A Flexible Methodology Based on Multimedia Training Systems

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Abstract—Article are devoted to the flexible training methodology descriptions based on multimedia training complexes which covered subject area of the specialty and help to form competencies needed at the working place.

Index Terms—Acmeology, competencies on the workplace, flexible training methodology, multimedia training complex

I. INTRODUCTION

In the information economy and the increasing demands of the labor market to the employees competence the task of customization and rapid reconfiguration raised before the educational system under the requests of employers. This problem can be solved through the use of multimedia training systems and learning process based on the concept of flexible methodologies, constructed in such a way that the changes are welcome, but uncertainty is recognized [1,2].

Then the purpose of research is pedagogical instruments structure and content of multimedia training complex (MTC) design to provide a flexible learning methodology.

Object of the research is the processes of training based on the MTC. Subject is the flexible learning methodology to competences formation while working with the MTC.

Let’s consider some features of the flexible methodologies for training with the MTC:

- training providing in a short iterations. The shorter the iteration, the more often you can check received competences and change of the trajectory of training. Teacher will lead the training process and monitoring if trainees have received the target the knowledge and skills;
- incrementality of the training. For each iteration a trainee receives a new or undeveloped deepens competence;
- self-organizing of training process. Practice shows [4] that only the self-organizing teams are able to respond flexibly to change;
- adaptivity of the process. In the traditional approach to the e-learning training organizing process is regulated in advance and determined by the curriculum and in proposed approach process during the training in collaboration between teacher and student with a focus on labor market demands.

II. MAIN RESULTS

Approach which proposed by the authors to flexible learning methodologies can be described by the following conceptual statements.

Statement 1. The training process is based on the acmeologic paradigm, which presupposes the individualization of learning, giving to the student the possibility of the formation and achieving their educational and professional goals.

Essence of the acmeologic approach based on complex research and restore the integrity of the subject who passing the stage of maturity when his (her) individual, personal and subject-activity-related characteristics are studied in solidarity, in all relationships and mediation in order to facilitate his (her) achievement of higher levels, which may be achieved by each subject [3].

Generalizing the concept of the acmeological paradigm we can represent it as such basic postulates.

1. The idea of the paradigm is that the process of education of individual should be provided with the maximum assistance in discovering their individual potential and creativity, help to climb on top of their own (acme — top).
2. The advantages are that this approach have a strong creative focus and used in the humanitarian sphere as well as in other various art schools and studios.
3. With the respect to object individual approach is used.
4. The teacher must be a person of great personality. Not only special but also psychological preparation and good knowledge of people is required.

Features of the acmeologic technologies are based on the internal guidelines of the subject on its design and implementation. Technologizing become the object of personal area of the development, the ways and conditions of the workplace, professional activity and development.

The main objective of the acmeologic technology is to generate and secure in the self-identity of person demanded need for self-awareness, self-development and self-actualization, achieved by the using of special moves and techniques of personal and professional identity self-actualization.

Many authors [3] include the following technologies in acmeologic: gaming (didactic games, technologies of game modeling); psychological consulting technology; training technology; technology of development training; technology of person-centered learning; project method.

Basing on acmeological paradigm and using we have an opportunity to build flexible, most personalized training program that focuses on professional competencies which needed in the workplace forming.

Statement 2. Approach focuses on the development of specific academic disciplines and formation of the professional competences.
Statement 3. The educational process is constructed using flexible learning technologies.

The educational process is proposed to construct by the analogy with the technology of Scrum [4] (one of the Agile process, which allows you to focus on delivering the most important from the trainee’s point of view, property in the shortest possible time). In addition, it allows us to form target competences quickly. Just as in the Scrum technology – for the process we can use the description

1 'WHO' want 'WHAT' and 'WHY'
transforming the "WHO" – as a role which carries a specialist in the workplace, "WHAT" - as the relevant production functions, and "WHY" – as the individual competencies.

Then the will have the form shown in Fig. 1

It is proposed to distinguish between trainees-users of the MTC based on roles: the goals of MTC using; the style of the MTC using; level of the previous knowledge in subject area, level of knowledge at the beginning of study. Another role-coordinate goes through official role on the working place (in the enterprise, company, etc.).

For each role is necessary to formulate questions about the way of discipline’s study. For example:
What trainee should do next?
What kind of mistakes he can avoid in the process of learning skills?
What may confuse the trainee?
What information should the trainee see or have?
In what form will information be given to the trainee?
What form of the control we use?

We shall use the typology of knowledge presented in the paper [5] under the ITS development based on flexible learning technologies. Bloom identifies the following types of knowledge.
1. Knowledge of titles and names.
2. Knowledge of the titles and names sense. The first two groups provide an opportunity to understand and correct activity, as understanding the sense of titles and names trainee to remember and correct use their.
3. Factual knowledge, which are often recorded in the form of scholarly texts, observations, recommendations, such as accident prevention, worldly-wisdom, proverbs.
4. Knowledge of definitions’ system, which is a testament to the theoretical training. In the training process, all four groups of knowledge can be combined into a group of reproductive knowledge.
5. Comparative knowledge.
6. Knowledge of opposites, contradictions, antonyms, etc.
7. Associative knowledge.
8. Classification knowledge.
9. Causal knowledge, knowledge of causal relations, knowledge of bases.
10. Processual, algorithmic, procedural knowledge.
Knowledge’s 9 - 10 are the basic in practice. This group may include technological knowledge which gives possibility to get the planned result.
11. Technological knowledge. This may be a relatively simple knowledge of some operation in technological chain, or a complex of knowledge, allowing achieving goals with the lowest possible cost.

Knowledge’s 9-11 can be attributed to the knowledge of a higher, third level. Higher, the fourth level of knowledge includes the following kinds of knowledge:
12. Probabilistic knowledge. Such knowledge we need in cases of uncertainty, lack of available knowledge, incorrectness of available information or if necessary, to minimize the risk of error in the decision making process. This knowledge is about the patterns of the data’s distribution, significant differences and degree of the hypotheses validity.
13. Abstraction Knowledge. This is a special kind of knowledge, which operate on idealized concepts and objects that do not exist in reality. This is the theoretical level of knowledge.
14. Methodological knowledge is the knowledge about reality transformation, scientific knowledge about an effective activity building. This knowledge are from the highest, fifth level.
At all levels of knowledge mastering we can distinguish four types of skills:

1) the ability to recognize objects, concepts, facts, laws, models;
2) the ability to act according to the patterns, algorithms, the rules;
3) the ability to analyze situations, to isolate the main and build procedures from the mastering operations that helps to obtain the solution of the test task;
4) the skills and ability to find original solutions.

Based on the mentioned above typology of knowledge we build a system of competencies, which are necessary to form for the trainee’s successful activity at the workplace.

**Statement 4.** The approach is implemented on the basis of information training space (ITS), which consists of a multimedia training complex (MTC) for each of the disciplines of the subject area (specialty). The general form of such a space is shown in Fig. 2.

To enter the ITS we should organize the space of the gateways or the entry points based on the structuring of disciplines, topics (within discipline) and competencies (production functions, tasks). One variant of such a structuring of this space is presented in Table. 1.

Thus, the trainee has the opportunity to enter the ITS (directed by the teacher or independently) trough the discipline or topic within it. Another possible gateway for entry is professional competences, which trainee will need at the workplace. We propose a method for constructing scenarios of MTC including such steps.

1. Formulated of the MTC’s goals set: a subset of targets MC1 – trainee’s target MTC, MC2 - goal of the MTC developer (the teacher).

2. The problems which are solved by the trainees at work with the MTC are defined and formulated - the set MZ of tasks ZI.

The desired results are described: for the trainee – the set MR1 of results R1J, and for the developer (the teacher) - the set MR2 of results R2J for each task ZI.

![Figure 2. Informational and training space of the specialty on the basis of the MTC](image)

**TABLE I.**

<table>
<thead>
<tr>
<th>Disciplines</th>
<th>Topics</th>
<th>Competencies (function or tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Д1</td>
<td>T11</td>
<td>K11, K12, K13, K14, ..., K1n</td>
</tr>
<tr>
<td></td>
<td>T12</td>
<td>K21, K22, K23, K24, ..., K2n</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯</td>
</tr>
<tr>
<td>Д2</td>
<td>Tm1</td>
<td>Km1, Km2, Km3, Km4, ..., Kmm</td>
</tr>
<tr>
<td></td>
<td>Tp2</td>
<td>Kp1, Kp2, Kp3, Kp4, ..., Kpn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯ ⋯</td>
</tr>
</tbody>
</table>

5. The set of criteria forming for assessing the impact on trainees different types of information.

6. The pieces of content for each of the tasks of the MTC are prepared:
   - structuring and determining of the content structure based on selected sources;
   - decomposition and distribution of the original sources - formation of the set MIO of information objects IOg;
   - rekomposition - drafting a new content based on fragments of the original sources formation of structures of representation of information objects in a sequence IOg required for specific tasks ZI;
   - structural and stylistic editing;
   - constructing of sequences performed on the bases of specific outcomes and criteria.

Set MIO of information objects include: regular text, hypertext, hypermedia; tabular information; illustrative materials - graphics, photographs, diagrams, explanatory drawings, cartographic information; fragments of filming and video recording; audio recording; music, recorded and recreated on the notes; animated sequences (given the opportunity to present the physical, technological, environmental and other processes); computer interactive materials: interactive charts and graphs (the user determines the form of tables and charts, lists of indicators, the nature of values); interactive animation (allow for transitions to different stages of the processes that are in the animation, change the various parameters of the objects animation) that allow empirically determine the difference in the development of these processes.

7. Developing material on the levels (if necessary), and the formation of the specifications [5]:
   - which multimedia components will be developed for the most effective solution of tasks;
   - nature of access to it;
   - author's wishes on design;
   - keywords, and navigation through the material;
   - necessary multimedia applications.

8. At the stage of the script creating sketches of the illustrations and animation pieces prepared, process of the sources selection for both video and sound design multimedia resource. begins
**Statement 5.** The MTC itself is composed from the knowledge fragments, tasks to diagnose the level of competencies components formation. It has an architecture that contains cognitive, reproductive and creative levels of development of the competencies mastering. Each level consists of the sections set that include fragments of content submitted through the teaching instruments of various complexity levels.

At the cognitive level there are: presentation section - the training course presentation with time-lapse organization of information, analytical section, including: an article done in encyclopedic style, which carried a description of ideas, approaches, educational, historical facts with links to all materials available in the section, and devoted to the issue theme, materials, revealing in detail the content of the question (presented in the form of text, audio and video); Illustrative section - examples illustrating and explaining the provisions of the theoretical part; CASE; reference section - links to sources of information in printed, electronic libraries and Internet sites, reference numeric and text information (e.g., specifications of equipment, a list of strategies, the list of posts, so on), specifying for example type "what does the example", "what do the trainee need to see in it", "what is a result of the example"; examples of the results obtained during work illustrations’ (for example, the business plan of the enterprise).

At the reproductive level, there are following sections: practical, seminars, testing (the list of tests about the topic) and a portfolio which contains a set of model results on the studied subject.

On the creative level, we have the following sections: "Micro project and creative work" - contains a list of micro-projects and creative assignments. "Year paper (project)" - contains guidelines and examples of coursework (projects) in the frame of one course or set of courses (complex project). "Scientific problems (engineering problems)" contains a list of scientific problems (engineering problems), relevant to the subject area. "ISRТ" contains a list of individual research assignments.

**Statement 6.** The educational system is generally oriented on the formation of a trainee's professional competencies.

We propose to describe competence as combination of two models - the content model of competence and profile model of the employees’ competence. For each subject, thus forming two sets of models which describe competencies. These two sets of models, determine the composition, structure, content and training instruments for the MTC. Content model of competence includes the elements of knowledge skills and abilities which are developed by authors in [6]

The elements of competence are the knowledge, skills and abilities formed on the basis of the principle of the MTC content development: “Through the development and intensification of the cognitive competencies to the formation of professional competencies.” Profile model of the employees’ competencies is based on the structuring of the competency space in functional areas and names of competencies, as well as the required level of the competencies development.

It is necessary to construct the ITS, based on such principles for skills formation.

1. The principle of the training non-linearity. Procedure of work with the MTC is implemented as a nonlinear dialogue, where learning procedure is aimed at creating an environment in which the process of acquiring skills by trainees is running. In this case, training is an interactive process of active and productive creativity. The mechanism for implementing this principle implies the implementation of the following provisions:

a) The nonlinearity of the teacher and student dialogue, carried out on the basis of random movement in the selected fragment of the subject area. Methods of a dialogue organization can be developed in two directions. Firstly, students can pre-view the content of the knowledge fragments which reflect the conceptual-semantic unit of the subject area (presentational section of the MTC). In the process of the pre-view, they form their own questions, which are then discussed with the teacher or on the forum. This allows the student to formed new knowledge (patterns), by establishing his own proper structures of these knowledge elements (concepts, terms, objects, their properties, etc.). Secondly, if students had no opportunity for pre-view of the MTC content, in the early stages of the work over the frame containing a fragment of knowledge is established, based on his cognitive map. Then, students are encouraged to production questions (using the Socratic method), allowing them to acquire new knowledge of the subject area.

2. The principle of resonance topologically corrects actions. The idea of “awakening training” on the basis of resonance effects can push the trainee into one of the ways of his (her) own development. This principle aims at overcoming the chaos in the learning process without having to overcome it, only through transformation into a process that generates fragments of competencies. The chaotic nature of the information space scanning trainees learning system is a motion to the nonlinear perception of student information.

The mechanism for implementing this principle is based on building a series of information packages in the form of images, problematic situations, mikroideas that are presented in the creative section of the MTC and suggest the possibility of creative of the student’s development. Thus, to overcome the chaos ensured by the fact that the teacher is ruled the trainee trough information packages and comes with him in a resonance. Intuitive thinking is chaotic, but in the course of its innovative impulses awakened, thus chaos is determined, as the student is not forced to memorize, but are encouraged to participate in the dialogue.

3. The principle of self-organization. M. Rubinstein and A. Firstenberg in [5] specify that between the extreme states of chaos and order system can self-organize into groups that follow both internal and external rules of their behavior influencing neighboring groups and being influenced by them. To developing in a constantly changing environment, the system must establish a balance between stability (order) and instability (changes): to be firm but not frozen in one state and be enough to switch quickly from one state to another as a result, even very little change in the environment.

The process of skills building with using of the MTC is based on the hypothesis that complex systems adapt better, where they are in a state of order on the border of chaos (on the edge of chaos), in which the measure of the
constant stability is closely connected with the flexible adaptability. In other words, in this case, evolutionary, planned, slow and orderly manner changing inside order process, rooted in casual mentality, strengthened by the revolutionary, rapid innovations, big achievements which embedded in unplanned, spontaneous way of thinking.

Intention to make the process of the competencies mastering stability and more efficiency in the way of solving practical problem leads to the idea of management self – organization of the process, at least, the ability to activate self-organizing processes during the training and their further coordination.

Formation of the competencies in the MTC area based on flexible training technologies can be based on the matrix presented in Table. 2 (a fragment of a template for the MBA program).

Statement 7. Teacher helps the trainee to form individual trajectories of the discipline study.

- The procedure of forming a flexible individual learning path consists of the following steps:
- Entrance knowledge control;
- The definition of "educational role";
- Identification of the trainee’s priority roles at the working place.

For this trainee’s roles determination he (she) has to fills out a questionnaire in which allocates the priorities that are then this information putting into basis in a system of role functions motivation.

Statement 8. Interaction between teacher and trainee is built with using of the MTC and the methods of coaching.

Authors agree with the interpretation of A. Chanko in [6] that coaching is a technology of partnership in professional training or technology of correction and improving skills in professional activities.

Coach is the professional, situated close to the trainee and able to transfer to him effectively not only the algorithm but the method of a working operation implementation, technology, features of the production process, but also the personal experience of this work, attitude to their work.

Coaching as a technology of professional skills transferring is effective when the trainee acts by himself, but the samples and standards (both at the level of simple operation, and at the behavioral level, at the level of the standard professional personality), he demonstrates to him by the teacher.

Map of the coach-teacher competencies may include three groups of competencies: personal characteristics, metaskills, professional knowledge and skills [7].

Interaction between coach-teacher and trainee takes place through decision of three problems’ types: stereotype (include work on a given algorithm with unique set of well-known previously selected complex operations), diagnostic (include activities in accordance with a specified algorithm, which contains the procedure of partial decisions design and using of the operations) and heuristic (include work on a complex algorithm that includes the procedure for solution constructing). Each of these problems can be solved by using one of the types of skills:

- sign and practical - the ability to perform the action of objects moving in space, changing of their shape and other;
- sign and mental - the ability to perform actions with mental images of objects. Require advanced systems and concepts of mental activities such as analysis, classification, generalization, comparison, etc.;
- symbolic and practical - the ability to perform actions with the signs and sign systems;
- symbolic and mental - skills regarding mental operations with signs and sign systems.

As a result, a competency at different levels of complexity - from the stereotypical action using the sign and practical skills to the heuristic action based on the symbolic and mental abilities is formed.

<table>
<thead>
<tr>
<th>Roles on the working place</th>
<th>Specialist’s function</th>
<th>Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F1</td>
<td>F2</td>
</tr>
<tr>
<td>Chief of HR department</td>
<td>Planning</td>
<td>Organization</td>
</tr>
<tr>
<td></td>
<td>2. Ability to define and evaluate information about finance system functioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. ...</td>
<td>30. Skills to define and preventing of conflicts</td>
</tr>
<tr>
<td>Chief of finance department</td>
<td>Planning</td>
<td>Organization</td>
</tr>
<tr>
<td></td>
<td>2. Skills to define and evaluate information about finance system functioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. ...</td>
<td>28. To control budget system</td>
</tr>
<tr>
<td>Chief of IT department</td>
<td>Planning</td>
<td>Organization</td>
</tr>
<tr>
<td></td>
<td>2. Skills to manage project team work</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. ...</td>
<td>25. Abilities to evaluate and ground project of IT implementation</td>
</tr>
</tbody>
</table>
III. CONCLUSION

The Improving the efficiency and quality of the training process can be achieved by constructing flexible learning methodology with using multimedia teaching complexes. These technologies are focused at forming professional competencies of the trainee based on a content model of competencies and model of the worker competency profile.

Synthesis of the multimedia training systems architecture is appropriate to carry out as construction of the tool covering which contains didactic instruments, allowing the students to carry information work on elements of information space. Authors determined the components of the MTC which used in the process of architectural design. In the process of MTC’ architecture developing we need to approximate the functionality of the complex to the possibilities of the training process managing flexible, individual interaction between trainees and teachers. For this purpose we have proposed to build an information training space based on a set of multimedia training complexes for each disciplines within speciality. Further research in this area requires solving a number of problems - scientific and engineering, among which are: development and justification of models for technological platform choice, development of technologies and documenting the process of the MTC design, formation of the knowledge bank, copyright protection for the product.

Mentioned methodical approach was tested at the Kharkov National University of Economics. MTC was developed for the disciplines at area of specialities “Multimedia Technology in Publishing” and “Business Administration” and based on implemented in the learning process of flexible teaching methodologies proposed by the authors.

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