

CONCEPT OF BUILDING A MANAGEMENT SYSTEM FOR DEVELOPING ADULT FOREIGN LANGUAGE SKILLS

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Abstract-In the modern world, there is an urgent need to raise the quality of communication between people speaking different languages. This will allow them to understand each other better, communicate more freely, to facilitate mobility of people and eventually result in closer cooperation. Therefore, we need to create an automated system fast and effective teaching another language that uses the mini-max criterion, which provides the maximum possible result to the minimum required amount of effort on the part of the student. The essence of the approach is to replace the description in our native language with visual objects using the latest technology for implementing this approach. This means that an intermediate language is introduced, not tied to any of the known languages. The Purpose of the research is to develop a methodology (technique) for applying the Visual Approach in the educational environment created on the basis of a distributed management system to accelerate the acquisition of foreign language skills by adults. The system provides the process of controlling the formation of speech skills to a threshold level, allowing the transition from language learning to its improvement and acceleration. On the basis of this new generation using continuous evaluation of the competency level of the trainee, visual models, and information technology, got them a new incarnation, opens a new direction in construction a new version of Learning Management System - E-AMS.

Keywords: Continuous evaluation; Electronic acquiring management system; Learning curve; Structural-visual method; Synergistic effect.

I. INTRODUCTION

The aim of our project is to develop a methodology for applying the Visual Approach in the educational environment. This will help both young people and older people to accumulate knowledge and acquire skills that will enable them to become more independent and responsible in judgments and actions and be open in relationships with others in the global community.

Traditional training programs and institutions are quite inefficient and very costly to meet these challenges. In addition, unlike schoolchildren and young students, adult education requires a special personalized approach, taking into account the current level of their language skills, general education, work and professional skills, personal and family situation, origin, general cultural background and other factors. In fact, each student needs to make a personal curriculum and constantly adjust it based on their results, successes and failures, systematic and regular classes, and many other factors, up to the daily routine and the load of household and industrial activities.

Therefore, it is necessary to create a new generation of tools that provide not only the structuring and transfer of knowledge from teacher to student, but also quantitative and qualitative management of the level of skills and competencies of the student and the parameters of their real progress along the learning curve. This is especially important in the field of adult education and retraining. As it was shown in the works of Bandura [1], learning occurs in the process of interaction of the external environment, human behavior and personal properties which influence each other greatly. At the same time, the previous experience influences usual logarithmic growth and therefore the learning curve acquires characteristic curves with several minima, the so-called "barriers of overcoming" [2].

The use of modern information and communication technologies (ICT) together with the use of effective models of obtaining skills will reduce and even completely eliminate the impact of such barriers and, accordingly, accelerate training and increase its success. System Analysis and Visual Modeling tools used in the project will help to ensure such integration.

They make it possible to effectively coordinate the structure of the subject area involving different branches of human activity, each with its own terminology, methodology and established paradigm. The proposed approach would involve multidisciplinary and multisector

groups to examine the complexity of adult learning and retraining, identify necessary changes, and identify risks and obstacles to their implementation.

To ensure the adaptability of the learning process and improve its efficiency, it is necessary to use the most modern technologies such as Big Data, augmented reality, cloud services, voice and speech technologies, powerful mobile computing devices, high-speed communication lines that allow you to work with multimedia content in real time. These technologies and devices have appeared or have reached the desired parameters only recently, so it was impossible to develop and implement the new generation of systems before.

At the moment there are no technical limitations to create a new generation of systems, and it is the complexity of combining in one project knowledge, theories and technologies from completely different branches of science, industry and educational sphere that does not allow to apply existing technical solutions in a new way, which will be offered in this project.

II. FEATURES OF DEVELOPING LANGUAGE SKILLS IN E-AMS

The integration of migrants, including refugees, into many member States of the European Union and associated countries has been a challenge for many years both for public authorities and for local communities.

Thus, even during the first wave of emigration, which occurred after the collapse of the Soviet Union in the early 90s of the last century, there was a great demand in effective language training and teaching tools to educate adult immigrants who faced a great challenge of acquiring foreign language skills. Immigrants used to attend special six-month language courses held by native speakers. However, they failed to speak a foreign language fluently even though they had been living in the foreign country for more than a year. In addition, there was a lack of appropriate textbooks that could serve as a tool for high quality and timesaving language acquisition.

To date, the number of refugees and migrants has increased dramatically and has become a humanitarian disaster. And even the most developed countries of the world are not able to solve this problem. Despite the experience and the desire to solve it, the situation is only getting worse and many countries simply refuse to accept refugees and migrants. For example, the official German language courses in Germany in 2017 were attended by about 340 thousand refugees, but even half of them could not score enough points on the final test. Out of the 339 578 migrants, who took up language learning, only 289 751 managed to take the exam. At the same time, only 48.7% of them passed the exam successfully and reached the sufficient level of German (B1). The same or even worse results are observed in other EU countries. Other regions of the world, including the United States, Canada and other English-speaking countries, have serious problems with language learning.

New generations of teachers and students are searching for new effective and timesaving methods and techniques to use in teaching. Unfortunately, traditional teaching techniques don't meet learners' and teachers' expectations, since the formal speech approach does not provide real conditions for the formation of psychophysiological mechanisms that ensure the competent use of the language.

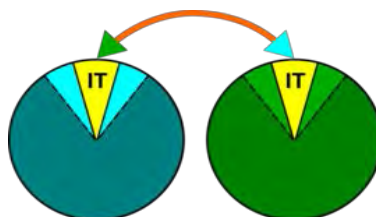


Figure 1. Interaction between native speakers of different languages within the same subject area.

Figure 1 shows a simplified diagram of the interaction of speakers of different languages within the same subject area. For example, if the work on a joint project in the IT sphere is carried out by specialists from different countries, their linguistic interaction should be considered not in the field of the entire language space, but only in the part that relates to their

professional activities. Similarly, it makes no sense to train refugees for a long time in all the intricacies of a new language, it is necessary to give them the language skills necessary for a new profession as soon as possible and to ensure open and direct communication within this subject area.

The main form of communication is the transmission of the necessary meaning through dialogue. The minimum possible fragment of the dialogue (Figure 2) is an elementary Question, the simplest Answer and the Delay between them. In case of a conversation between partners speaking different languages, an extra delay Δ is inevitably added to the process of their dialogue, related to the internal translation of the information received from the language of the question to its presentation in their minds in their native language. The same process occurs in the opposite direction when forming the answer.



Figure 2. A fragment of dialogue between native speakers of different languages.

Considering the same processes from the point of view of training, or rather developing language skills in a foreign language, we can safely say that either the teacher or any training system should strive to compensate as quickly as possible for this internal delay $\Delta \rightarrow 0$. Then the language zone of the new language will be formed in the consciousness of the learner, or in other words, the curve of learning a foreign language will reach the point of "spontaneous speaking". That is, the construction of the ideal process of learning a foreign language is reduced to the creation of such learning tools that guarantee the complete elimination of the delay $\Delta = 0$ in the shortest possible time.

It takes at least 100 hours to develop spontaneous speaking skills. However, we do not imply continuous speaking, but daily performance of 30-minute tasks twice a day (morning and evening), taking into account the interval repetitions. Such a schedule should be created by the joint efforts of an adult student and a teacher at least in the first 40 days of the process of developing language skills. The habit developed during this time will allow trainees to reach the level of spontaneous speaking depending on their abilities in about 3-6 months of continuous training, using a Structural-Visual Method. The implementation of this approach will not disrupt the continuity of learning.

Structural-visual method in linguistics is a representation of the structure of information of the subject industry and linguistic knowledge in graphical form using color to encode the most common patterns. Thus obtained visual models replace text explanations (rules) in the formation of appropriate skills and abilities. Visual symbols and visual properties of model elements (shape, size, relative position, frames, font, underscores, etc.) are used to encode other important properties and parameters of system elements. This approach in linguistics allows to transform information about the structure of the language from verbal to visual form, and thus eliminate the shortcomings of the grammatical approach.

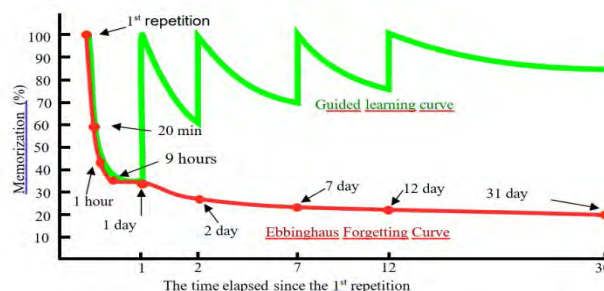


Figure 3. Comparison of Guided and Unguided Learning Processes.

The process of forgetting information is fast enough, but Electronic Acquiring Management System will ensure the formation of a logarithmic dependence of the learning curve,

will avoid the "barrier of overcoming" and prevent the transition of training in the mode of retraining (Figure 3).

The proposed E-AMS is aimed primarily at the formation of listening and speaking skills, which are fundamental [8, 9, 10] and make up about 75% of the total volume of necessary competencies (Figure 4). As we can see, written speech makes up less than 10% of the total language competence, so it is not the goal to set and reach in our system. In addition, there are several variants of perfectly working Internet systems that are specifically designed to study grammar in writing, and can be easily added to the proposed E-AMS.

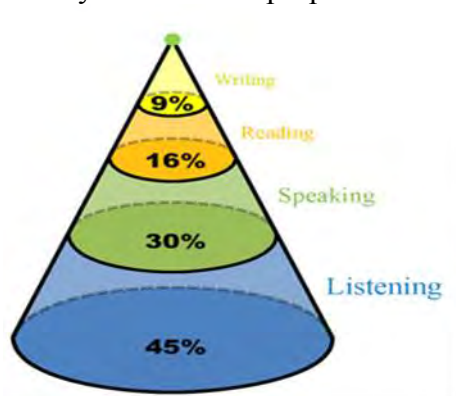


Figure 4. Distribution of language competences.

In fact, the description of the process of obtaining the necessary result is reduced to mathematical dependence:

$$Rez = F_{\min} \max (Li, Sp, Re, Wr) \approx 350 \text{ hours,}$$

where: Li – listening, Sp – speaking,

Re – reading, Wr – writing.

Moreover, particular importance is attached to the correlation between $R_{(Li+Sp)}$, $R_{(Li+Re)}$ and $R_{(Li+Wr)}$, because the process of developing language skills is not determined by simple trial, and works only if the learner seeks as accurately as possible to imitate the sounds of the new language.

Therefore, typical lessons in E-AMS (Figure 5) lasting 25-30 minutes each should consist of:

pre-recorded introductory part (3-5 minutes), in which the teacher in the native language of the student explains the content of the lesson;

main part (about 20 minutes) which can be carried out in a virtual classroom for the chosen profession and uses the main components of the SVM - Visual Dictionary and Visual Models;

final part (5-7 minutes) is a grammatical training based on maps-tables, perfecting the language skills up to the required level.



Figure 5. Schematic diagram of an E-AMS typical lesson structure.

This learning approach helps to develop foreign language communication skills in the shortest possible time along with simultaneous development of the grammatical system of the language. Only in this way foreign language thinking can be formed quickly. In this case, learners begin to express their thoughts competently and freely, it is easier to perceive the speech of people around them and gradually become an active participant in the communication process. As a result, we can see not only coexistence and contact of the old and the new language in the mind of the learner, but also the direct influence of the experience of the native language on an

accurate perception of reality in another language, the direct interpenetration of naturally digestible and consciously learned language material, which is particularly important when teaching adults. As experience shows, unsystematic mastering of a foreign language is extremely unproductive.

In addition, it should be well understood that the main contradiction that prevents the creation of effective tools for rapid mastery of another language is the logical closure between the language as a tool for managing activities and the language as a subject of activity. The essence of this problem is that if the student does not know how to make a proposal that conveys the desired meaning, then he will not be able to do it. But if he knows the rules how to do it, then he is still not able to do it, since the area of the brain responsible for speaking is busy thinking about this rule.

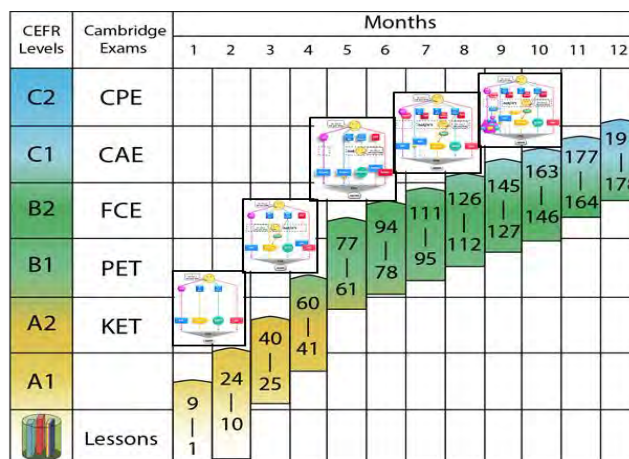


Figure 6. Approximate order of use of Visual Models in accordance with the learning curve.

Thus, the development of a new language is a transition to a new way of thinking, causing speech production in accordance with the grammatical schemes and semantic connections of the system of the studied language. It is here that the epistemological roots of the proposed CBM are located (see Figure 6).

III. STRUCTURE OF ELECTRONIC ACQUIRING MANAGEMENT SYSTEM

Now the conceptual solution has been found. Innovative training system allowing to operate the process of developing professional and language skills of adults has been created and it combines the following:

- methodological principles, grounded in the works of Bandura and Galperin [5];

- Structural Visual Method [6] that forms a synergetic effect, both in the initial phase of foreign language learning, and at the stage of “overcoming the barrier”;

- using the achievements of the ICT sphere as a tool to ensure the implementation of learning objectives with continuous monitoring of the current state and obtaining a guaranteed learning result in a finite number of steps.

The generalized structure of E-AMS is a distributed control system and consists of (Figure 7):

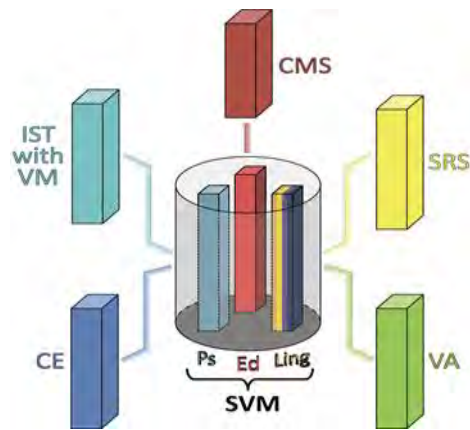


Figure 7. E-AMS generalized structure.

Interactive Speech Trainers (IST) that use visual vocabulary and Visual Models of the language being acquired [7];

Content Management System (CMS);

Speech Recognition and modeling System (SRS);

system of Continuous Evaluation (CE) of the current language competence in combination with Virtual Assistant (VA).

Currently, the development of the main components of the E-AMS is carried out in four interrelated areas:

further improvement of the visual approach modeling the structure of the mastered activity on the basis of interactive visual dictionary and visual models;

creation of a set of interactive speech simulators with elements of augmented reality, video lessons and training exercises corresponding to different levels of students' competence;

setting up a system of continuous evaluation and management of the learning process in real time;

CMS development in the Content Management System, repositories of training materials for video lessons and mechanisms for managing the synthesis of training exercises are formed.

The last two directions of development of EAMS are connected exclusively with Big Data. The language system is not limitless and, in fact, is quite observable, but its full use presents numerous opportunities for combining, which until recently exceeded all possible system conditions, and only now the use of Big Data technology can successfully solve these problems.

In turn, the system of continuous evaluation and management of the educational process provides the configuration of the entire system at three main levels:

interface of speech simulators, where all the achievements in the field of gamification, socialization and cooperation should be fully provided for the translation of the educational process into a modern, intensive and effective format;

teacher, where the current statistical analysis of the results of the language activity of each student is carried out;

continuous measurement and management of the learning process at each specific point of the learning curve or retraining in real time, which provides an individual approach to the parameters of a particular skill training, as the speed of the exercises is not set by external instructions or the interface of the training program, but by the abilities, capabilities and level of competence of each individual student.

Currently, the first prototypes of interactive trainers using visual models have been created. To implement the full functioning of the AMS, 3-7 standard simulators are required at each of the increasing levels of language proficiency in accordance with the program of developing learners' professional. The total number of trainers is about 25.

The proposed approach makes it possible to form a speech zone on the basis of learning not separate words and grammar, but to use typical situations, dialogues, short sentences,

collocations, speech patterns and even slang. A General view of the process of formation of a new speech zone is shown in the Figure 8.

Teaching materials should be presented in about 90 video tutorials and about 60 training exercises. The corresponding Common European Framework of Reference (CEFR) test system is quite suitable as control tests when moving from one level to another.

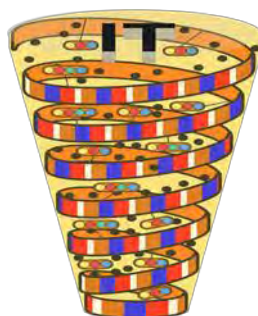


Figure 8. General view of a new speech zone formation process in EAMS.

E-AMS is created on a modular basis, so each element of the system can be effectively used separately. At the same time, the synergetic effect of the joint use of all elements of the system and the integration of additional developments can significantly exceed the capabilities of existing analogues and will help to solve very important social problems, including the problems of training in professional skills and language adaptation of refugees and migrants.

IV. CONCLUSION

The main properties of E-AMS were repeatedly discussed at high-level conferences held by such organizations as IEEE, IEDRC, IATED and received positive feedback [11, 12, 13, 14].

The conceptual solution is based on the use of mechanisms of system analysis and unification of scientific concepts of representatives of the Soviet school and scientists of Western countries against the background of the technological leap of the second decade of the 21st century.

The use of modern ICT, together with the use of effective models of skills acquisition, accelerates learning and increases its success by transferring the synergetic effect to all stages of language skills formation, especially to the “barriers overcome” to accelerate the return to the expected competence curve.

To solve our problem, we use the minimax criterion, which provides the maximum possible result for the minimum required amount of effort on the part of the student. The process of developing language skills using the proposed E-AMS is almost the same as the expected competence curve, and its minor fluctuations will be compensated by a system of continuous evaluation in real time (Figure 9).

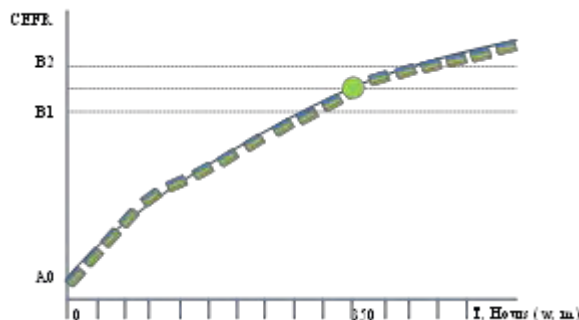


Figure 9. Process of developing language skills using the E-AMS.

During the work of the system, a detailed statistical analysis of the results is carried out, dynamic learning curves of each adult learner are displayed, tables of coefficients are substantiated and indicators of the speed of speech skills formation are specified, levels of speaking from

primary to spontaneous speaking are determined in accordance with the scale of CEFR. Figure 10 displays the authors' ideas mentioned above.

This project is a joint project of researchers from the Lebanon, United States, Japan, Ukraine, and Belarus. The authors of the project emphasize that it does not contradict the existing system of assessment of language competencies in Europe, but rather contributes to their importance. The location of the proposed E-AMS is shown in Figure 11.

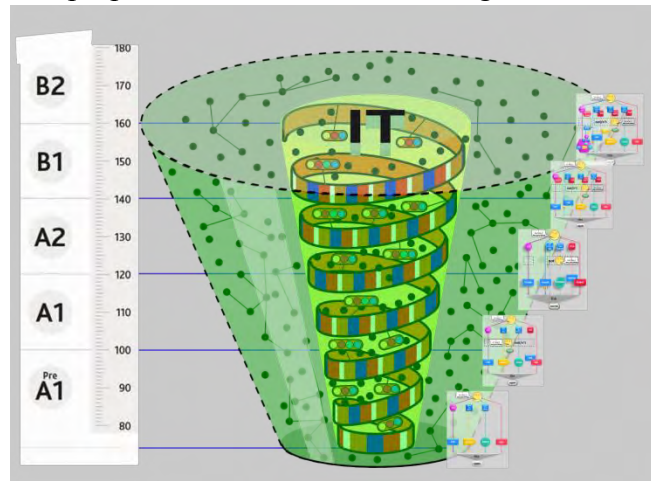


Figure 10. Visual representation E-AMS.

The project is planned in accordance with the priorities of the European Commission (topic: Addressing the challenge of migrant integration through ICT-enabled solutions) under the Horizon 2020 program.

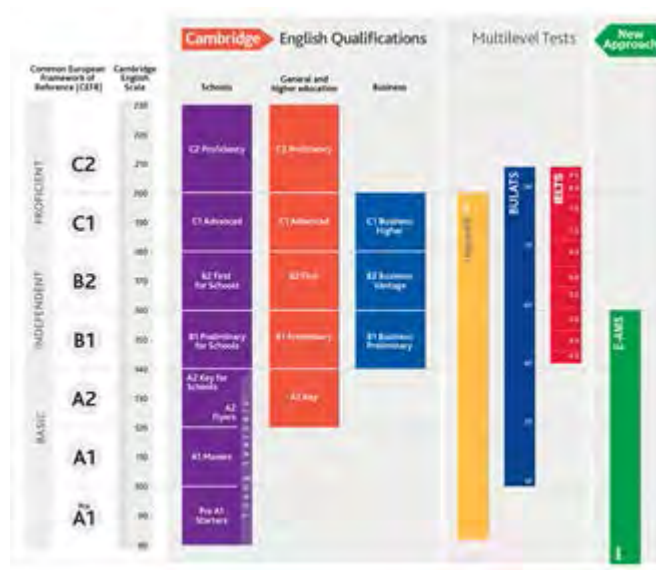


Figure 11. Location of the proposed E-AMS.

The resulting solutions and tools will actively contribute to the efforts of public administrations at EU, national and local levels to manage the integration of migrants. They will develop and deploy the necessary processes and services to effectively identify and engage migrants. They will also facilitate communication with migrants and their access to services such as community language teaching, training, employment, education and social security in host communities.

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