of practitioners who will apply them. Accordingly, our research is a search for ways to solve the problem of providing the practice of future social sphere specialists professional training with scientifically sound and empirically tested modern educational technologies.

2. Materials and Methods

Analyzing the methods of evaluation of the latest educational technologies by domestic scientists, we can say that most of them use the methods of mathematical statistics and hypothesis testing, evaluating the effectiveness of the latest technologies introduced by them into the educational process. We believe that these methods do not allow to fully assessing the effectiveness of the latest educational technologies, as they require a large number of

statistical materials, a long period of application the technology and significant human impact.

Instead, we propose to use the Delphi technique to evaluate the effectiveness of new educational technologies that is one of the main classes of methods for scientific forecasting and evaluation. This technique is based on the assumption that depending on expert opinions it is possible to decide on the effectiveness of certain criteria of the object of evaluation as the starting point is the opinion of experts engaged in research and development in the relevant field.

This will allow evaluating the level of preparedness of future professionals to do the professional duties not only from the teachers (experts) point of view, but also the employers (experts), who will also be involved in the evaluation process [4, 11, and 12].

Taking into account the significant number of formalized and non-formalized factors that affect the outcome of the assessment of professional training during bilingual education, one of the appropriate evaluation methods may be the analytic hierarchy process (AHP) that is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology [5]. Users of the AHP first decompose their decision problem into a hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently. The elements of the hierarchy can relate to any aspect of the decision problem – tangible or intangible, carefully measured or roughly estimated, well or poorly understood – anything at all that applies to the decision at hand. Once the hierarchy is built, the decision makers systematically evaluate its various elements by comparing them to each other two at a time, with respect to their impact on an element above them in the hierarchy. In making the comparisons, the decision makers can use concrete data about the elements, but they typically use their judgments about the elements' relative meaning and importance. It is the essence of the AHP that human judgments, and not just the underlying information, can be used in performing the evaluations [16].

Therefore, in our case this method involves the decomposition of the problem of evaluation of the latest educational technologies (its hierarchical image) into simpler components and further processing of the sequence of judgments of experts by pairwise comparison. Compromise decisions on the effectiveness of technology are made on the basis of formalized and non-formalized factors, the impact of which on the purpose of the task (assessment of acquired knowledge, skills and obtaining the appropriate level of training in bilingual education) is not described by analytical dependencies.

The degree of advantage of alternative solutions to acquire the appropriate level of training in bilingual education is calculated relative to one, and their sum is equal to one.

The basis for the formation of initial data to determine alternative options for assessing the acquired students' knowledge in the process of implementation of the technology of professional training on a bilingual basis is the need for adequate assessment formation. It includes cognitive-operational, professional-communicative, motivational and reflexive components (the components of bilingual professional communicative competence which is the main goal of described technology), which allows to evaluate professional and communicative training, motivation and reflection of future social sphere specialists who study professional subjects bilingually [19].

It should be noted that the above components of the integrated assessment of the technology of future social sphere specialists' bilingual professional training are not functionally related and are characterized by different parameters and evaluation criteria, which can be divided into two groups: basic and additional. The main parameters of this method according to our research were identified: motivational, reflective, operational and communicational. Additional parameters in the conditions of bilingual learning, which is characterized by the active use of the case method, were identified the following parameters: the intensity of tasks completing during the bilingual cases solving, activity, and ethics of leading the discussion during the execution of bilingual cases.

Note that in the process of other new technologies evaluation, both basic and additional parameters may differ in content and quantity depending on the purpose and objectives of the technology.

3. Results and Discussion

Thus, the main parameters for assessing the effectiveness of the technology of future social workers' professional training on a bilingual basis will be considered:

- The level of students' knowledge of professional subjects, which characterizes the cognitive-operational component - α_1 ;
- The level of students' language competence, which characterizes the professional-communicative component - α_2 ;
- The level of students' motivation to study, which characterizes the motivational component - α_3 ;
- The level of students' reflection, which characterizes the reflexive component - α_4 ;

- The intensity of tasks completing during the bilingual cases solving - α_5 , test/hour;
- The activity during the cases completing within the bilingual learning - α_6 ;
- The ethics of leading the discussion during the completion the bilingual cases - α_7 .

Alternative options for assessing the level of training during bilingual education are determined by a group of experts formed of pedagogical staff representatives of higher education institutions, which train specialists on a bilingual basis, and pedagogical staff of higher education institutions, which do not train specialists on bilingual basis, but who are able to carry it out, and employers.

It is recommended to appoint a group of at least 10 experts to evaluate the indicators.

Evaluation of indicators to determine the resulting assessment of the level of training during bilingual education will be carried out using an expert method of evaluation by qualitative and quantitative criteria: for indicators α_1 , and α_2 - given in Tables 1 and 2; for the indicator α_3 - given in the Table 3; for the indicator α_4 - given in the Table 4; for the indicator α_7 - given in the Table 5.

Parameters α_5 , α_6 are calculated according to the appropriate methods, taking into account the peculiarities of bilingual education and the institution of higher education in which it is carried out.

To decide on the resulting assessment of the level of future specialists' professional training within bilingual education, the following stages are carried out: determining the purpose of assessment, acquaintance with possible assessments and criteria for them, creation of a hierarchical image of the problem, formation by experts initial data tables to determine the priority coefficients of the parameters that affect the final value of the assessment, determining the priority coefficients of the parameters that affect the final value of the assessment by pairwise comparison, determining the local priorities of possible assessment options by pairwise comparison, determining the integrated assessment for each option and selecting the most appropriate.

Thus, in the course of determining the purpose of assessment, the task of obtaining the most adequate assessment of the level of students' professional training in terms of bilingual education is formulated. During the acquaintance with possible assessments and criteria for them, experts get acquainted with the features, techniques and criteria for assessing bilingual education. The next stage is the creation of

Table 1. Criteria for assessing the parameter α_1 (the level of students' knowledge: professional subjects)

| Qualitative (quantitative) criteria for evaluating the parameter | | | |
|---|---|---|--|
| "high" "excellent" ($\alpha_1 \leq 0.7 - 1.0$) | "sufficient" "good" ($0.5 \leq \alpha_1 < 0.7$) | "average" "satisfactory" ($0.3 \leq \alpha_1 < 0.5$) | "low" "unsatisfactory" ($\alpha_1 < 0.3$) |
| The student has a high level of professional knowledge and excellently presents solutions of problems in a foreign language | The student has a high level of professional knowledge and presents professional issues and problem-solutions in a foreign language at a sufficient level | The student has professional knowledge and satisfactorily presents problematic issues and solutions in a foreign language with minor mistakes | The student has a satisfactory level of professional knowledge and presents problematic issues and solutions in a foreign language with a large number of mistakes |

Source: developed by the authors.

Table 2. Criteria for assessing the parameter α_2 (the level of students' language competence)

| Qualitative (quantitative) criteria for evaluating the parameter | | | |
|--|--|---|--|
| "high" "excellent" ($\alpha_2 \leq 0.7 - 1.0$) | "sufficient" "good" ($0.5 \leq \alpha_2 < 0.7$) | "average" "satisfactory" ($0.3 \leq \alpha_2 < 0.5$) | "low" "unsatisfactory" ($\alpha_2 < 0.3$) |
| The student has a high level of reading, writing, speaking and listening skills, communicates in a foreign language on professional topics easily. | The student has a sufficient level of reading, writing, speaking and listening skills, but has some difficulties in communicating on a professional topic in a foreign language. | The student has a satisfactory level of reading, writing, speaking and listening skills. Communication in a foreign language on professional topics is complicated. | The student has a satisfactory level of reading, writing, speaking and listening skills, but communication in a foreign language on professional topics is impossible. |

Source: developed by the authors.

Table 3. Criteria for assessing the parameter α_3 (students' motivation to study)

| Qualitative (quantitative) criteria for evaluating the parameter | | |
|--|--|---|
| "high" "excellent" ($\alpha_3 \leq 0.7 - 1.0$) | "average" "good" ($0.3 \leq \alpha_3 < 0.7$) | "low" "unsatisfactory" ($\alpha_3 < 0.3$) |
| Presence of cognitive interest in innovation processes in the social sphere and mastery of innovations through the process of borrowing and adapting positive foreign experience; formed a conscious need to study professional subjects bilingually and goals of own bilingual professional activity; desire to participate in the creation, implementation and dissemination of international social projects. | A conscious need to study professional subjects bilingually; formation of goals for own bilingual professional activity; desire to participate in the creation, implementation and dissemination of international social projects. | The need to study professional subjects bilingually only for the sake of obtaining a diploma. |

Source: developed by the authors.

Table 4. Criteria for assessing the parameter α_4 (the level of students' reflection)

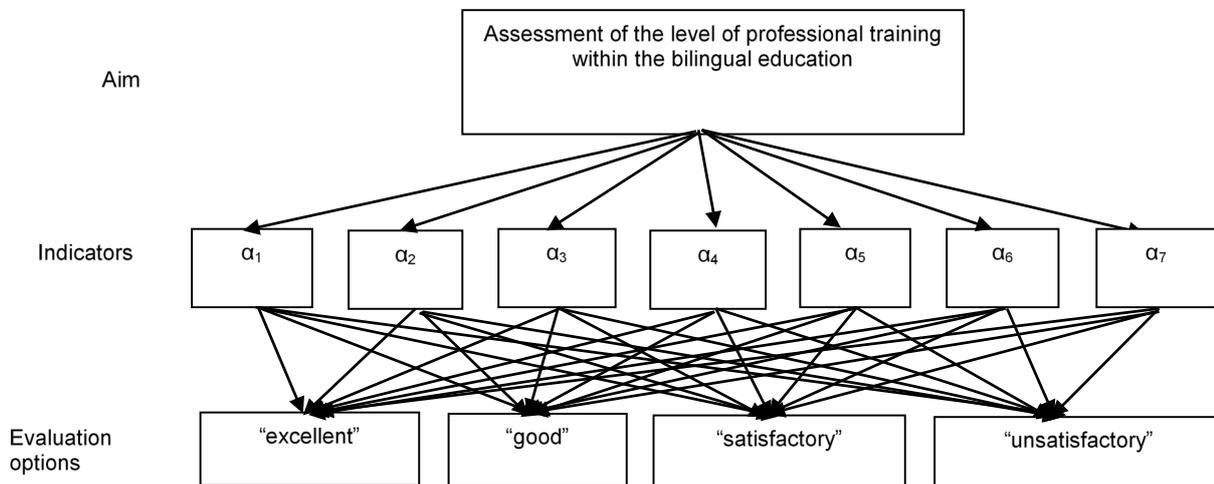
| Qualitative (quantitative) criteria for evaluating the parameter | | |
|--|---|---|
| "high" "excellent" ($\alpha_4 \leq 0.7 - 1.0$) | "average" "good" ($0.3 \leq \alpha_4 < 0.7$) | "low" "unsatisfactory" ($\alpha_4 < 0.3$) |
| Conscious assessment of a future specialist himself/herself as a subject of professional activity; critical self-assessment of their bilingual professional training; the presence of a quick reaction to certain professional circumstances, as well as the ability to think critically, analyze their own bilingual professional activity; ability to find contradictions and shortcomings, means of their elimination, ability to express own thoughts and judgments both in native, and foreign languages. | Conscious assessment of a future specialist himself/herself as a subject of professional activity; critical self-assessment of their bilingual professional training; the presence of a reaction to certain professional circumstances, as well as the ability to think critically, to express their own opinions and judgments in both native and foreign languages. | Conscious assessment of a future specialist himself/herself as a subject of professional activity; critical self-assessment of their bilingual professional training. |

Source: developed by the authors.

Table 5. Criteria for assessing the parameter α_7 (the level of ethics in leading the discussion during the completion of the bilingual cases)

| Qualitative (quantitative) criteria for evaluating the parameter | | |
|--|---|--|
| "high" ($\alpha_7 \leq 0.7 - 1.0$) | "average" ($0.3 \leq \alpha_7 < 0.7$) | "low" ($\alpha_3 < 0.3$) |
| To speak openly, to respect the views of all members of the discussion, to listen to others without interrupting, not to speak too long and too often, at the same time only one person should speak, to adhere to positive ideas in solving situations, do not criticize yourself and others, disagreements and conflicts over ideas should not be directed at a particular person, to give preference to statements in a foreign language. | To express opinions with the consent of group (microgroup) members; not to interrupt; the report can be somewhat delayed; if possible to express in a foreign language and only in the inability to do so to switch to the native language, not to criticize the statements of those who spoke earlier. | The speaker is characterized by short statements, due to the inability to formulate an unambiguous solution to the situation; can afford to criticize other members of the group, interrupt during the discussion due to disagreement with the position of the speaker, mostly in the native language. |

Source: developed by the authors.


Figure 1. Hierarchical image of assessment of students' professional training within the bilingual education

Source: developed by the authors

a hierarchical image of the task, the construction of a three-level hierarchy, in which:

- At the first level - the purpose of assessment of students' professional training on a bilingual basis is formulated;
- At the second level of the hierarchy - the parameters, using which experts assess the feasibility of applying the appropriate assessment, are grouped;
- At the third level of the hierarchy - possible assessment options are grouped.

An example of building a hierarchy is shown in Figure 1.

During the next stage of evaluation, experts form a table of initial data to determine the priority coefficients of indicators that affect the formation of the resulting assessment. The work of experts is organized by the method of collective discussion. An example of initial data table for calculations to assess the level of students' professional training in terms of bilingual education is given in Table 6.

Table 6. Initial data for calculations to assess the level of students' professional training in terms of bilingual education

| The value of indicators according to the options for assessing the level of students' professional training within the bilingual education | | | | |
|--|-------------|--------|----------------|------------------|
| Indicators | "excellent" | "good" | "satisfactory" | "unsatisfactory" |
| α_1 | 0.6 | 0.4 | 0.7 | 0.3 |
| α_2 | 0.7 | 0.3 | 0.6 | 0.4 |
| α_3 | 0.3 | 0.7 | 0.7 | 0.7 |
| α_4 | 0.7 | 0.7 | 0.7 | 0.7 |
| α_5 | 0.82 | 0.92 | 0.85 | 0.91 |
| α_6 | 15 | 17 | 16 | 17 |
| α_7 | 0.8 | 0.4 | 0.7 | 0.5 |

Source: calculated by the authors.

At the end of the next stage of assessment, the priority coefficients of the indicators that influence the decision on the level of students' professional training achieved within the bilingual education are determined. With this aim, in accordance with the hierarchical image of the task (Figure 1), experts at the second level of the hierarchy build a common matrix of pairwise comparisons of 7 x 7, which determines the degree of influence of indicators on the rating of options for assessing students' professional training (alternatives). Expert estimates are placed in a square matrix $m \times m$ in the form of values of the weight of the i -th and j -th elements w_i/w_j , which are determined by assessing the importance of the i -th element in comparison with and j -th (Table 7).

Table 7. Matrix of expert assessments

| Elements | 1 | 2 | ... | j | ... | m |
|----------|-----------|-----------|-----|-----------|-----|-----------|
| 1 | 1 | w_1/w_2 | | w_1/w_j | | w_1/w_m |
| 2 | w_2/w_1 | | | w_2/w_j | | w_2/w_m |
| ... | | | | | | |
| i | w_i/w_1 | w_i/w_2 | | w_i/w_j | | w_i/w_m |
| ... | | | | | | |
| m | w_m/w_1 | w_m/w_2 | | w_m/w_j | | 1 |

Source: developed by the authors.

When filling in the matrix, experts use the gradations of preferences for a pairwise comparison of options for the level of students' professional training achieved in the conditions of bilingual education, shown in Table 8.

Table 8. Gradations of advantages for pairwise comparison of options for assessing the level of students' professional training achieved within the bilingual education

| Quantitative assessment | The degree of advantage of one option over others | Quantitative assessment | The degree of advantage of one option over others |
|-------------------------|---|---|---|
| 9 | A very significant advantage | 1/9 (0,111) | Incomparably worse |
| 7 | A significant advantage | 1/7 (0,143) | Much worse |
| 5 | Essential or strong advantage | 1/5 (0,2) | Worse |
| 3 | Moderate advantage of one over the other | 1/3 (0,333) | Moderately worse |
| 1 | Equal importance | 1 | Equal importance |
| 2, 4, 6, 8 | Intermediate decisions between two adjacent judgments | 1/2 (0,5) 1/4 (0,25) 1/6 (0,166) 1/8 (0,125) | Intermediate decisions between two adjacent judgments |

Source: developed by the authors.

To determine the significance of each element, the eigenvector of the evaluation matrix is calculated.

The components of the matrix's rows are multiplied, the root of the m -th degree is extracted and further normalization of these values is carried out by the formulas:

$$a_i = \sqrt[m]{\frac{w_i}{w_1} \cdot \frac{w_i}{w_2} \dots \frac{w_i}{w_m}} \quad (1)$$

$$X_i = a_i / \sum_i a_i; i = \overline{1, m}; \sum_i X_i = 1 \quad (2)$$

Consider the example of determining the priority coefficients of indicators that affect the determination of the resulting assessment of the level of students' professional training achieved within the bilingual education.

Using Table 3, experts fill in the matrix of expert assessments of the priority of indicators that affect the determination of the resulting assessment of the level of students' professional training (Table 9).

Table 9. Matrix of expert assessments of the priority of indicators that affect the determination of the resulting assessment of the level of students' professional training achieved in the conditions of bilingual education

| Indicators | α_1 | α_2 | α_3 | α_4 | α_5 | α_6 | α_7 |
|------------|------------|------------|------------|------------|------------|------------|------------|
| α_1 | 1 | 0.125 | 0.25 | 5 | 0.333 | 0.333 | 3 |
| α_2 | 8 | 1 | 2 | 9 | 2 | 4 | 3 |
| α_3 | 4 | 0.5 | 1 | 7 | 2 | 3 | 2 |
| α_4 | 0.2 | 0.111 | 0.143 | 1 | 0.2 | 0.2 | 3 |
| α_5 | 3 | 0.5 | 0.5 | 5 | 1 | 1 | 3 |
| α_6 | 3 | 0.25 | 0.333 | 5 | 1 | 1 | 2 |
| α_7 | 0.333 | 0.333 | 0.5 | 0.333 | 0.333 | 0.5 | 1 |

Source: calculated by the authors.

According to formula (1), the geometric mean for each vector of priorities by rows is calculated by multiplying the elements of the matrix of each row and determining the root of the m -th degree (m is the number of elements of each row).

For example, we calculated the geometric mean for the first vector of priorities by the formula:

$$\bar{a}_1 = \sqrt[7]{1 + 0,125 + 0,25 + 5 + 0,333 + 0,333 + 3} = 0,656$$

Similarly, the calculation of the geometric mean values for the other priority vectors is performed. The obtained values of the geometric mean for each of the i -th vectors of priorities are formed by the formula:

$$\sum a_i = a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7$$

Table 10. Estimates of the priority of indicators that influence the determination of the resulting assessment of the level of students' professional training achieved in the conditions of bilingual education

| Indicators | α_1 | α_2 | α_3 | α_4 | α_5 | α_6 | α_7 | \bar{a}_i | X_i |
|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------|
| α_1 | 1 | 0.125 | 0.25 | 5 | 0.333 | 0.333 | 3 | 0.656 | 0.071 |
| α_2 | 8 | 1 | 2 | 9 | 2 | 4 | 3 | 3.203 | 0.346 |
| α_3 | 4 | 0.5 | 1 | 7 | 2 | 3 | 2 | 2.079 | 0.225 |
| α_4 | 0.2 | 0.111 | 0.143 | 1 | 0.2 | 0.2 | 3 | 0.325 | 0.035 |
| α_5 | 3 | 0.5 | 0.5 | 5 | 1 | 1 | 3 | 1.413 | 0.153 |
| α_6 | 3 | 0.25 | 0.333 | 5 | 1 | 1 | 2 | 1.140 | 0.123 |
| α_7 | 0.333 | 0.333 | 0.5 | 0.333 | 0.333 | 0.5 | 1 | 0.438 | 0.047 |
| Sum | 19.533 | 2.819 | 4.726 | 32.333 | 6.866 | 10.033 | 17 | 9.254 | 1 |

Source: calculated by the authors.

Next, according to formula (2), the assessment of the priority of indicators that affect the determination of the resulting assessment of the level of students' professional training, achieved in the conditions of bilingual education is conducted.

For example, we give the calculation of the priority evaluation of indicators of the first vector:

$$X_i = a_i / \sum_i a_i = 0,656 / 9,254 = 0,071$$

The results of calculations of the geometric mean for all vectors of priorities of indicators that affect the determination of the resulting assessment of the level of students' professional training achieved within the bilingual education, are given in Table 10.

We check compliance with the condition - the sum of the received estimates of the priority of indicators X_i should be equal to one.

To determine the coherence of the received expert assessments of the priority of indicators that affect the determination of the resulting assessment of the level of students' professional training, the coherence index is calculated by the formula:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (3)$$

Where: $\lambda_{max} = (\sum_{i=1}^{n1} a_i) \cdot X_1 + (\sum_{i=2}^{n2} a_i) \cdot X_2 + \dots + (\sum_{i=3}^{ni} a_i) \cdot X_n$ - the maximum eigenvalue of the matrix.

Let's determine the maximum eigenvalue of the matrix shown in Table 10. In order to do this, first we should find the sum of the elements of the matrix in the first column; multiply it by the first component of the geometric mean for the first priority vector. A similar procedure is performed for other columns and geometric means:

$$\lambda_{max} = 19,533 \cdot 0,071 + 2,819 \cdot 0,346 + 4,726 \cdot 0,225 + 32,333 \cdot 0,035 + 6,866 \cdot 0,153 + 10,033 \cdot 0,123 + 17 \cdot 0,047 = 7,64$$

Taking into account the symmetry of the matrix, we check the condition $\lambda_{max} > n$, where n is the order of the matrix. Under conditions of absolute coherence of the matrix $\lambda_{max} = n$.

For the given example $\lambda_{max} = 7,64 > 7$. The condition is met.

After calculating λ_{max} by formula (3), we calculate the coherence index of the obtained expert assessments of the priority of indicators that affect the determination of the resulting assessment of the level of students' professional training, achieved in the conditions of bilingual education:

$$CI = \frac{(7,64 - 7)}{(7 - 1)} = 0,12$$

Next, we should determine the coherence ratio of the matrix. To do this, the obtained value of the coherence index (CI) is compared with a random coherence index (RCI):

$$RC = \frac{CI}{RCI} \cdot 100\% \quad (4)$$

To determine the random coherence index, we compare the value of λ_{max} with the value that could be obtained for a completely random set of expert opinions on a scale of 1/9, 1/8, 1/7, ..., 1, 2, 3, ..., 9, but creating an inverse symmetric matrix. The values of the random coherence index (RCI) for the inverse matrix of different sizes are given in Table 11.

Table 11. The value of the random coherence index for the inverse matrix of different sizes

| The size of the matrix | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------------------------------------|---|---|------|-----|-----|------|------|------|------|------|
| Random Coherence Index (RCI) | 0 | 0 | 0.58 | 0.9 | 1.2 | 1.24 | 1.32 | 1.41 | 1.45 | 1.49 |

Source: calculated by the authors.

The value of the coherence ratio of the RC matrix $< 10\%$ is considered acceptable.

For the given example:

$$RC = \frac{0,12}{1,32} \cdot 100\% = 9\%$$

Therefore, the coherence ratio of the matrix $RC = 9\% < 10\%$ is acceptable.

The obtained results of calculations of determining the priority coefficients of indicators that affect the determination of the resulting assessment of the level of students' professional training achieved within the bilingual education (for this example) will coincide with the values of the last column of Table 10.

During the next stage of determining the resulting assessment of the level of students' professional training achieved within the bilingual education, with the analytic hierarchy process technique it is determined the local priorities of possible results of assessing the level of students' professional training for each indicator by pairwise comparison.

With this aim, experts, taking into account the possible options for the resulting assessment of the level of students' professional training, achieved within the bilingual education, form matrices to determine local priorities at the third level of the hierarchy. The formation of such a matrix is carried out by experts for each indicator based on the results of collective discussion. When determining the values of indicators for each possible evaluation option, the criteria given in tables 1-5 are used, and indicators α_5, α_6 are calculated according to the appropriate techniques, taking into account the peculiarities of bilingual education and higher education institution in which it is carried out.

The procedure for determining local priorities of possible options for the resulting assessment of the level of students' professional training, achieved in the conditions of bilingual education, is similar to that described for the previous stage.

In particular, for the given example, a matrix of pairwise comparisons is formed firstly for the indicator of the

level of the operational component of training - α_1 (the level of students' knowledge of professional subjects). Experts using the criteria from Table 1 determine the values of α_1 for each possible assessment option.

Let the experts using the criteria listed in table 1 determined the values of α_1 for each assessment option:

"Excellent" - 0.7;

"Good" - 0.5;

"Satisfactory" - 0.6;

"Unsatisfactory" - 0.4.

Next, we make a pairwise comparison. In this case, when filling the matrix of pairwise comparisons, each row object is compared with a column object.

For the given example and for the first line of a matrix values are defined:

"Excellent"/"Excellent" = $0.7/0.7 = 1$;

"Excellent"/"Good" = $0.7/0.5 = 1.4$;

"Excellent"/"Satisfactory" = $0.7 / 0.6 = 1.16$;

"Excellent"/"Unsatisfactory" = $0.7 / 0.4 = 1.75$.

Similarly, we determine the other rows of the matrix of pairwise comparisons to determine the priority of α_1 (Table 12).

For the specified matrix $\lambda_{max} = 4.28$; $CI = 0.09$; $RCI = 10\%$.

According to the results of experts' work, the calculations, taking into account the criteria defined by the requirements of Tables 2 - 5 and the corresponding techniques for determining the activity during the completion of cases - α_6 , ethics of conducting the discussion - α_7 , local priorities are calculated for the second - seventh indicators of training by pairwise comparison. Methodological approaches in determining these indicators are similar to those used to calculate the indicator α_1 .

Based on the results of this work, a matrix of local priorities is formed for each of the indicators for each possible option of assessing the level of students' professional training, achieved within the bilingual education. For the example under consideration, such a matrix of local priorities has the form shown in Table 13.

Table 12. The results of calculating the priority of the indicator α_1 for each option of assessing the level of students' professional training in terms of bilingual education

| Marks | "excellent" | "good" | "satisfactory" | "unsatisfactory" | $\bar{\alpha}_1$ | $Z_1 = \bar{\alpha}_1 / \lambda_{max}$ |
|------------------|-------------|--------|----------------|------------------|------------------|--|
| "excellent" | 1 | 1.4 | 1.16 | 1.75 | 1.298 | 0.304 |
| "good" | 0.71 | 1 | 0.5 | 0.25 | 0.547 | 0.128 |
| "satisfactory" | 0.86 | 2.0 | 1 | 0.5 | 0.964 | 0.226 |
| "unsatisfactory" | 0.57 | 4.0 | 2.0 | 1 | 1.462 | 0.342 |
| Sum | 3.15 | 8.40 | 4.66 | 3.5 | 4.27 | 1 |

Source: calculated by the authors.

Table 13. Matrix of local priorities according to certain indicators for possible options for assessing the level of students' professional training in terms of bilingual education

| Possible options for assessing the level of students' professional training | Local priorities of indicators for each possible variant of an estimation the level of students' professional training within the bilingual education | | | | | | |
|---|---|------------|------------|------------|------------|------------|------------|
| | α_1 | α_2 | α_3 | α_4 | α_5 | α_6 | α_7 |
| "excellent" | 0.304 | 0.144 | 0.139 | 0.067 | 0.456 | 0.512 | 0.475 |
| "good" | 0.128 | 0.144 | 0.340 | 0.533 | 0.311 | 0.300 | 0.268 |
| "satisfactory" | 0.226 | 0.319 | 0.404 | 0.133 | 0.151 | 0.138 | 0.184 |
| "unsatisfactory" | 0.342 | 0.393 | 0.117 | 0.267 | 0.072 | 0.050 | 0.073 |
| Sum | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Source: calculated by the authors.

During the final stage of determining the level of students' professional training achieved within the bilingual education, an integrated assessment is determined for each assessment option and the most appropriate one is chosen among them.

For this purpose, a table of source data is formed to determine the integrated estimation (S) for each i-th variant of the estimation. Next we should find the product of the values of the priority coefficients of indicators (X_i) (the second level of the hierarchy) and the priority vector of local indicators (Z_i) (the third level of the hierarchy) in accordance with the expression:

$$\begin{aligned}
 S_1 &= (X_1Z_1^1) + (X_2Z_2^1) + \dots + (X_nZ_n^1) \\
 S_2 &= (X_1Z_1^2) + (X_2Z_2^2) + \dots + (X_nZ_n^2) \\
 &\dots\dots\dots \\
 S_m &= (X_1Z_1^m) + (X_2Z_2^m) + \dots + (X_nZ_n^m)
 \end{aligned}
 \tag{5}$$

Where: n is the number of indicators by which the assessment of the level of students' professional training achieved in terms of bilingual education is performed; m - the number of possible options for assessing the level of students' professional training, achieved within the bilingual education.

In this case $S_1 + S_2 + \dots + S_m = 1$.

Comparing the obtained integrated grades (S_i) for each i-th variant of evaluating the level of students' professional training – the largest value of the indicator $S_i = S_{max}$ determines the most appropriate evaluation of the level of students' professional training achieved within the bilingual education.

In the conditions of the considered example from the generalized Tables 8 and 10 initial data for determining the integrated assessment for each possible option of evaluating are formed (Table 14).

According to the data and using the given ratio (5) we will carry out calculation of integral estimations S for each possible variant of an evaluation of the level of students' professional training achieved within the bilingual education:

$$\begin{aligned}
 S_1(\text{"excellent"}) &= 0.71 \cdot 0.304 + 0.345 \cdot 0.144 + 0.225 \cdot 0.139 + 0.035 \cdot 0.067 + 0.153 \cdot 0.456 + 0.123 \cdot 0.512 + 0.047 \cdot 0.476 = 0.262; \\
 S_2(\text{"good"}) &= 0.251; \\
 S_3(\text{"satisfactory"}) &= 0.271; \\
 S_4(\text{"unsatisfactory"}) &= 0.217.
 \end{aligned}$$

The most adequate option for assessing the level of students' professional training, achieved within the bilingual education, in case of used indicators and criteria is the "satisfactory" level.

This method of evaluation cannot be considered absolutely reliable in terms of formalized and non-formalized factors influencing this process, because it is based on certain criteria and indicators. However, it makes it possible to assess informal processes at a certain level of formalization.

Adding other indicators and criteria, it can be used to most reliably assess such a complex phenomenon as

Table 14. Initial data for determining the integrated assessment for each possible option of evaluating the level of students' professional training within the bilingual education

| Indicators α_i | α_1 | α_2 | α_3 | α_4 | α_5 | α_6 | α_7 | |
|--|------------------|------------|------------|------------|------------|------------|------------|-------|
| Values of priority coefficients of indicators X _i | 0.071 | 0.346 | 0.225 | 0.035 | 0.153 | 0.123 | 0.047 | |
| Z _i values for training level assessment options | "excellent" | 0.304 | 0.144 | 0.139 | 0.067 | 0.456 | 0.512 | 0.475 |
| | "good" | 0.128 | 0.144 | 0.340 | 0.533 | 0.311 | 0.300 | 0.268 |
| | "satisfactory" | 0.226 | 0.319 | 0.404 | 0.133 | 0.151 | 0.138 | 0.184 |
| | "unsatisfactory" | 0.342 | 0.393 | 0.117 | 0.267 | 0.072 | 0.050 | 0.073 |

Source: calculated by the authors

the level of multi-vector students' training, achieved within a bilingual education.

4. Conclusions

- Thus, we have substantiated the possibility of evaluating the future social sphere specialists' bilingual professional training using the Delphi method.

- It was clarified the advantages of the specified method that allows to come to a conclusion about efficiency of future social sphere specialists' bilingual professional training, taking into account the conclusions of the main experts: teachers and employers (AHP technique).

- The structured assessment of the level of bilingual competence of future social sphere specialists is presented in the unity of cognitive-operational, professional-communicative, motivational and reflexive components. Evaluation as a research method is implemented on the basis of studying the level of students' knowledge of professional subjects (α_1), their communicative competence (α_2), the motivation to bilingual education (α_3), the level of students' reflection (α_4), the intensity of tasks completing (α_5), personal activity during completing bilingual tasks (α_6) and ethical principles of dialogical teaching methods (α_7).

- As a result of the evaluation carried out in this study, a common matrix of pairwise comparisons of the degree of indicators influence (factors) on the rating of options for assessing the level of students' professional training achieved within the bilingual education (alternative) is constructed. Local priorities of possible results assessing of the level of students' professional training for each indicator by their pairwise comparison (from α_1 to α_7) were determined by analytic hierarchy process (AHP).

- At the last stage of the evaluation, an integrated assessment and selection of the most appropriate option for assessing the bilingual training of future social sphere specialists was determined. It is established that the most adequate option for assessing the level of students' professional training within the bilingual education is satisfactory.

- Among the prospects for further studies of bilingual training, we see the development and applying innovative teaching methods.

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