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## **Mathematical Approaches of Creating to Educational Content Formation in the Professional System Computer Training of Blind People**

Current approaches for structuring learning material develop under the influence of new means of information presentation. Transition to the computer learning tools initiated research areas that develop various approaches to knowledge representation in a concise, compact and easy for perception form. The logical structuring, productive models and semantic networks are used increasingly in the process of simplifying and optimizing the transmission of educational information that is facilitating the development of new methods of formalization didactic text (A. Gagarin, S. Titenko, P. Brusylowskiy). According to these approaches the professional computer training content of persons with visual impairments must correspond to socially integrated didactic purpose, which is to achieve an appropriate level of socialization and rehabilitation of people with visual deprivation through their professional computer training.

The analysis on the design professional computer training content of persons with visual impairments identified the relevance of research to outline the features of its formation. In the process of presentation and formation of educational content should be considered the following physiological characteristics of individuals with visual deprivation as fragmentation, verbalism and reduced rate of learning [Тулашвілі 2012]. Therefore, one of the effective solutions of the professional computer training content is to maximize the incorporation of natural features of persons with visual impairments.

The unity of the substantive and activity sides of professional computer training persons with visual disabilities must be provided by a combination of elements of educational training when along with the mastery of professional knowledge and skills the initial experience is formed for individuals with visual deprivation the computer technologies for manufacturing product of professional activity.

Each process, according to N. Lazarev [Лазарев 2003: 62] before becoming a reality is first seen as a system of links and content of the learning process. In accordance with the pairwise review of the polysystemic simulation principle the educational process system and professional computer training content system at the first level of decomposition it could be distinguished two main sub-

systems categories: subsystem of teaching and the learning process subsystem. The proposed approach pairwise review of categories of possibilities and reality between the system learning process and system training content was laid in the basis for models of didactic learning content formation on the micro level of professional computer training people with visual impairments.

Due to the inability of both visually impaired and blind individuals directly perceive illustration of the process of studies the considerable amount of learning content should be submitted for independent processing aids using modern information technology adaptation (MITA). This approach involves increasing of the learning process part in the system of professional computer training, which leads to review and adaptation of learning content and, accordingly, the upward redistribution of content that corresponds to the learning process.

According to the psychological aspects of training persons with visual disabilities to the usage in their work computer technologies individual because of defects performs perceptual actions using tactile and auditory perception of information about the properties of learning objects. In the system of professional computer training content can not be applied learning activities where replacement of visual perception is impossible with auxiliary means of MITA. In addition, the learning process needs help and support from faculty. Such interaction promotes mutual communication links within the learning environment, which in its turn enhances the mechanisms of socialization education individuals with visual deprivation.

Based on the system characteristics polysystemic content [Лазарев 2003: 83] on the micro didactic level, during the educational process of professional computer training persons with visual impairments the question of simultaneous implementation of two teaching tasks are given: to achieve didactic aim of a certain training level under a given applied field and provide the development of compensatory adaptations as a mandatory factor of success of training individual with visual deprivation and mastery of the list of identified competencies.

The effective of the educational process on the didactic micro level can be expressed in the functional model  $R$  of learning activities of individuals with visual deprivation that reveal the influence of the training content parameters on the formation of mental image of the object.

$$R = f(P, Q, S) \quad (1)$$

where  $P (P_1, P_2, \dots, P_n)$  is a set of educational content elements that reveals the professional competency requirements for the application of computer technologies;

$Q (Q_1, Q_2, \dots, Q_n)$  is a set of structure variations of learning objectives;

$S (S_1, S_2, \dots, S_n)$  is a set of characteristic signs of a mental image of the object which labor learning object (LO) consists of.

Training activities R on didactic micro level we offer to define as the process of mastering individual with visual deprivation totality of elements of educational content Pi that reflect the demands of professional competence for the application of computer technologies. Each content element Pi contains learning objectives Qj that consist of combinations of characteristic features Si of labor object mental image, and reveal the conditions, tools and techniques for working individuals with visual impaired person with computer technologies through the knowledge and skills that is needed to be learned. Determination of the characteristic features Si that form the lowest structural hierarchical level of the educational process requires the analysis of elementary sensory-perceptual and psychomotor activities that are available to individual with visual deprivation in the process of usage the computers which he can master using mnemonic memory mechanisms (grouping the characteristics, determining relationships, establishing structure).

Selection peculiarities of training content for professional computer training people with visual impairments involve the formation of educational material to provide effectively its perception in condition when the education individual has damaged visual analyzer or completely eliminate its use in the processes of sensory perception. The selection of the educational content at each stage of educational training process can be described with the formalization process of educational material. The formalization of the educational content of professional computer training we suggest to perform using the following operators of content formation:

- on the stage of theoretical studies with verbal and information methods

$$P \in \{S|Q(S)\} = \{Q|Q(p) \cap S|S(p)\}; \quad (2)$$

namely, the notion of the labor object P (content of professional competence) belongs to the expression tag Q, which revealed a characteristic feature of the object S, that is the set-thesis statements, which dealt with the labor object and both the set of characteristic features of the labor object;

- on the stage of practical training in the process of reproductive education

$$Q \in S(p) = \{S|S(Q) \cap Q(p) \neq 0\}; \quad (3)$$

namely, the characteristic feature of S revealed in practical exercises Q, implementation of which forms the image of the labor object P, i.e., the set of characteristic features of the labor object which is opened in practical exercises, reveal the object of labor.

The basic condition for the formation of the content of practical work is that the number of the units shall not exceed the cortege dimension. To form the structure combinations of LO in each learning objectives we apply the polynomial generatrix function [Бардачов 2002: 211]:

$$\sum_{k=1}^n \binom{n}{k} x^k = (1+x)^n. \quad (4)$$

According to our calculations, binomial coefficients will give the combinations of possible structures.

We expand the principles of this approach on the example of the identification of learning tasks possible structures that are formed from three LO S1, S2, S3, in condition of their connection to the number  $n = 5$ , when following characteristic features was determined:

S1 occurs only once, S2 – not more than two times and S3 – once or twice.

Then generatrix function takes the following form:

$$(1 + S_1 x)(1 + S_2 x + S_2^2 x^2)(S_3 x + S_3^2 x^2).$$

According to our calculations, we get:

$$S_3 x + (S_1 S_3 + S_2 S_3 + S_3 S_3) x^2 + (S_1 S_2 S_3 + S_2 S_2 S_3 + S_1 S_3 S_3 + S_2 S_3 S_3) x^3 + (S_1 S_2 S_3 S_3 + S_2 S_2 S_3 S_3 + S_1 S_2 S_2 S_3) x^4 + (S_1 S_2 S_2 S_3 S_3) x^5.$$

From the solution we have the following possible values of LO that can be formed in the process of drafting the educational tasks with determined condition:

$$n = 1: [S_3];$$

$$n = 2: [S_1 S_3], [S_2 S_3], [S_3 S_3];$$

$$n = 3: [S_1 S_2 S_3], [S_2 S_2 S_3], [S_1 S_3 S_3], [S_2 S_3 S_3];$$

$$n = 4: [S_1 S_2 S_3 S_3], [S_2 S_2 S_3 S_3], [S_1 S_2 S_2 S_3];$$

$$n = 5: [S_1 S_2 S_2 S_3 S_3].$$

One of the advantages of proposed method for determining the content of learning tasks for the learning process in the practical training of persons with visual impairments is the simplicity of its usage. This approach automates the process of the content formation using applied mathematical software. Suitably qualified teacher define the major LO that provide the aim achievement concerning the mastering of the techniques with computer technology and make their calculation and determine the characteristic features of the LO in the interconnection system between actions that are studied.

## Conclusions

On the basis of the proposed approaches for determining the educational content of professional computer training people with visual impairments it can be concluded that the existing traditional system content in regulatory training

documentation could be adapted easily enough, using the principle of correspondence to individuals with visual deprivation.

We believe that the proposed formal approach to learning content formation as the polysystemic system is more efficient because it does not require additional complex mathematical apparatus that allows to realize simple algorithms of content structure for training people with visual impairments. This creates an opportunity for the application in teaching technology principles of individual and differentiated approaches that is based on special educational administration of educational and developmental process of professional computer training people with visual impairments.

## Literature

Бардачов Ю.М. (2002): *Дискретна математика: підручник*, „Вища школа”.

Лазарев М.І. (2003): *Полісистемне моделювання змісту технологій навчання загальноінженерних дисциплін: монографія*, Харків.

Тулашвілі Ю.Й. (2012): *Особливості побудови змісту професійної комп'ютерної підготовки осіб з порушеннями зору [Електронний ресурс]*, „Теорія і методика професійної освіти: Електронне наукове видання” № 3, <http://www.tmpe.gb7.ru/docs/3/12tulpvi.pdf>- Назва з екрану.

## Abstract

Paper presents relevant areas for further development of outlined problem are the development of methods for logical structuring, production models and semantic networks to simplify and optimize the procedures for transferring of educational information, improving educational and developmental process.

**Keywords:** mathematical approaches, creating educational content, training of blind people.