

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

186,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Concept of a Management System for the Formation of Adult Language Skills on the Example of English

Aliaksei Dadykin

Abstract

The relevance of the research topic is determined by the need to create a new technology for applying the most effective methods of forming speech skills of foreign language proficiency in adults. The research is interdisciplinary and is located at the intersection of psychology, pedagogy, linguistics, information technology and systems analysis. The goal is to implement a visual approach in an electronic educational environment to accelerate the acquisition of a new language by adults. The peculiarity of the approach is the logical relationship of the entire language system, time-saving learning of the material and the dynamics of the use of language structures. The proposed training management system is a distributed system for managing the formation (acquisition) language skills of adults. In the course of the system's operation, a detailed statistical analysis of the results is carried out, dynamic learning curves of each student are displayed, coefficient tables are justified and indicators of the formation of speech comprehension skills by ear are specified, and speaking levels are determined from the initial to the threshold level of spontaneous speaking. The conceptual solution of such a system has been obtained, and its use will lead to a synergistic effect in the learning process and, as a result, the accelerated creation of a new language zone in the student's mind. The system provides a process of controlled formation of speech skills to a threshold level that allows you to move from learning a language to improving it in the process of using it. Continuous evaluation of the level of competence of the learner leads to the formation of logarithmic learning curve and compensates for the prerequisites of the degradation of a learning curve in the direction of loss of expected competence, which opens up a new area of search in building learning management systems.

Keywords: continuous evaluation, learning curve, learning management system, synergistic effect, visual approach

1. Introduction

English dominates the world as the language of science, international communication, and information technology. The need for ubiquitous English language teaching continues unabated, and over time, everything gets stronger. Education

systems being one of the most conservative systems of society do not keep up with scientific and technological progress and social changes do not have the capabilities and resources to solve the problems of quickly preparing a large number of adults for language, social and industrial activities. In addition, the coronavirus epidemic has befallen the whole world has aggravated all social problems many times over. We live in a time when the main state structures simply do not cope well with the duties assigned to them:

health care systems fail to perform their functions and medical staff are forced to show real heroism to rescue people;
education systems are not able to train people in professional and language skills in a sufficiently short time as a result of which the migration crisis turns into a catastrophe and this is becoming especially relevant now during the pandemic.

The transition to remote learning is a forced measure, but the distance education currently practiced cannot show decent results primarily due to the tendency to use the same approaches for both classroom and distance learning. The main task today is the transition from distance education to full-fledged e-education. However, we cannot use traditional educational technologies that will not bring the desired effect, but will only undermine faith in new approaches. Therefore, it is necessary to develop such teaching methods that will most fully meet the emerging educational needs and will form the basis of electronic educational systems.

Existing learning management systems (LMS) are mainly aimed at managing standard educational processes for the transfer of theoretical knowledge to the education system and are not suitable for monitoring and managing the acquisition of primary language and labor skills. In addition, they usually have a rather complex interface both on the client side and on the part of the administrator and the creator of the training content. These features almost completely exclude the possibility of using LMS as a tool for self-study at home, for example, in a typical situation of migrants and refugees. And filling such a training system with content for different

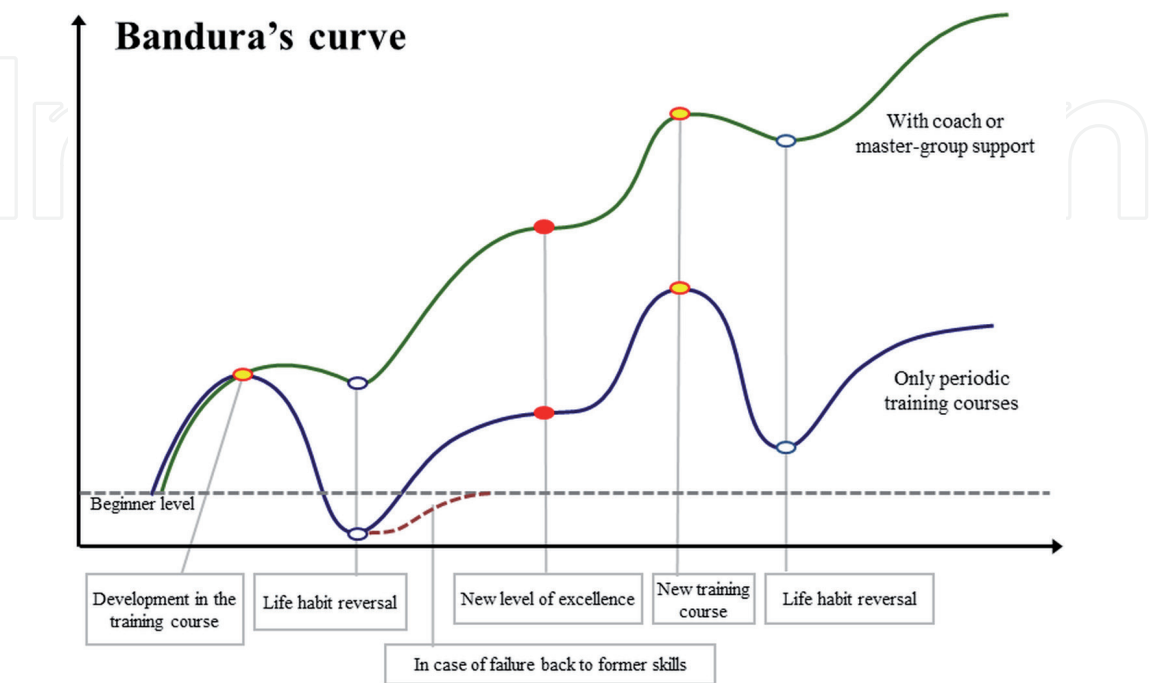


Figure 1.
Comparison of learning curves for retraining.

countries, languages, activities and professions is a task of great complexity, which requires too much time and resources to solve.

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 his 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 influence of the external environment, human behavior and the properties of his personality. At the same time, the presence of previous experience leads to the fact instead of the usual logarithmic growth, the learning curve acquires characteristic curves with several minima the so-called “barrier to overcome” (**Figure 1**).

The use of modern information and communication technologies (ICTs) together with the use of effective models of skills acquisition will reduce and even completely eliminate the impact of such barriers and, accordingly, accelerate learning and increase its success. System analysis and visual modeling tools will help ensure such integration. At the moment, there are no technical limitations for creating a new generation of systems, and only the complexity of combining knowledge, theories and technologies from completely different branches of science, industry and education in one project does not allow us to combine the existing technical solutions that will be proposed in this project in a new way.

2. Prerequisites for creating a system for acquiring language skills

The ability to communicate in a foreign language is most quickly achieved through progressive mastery of labor skills while simultaneously developing the entire language system, which very accurately and in a timely manner implements the speech skills of a new language necessary for the student in his daily activities. This is the only way to quickly form thinking in a foreign language, in which the presentation of thoughts takes place in accordance with the norms of the new language system acquired for its expression in everyday speech. Modern research is interdisciplinary and is located at the intersection of systems analysis, ICT, psychology, linguistics and activity theory.

The relevance of the topic is determined by the need to create a new detailed technology for the formation of speech skills in the electronic management system for teaching a foreign language to adults. In the third decade of the XXI century, both methodological and technological prerequisites have matured for the realization of this goal. Technologies and tools created under their influence are directly influenced by a changing culture, and their further use is a way of accumulating and transmitting social knowledge.

Technologies using Big Data, artificial intelligence, machine learning, speech recognition and synthesis systems, as well as augmented or virtual reality create the technological basis that forms the basis for creating new LMS. In turn, the Korzybsky structural differential, the theory of activity of Leontiev and his followers, the system of interval repetitions based on the ideas of Ebbinghaus, the theory of formation of Bandura skills and the Structural-Visual Method (SVM) form the core of the Electronic language Acquisition Management System (e-AMS).

2.1 Typical systems for teaching a foreign language

There are a huge number of offers on the market to solve the problem of managing foreign language teaching. These are general-type LMS, programs and

applications for learning languages, both for individual aspects of the language and for the entire language as a system. In the course of research, a large number of such programs, applications and services were studied and tested. Let's focus only on the general features of entire classes of programs and services, mentioning only the most typical examples.

LMS of general type, such as Moodle, Docebo, Edmodo, Schoology and many others, are created mainly for the organization of the educational process within the framework of the classical path of knowledge acquisition. They are designed to facilitate and simplify the activities of the teacher, methodologist, and management of the educational institution and contain a large number of properties, functions, and tools. They are difficult to set up and master and are designed for use within large organizations (schools, universities, large firms). They perform their functions well, but it is extremely problematic to adapt them to manage the individual process of obtaining a specific skill.

Specialized programs due to the low methodological competence of programmers in most cases are created for the study of words. The use of interval repetition methods in such programs and services as Memrise, Mnemosyne, Anki, Supermemo, etc. allows you to quickly memorize poorly structured information, which provokes users to spend a lot of time on rather unproductive activities for memorizing the translation of words out of context and structure. This is also the sin of most services and social networks for language classes such as Duolingo, Busuu, LinguaLeo, etc.

The closest prototype is programs for complex language learning such as Rosetta Stone, Tell Me More, Babbel, etc. They offer tools for developing most language skills and are designed more for self-directed language learning. These programs do a good job with their functions, due to the direct, untranslated method laid down in their basis. But they have their own limitations and shortcomings that slow down progress and force people to quit classes. The main one is the same direct method, which reduces exercises to repeated repetition without understanding the logic of the language.

The situation is aggravated by the complexity and congestion of the interface, the non-obvious methods of training and the rather high cost of such programs. Such programs are created by programmers for people who are good at computers and are poorly adapted for use by ordinary people who are not familiar with computer technology. In addition, the presence or absence of a native language in the interface and content of the program does not guarantee the absence of translation, thinking and comprehension of the material in the native language, especially for people who have already had many years of experience in translation training.

To achieve direct understanding and completely untranslated thinking is possible only by combining the ideal balancing of the complexity and pace of training with the abilities and capabilities of the student by controlling the learning curve, which is one of the most important tasks of the controlled formation of language skills. As the review showed, at the moment there are no programs that allow you to block thinking in your native language and guarantee quick acquisition of direct thinking skills in another. This goal is not only not implemented, but it is not even put.

2.2 Features of language skills formation in e-AMS

New generations of teachers and students have, as before to wonder how to make the process of mastering the language quality and time-saving, what method to use in teaching. As sad practice shows, mechanical mastery of the language,

unfortunately, does not provide any quality or effectiveness of the results, i.e. the ability to complete communication. This result is more natural than accidental: the focus of traditional communication techniques on practical purposes is actually unjustified, since the formal speech approach does not provide real conditions for the formation of psychophysiological mechanisms that ensure the competent use of the language.

2.2.1 Approach to measuring speech skills in a foreign language

The mechanism of speaking any language is set genetically, and it can not be simply changed. As the outstanding Russian scientist academician Shcherba said “We can banish the native language from textbooks and classes, but we cannot banish it from the student’s head” [2]. **Figure 2** 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 skills of a new profession as soon as possible and to ensure full 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 3**) is an elementary Question, the simplest Answer and the Delay between them. In case of a conversation between partners speaking different languages an additional 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.

Considering the same processes from the point of view of training or rather the formation of 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

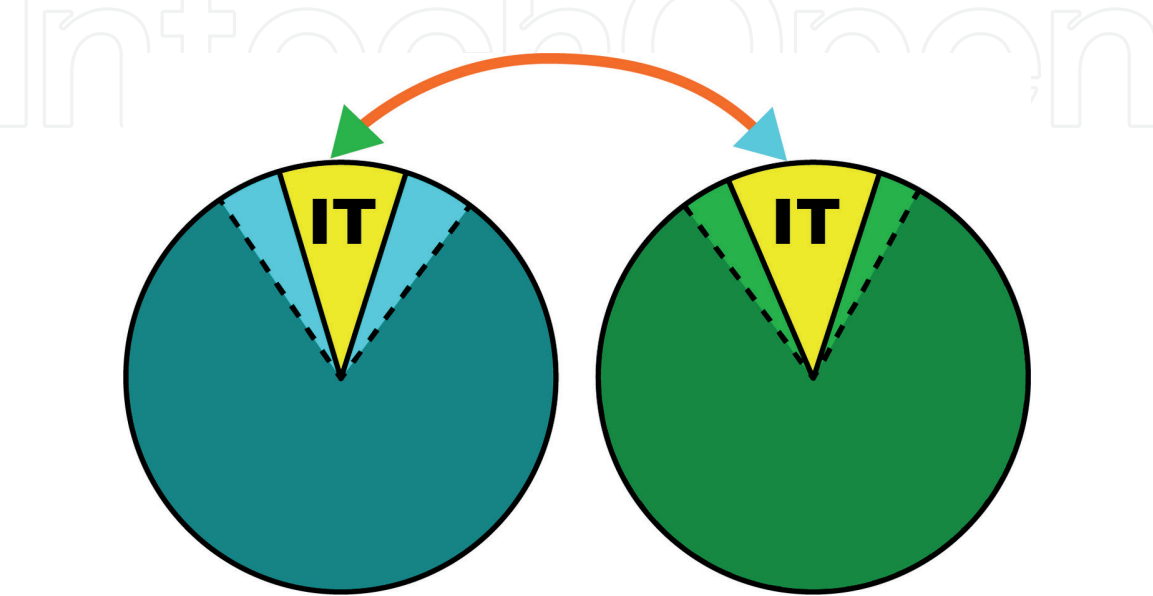


Figure 2.
Interaction between native speakers of different languages within the same subject area.



Figure 3.
Fragment of dialogue between native speakers of different languages.

construction of the ideal process of learning a foreign language is reduced to the creation of such learning tools guarantee the complete elimination of the delay $\Delta = 0$ in the shortest possible time.

It takes at least 100 hours to master the skill of spontaneous speech. This means that we are not talking about continuous speaking, but about completing 30-minute tasks daily, taking into account interval repetitions twice a day (in the morning and in the evening). 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 language skills development process. The habit developed during this time will allow the student to reach the level of spontaneous speech, depending on his abilities, after about 3–6 months of continuous training, while making extensive use of the structural-visual method. Implementing this approach will not disrupt the continuity of learning.

2.2.2 Structural-visual method in linguistics

For most people instead of a speech mechanism a translation mechanism works introduced by the school approach to language learning, which is physiologically a different process, the opposite of language. To start the speech mechanism, you need to create a database of sound images, speech-motor images and direct connections of these images with meanings.

The translation mechanism prevents the creation of such links and leads to the formation of links between the signs of one and another language. Therefore, after school experience even in non-translation courses on the communicative method or when using programs like “Rosetta stone” most students choose their usual translation strategy. At the same time, acts of thinking and understanding are performed in the native language, and externally language actions (listening, speaking, and communication) in the target language.

Teachers do not yet have the tools to identify, measure, and change the type of mental process, and to find out what process is actually going on. And it is almost impossible to explain these subtleties to the student in order to obtain self-esteem, especially since these processes are unconscious and do not lend themselves to conscious regulation. The relations between processes in reality, sensory and motor processes in the psyche and language are extremely difficult to explain and poorly understood, and have long been the subject of disputes and disagreements between various sciences and scientific directions. Therefore, consciously explaining to the student what, how and why he needs to do is not a solution to the problem. As a result, the habit of the student, developed earlier in the course of a long experience of studying at school or other institutions, still takes over.

Psycholinguistic studies have shown that the use of grammatical rules for planning and controlling utterances slows down speech activity [3], since the same areas of the brain and mental processes that are needed for understanding or producing speech are involved in operating with the rules.

The Structural-Visual Method, which replaces complex text rules with corresponding visual structures in the form of drawings, diagrams and diagrams, allows us to get out of this contradiction. The application of SVM in linguistics consists in the use of graphical means to demonstrate the structure of an English sentence and how it is constructed in various forms with extensive use of color for encoding meanings.

Replacing verbal Rules with Visual Models (VMs) allows you to make significant improvements to any training method. Instead of hindering language activity, SVM allows you to consciously manage the training of professional skills and very accurately control the process of forming language skills. This removes the acquisition-learning contradiction and turns the grammar monitor into a grammar scaffold. Visual models allow you to quickly launch the speech mechanism and provide not only a comprehensible input, but also a comprehensible output, which in Krashen's theory rightly seemed inefficient [4].

SVM reveals the mechanisms of practical use of both visualizations of the first kind, which include visual dictionaries and virtual classes, and visualizations of the second kind, which are embodied in Dynamic Grammar, as well as Visual Models based on it [5] and map-tables for different levels of foreign language acquisition.

Leontiev defined visualizations of the second kind as “the external support of internal actions” [3]. Such tools for describing the grammar of a foreign language should be available in every linguistic class, and then only a thoughtful look is enough to understand the structure of the language. The subsequent training of professional skills will allow you to consolidate and transform the consistently formed fundamental grammatical skills into solid skills of speaking a new language in the form of a conscious statement or dialogue. In their significance, Visual Models and Dynamic Grammar are comparable to the periodic table of chemical elements, which hangs on the wall in any classroom where chemistry classes are held.

Figure 4 shows the stages of development of elementary action [6] on the example of the verb Do, where the black arrow indicates the direction of development of the elementary process and the flow of time. The figures below the arrow indicate what is happening in reality, and above the arrow is in the mind. Moreover, the dynamics of the development of an action can be clearly traced from the idea to its completion and is quite accessible to any adult student.



Figure 4.
Dynamics of change of the verb DO.

The extended dynamics (**Figure 5**) is created by highly qualified linguists and is difficult for students to understand in the first stages of training. In the future, each visual grammatical construction is transformed into a Visual Model of the appropriate level with such assumptions, when the illustrative material is correlated with a specific task of mastering professional material, with specific educational actions. Then the teachers know exactly what the introduction of visibility is necessary for in each particular case, and submit Visual Models in combination with map tables in the form in which they can best perform the corresponding professional task.

Without basic grammatical skills, the same communicative approach turns into simple memorization of spoken phrases. Visual structures of English sentence construction allow for conscious practice, that is, independent planning of the utterance and control of its correctness. It is proposed to focus primarily on mastering the system of English tenses and automation skills, and to postpone the variety of communicative situations for subsequent practice. If you work out the basic construction on a limited number of vocabulary to full automatism, then their use in the future will not cause difficulties and will not require conscious control by the rules. Language acquisition is much faster when there are ready-made algorithms with which the language “works” than when you try to independently derive these algorithms from the speech stream and communicative situations.

A simple video lesson using Visual Models of the English Language for beginners can be viewed at the link Video 1. More detailed information about SVM is provided in [7].

In combination with Visual Models [8, 9], lingvomaps are used (**Figure 6**) and card tables that provide a mode of accelerated formation of grammatical skills. According to the Krashen’s input hypothesis of the understandable input material, which is in good agreement with Vygotsky’s theory of the Zone of proximal development (the methodological principle of potency) [10], the development of skills occurs when performing exercises that are one step more complex than the current learned level. Increasing the current level can be achieved by increasing the speed and accuracy of the material of the same level of complexity (advanced training), or the introduction of new material (new knowledge-competence-skills).

Since the learning curves (acquisition of knowledge) and learning skills (acquisition of skills) have significantly different forms and numerical parameters, unjustified transfer of methodological techniques from one field of application to another leads to unreasonably slow progress or its complete absence. The choice of the optimal mode of teaching skills in the field of grammatical skills is complicated by the lack of a mathematical description of the regularities of this process, almost complete lack

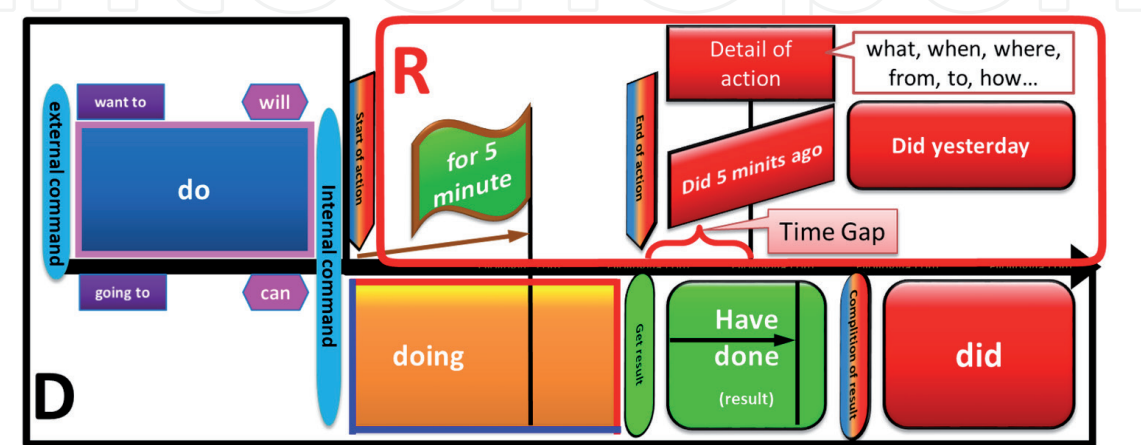


Figure 5.
Extended dynamics of change of the verb DO.

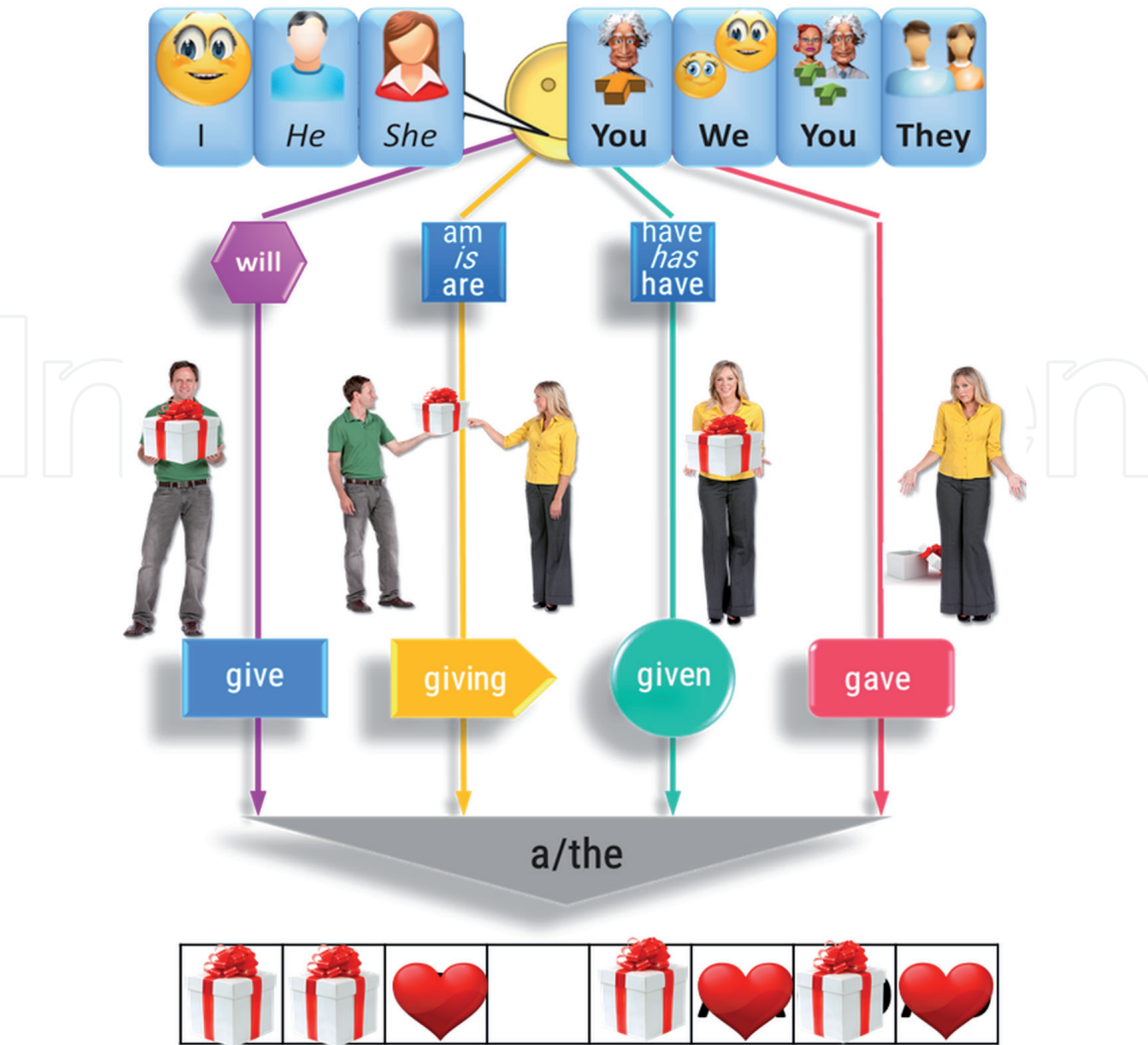


Figure 6.
Lingvomap.

of accurate data and available means of obtaining them. This is due to the extreme complexity and multilevel structure of the language, which is a fractal system with a huge number of interrelated variables, mathematically not strict and ambiguous.

Dynamic Grammar can be used as an independent tool that allows you to bring “correct speaking” into everyday speech activity, but its most effective seems to be to use it as part of interactive speech simulators as part of an electronic acquiring management system (e-AMS).

2.2.3 Language competence management

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 to overcome” and prevent the transition of training in the mode of retraining (**Figure 7**).

The proposed e-AMS is primarily aimed at developing listening and speaking skills, which are fundamental [11–13] and account for about 75% of the total required competencies (**Figure 8**). As we can see, written speech accounts for less than 10% of the total language competence, so it is not taken into account in our system. In addition, there are several variants of perfectly functioning Internet systems that are specifically designed for learning grammar in writing and can easily be added to e-AMS.

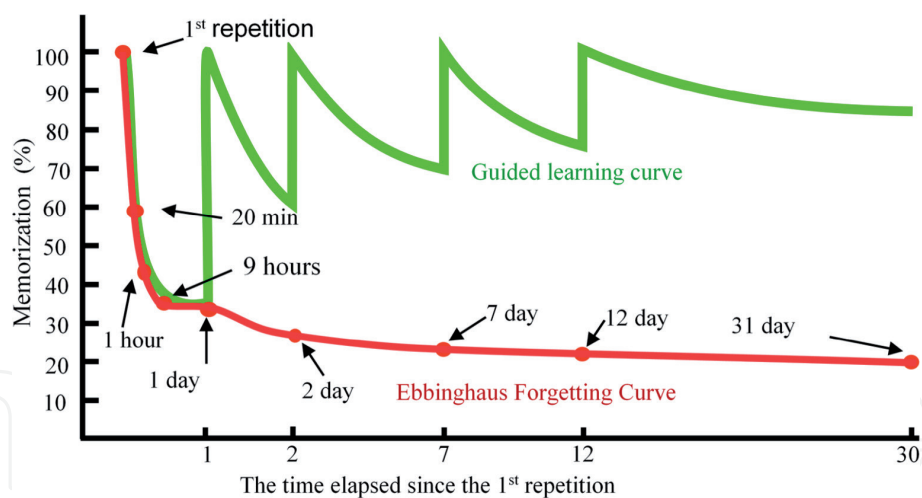


Figure 7.
Comparison of guided and unguided learning processes.

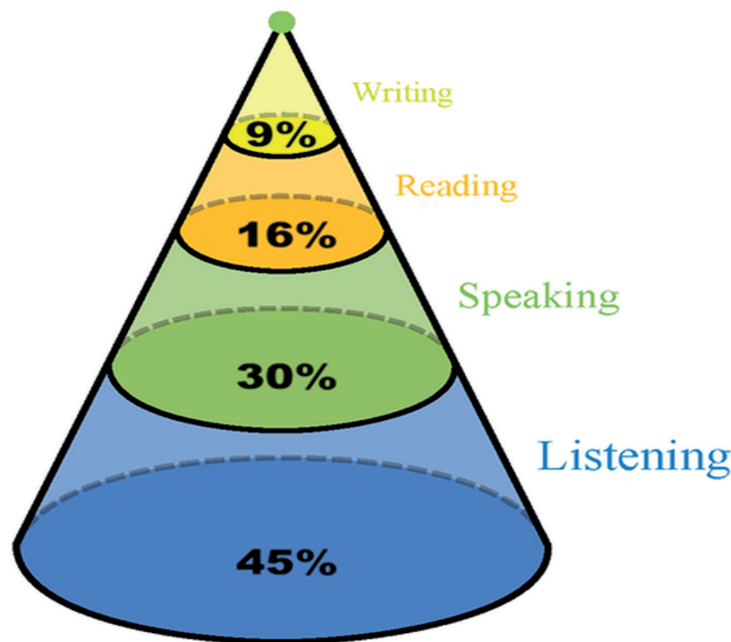


Figure 8.
Distribution of language competences.

In fact, the description of the process of obtaining the necessary result i.e. achieving the level of “spontaneous speaking” is reduced to a 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 attaches to the correlation between R_{Li+Sp} , R_{Li+Re} and R_{Li+Wr} , because the process of forming language skills is not determined by simple listening, but works only if the learner strives to imitate the sounds of new speech as accurately as possible and understands the structure of the language at an accessible level.

Therefore, regular lessons (**Figure 9**) in e-AMS of 25–30 minutes each should consist of:

pre-recorded introductory part (3–5 minutes) in which the teacher explains the meaning of the lesson, and only in this part of the lesson explanations in the student’s native language are allowed, if the visualization mechanisms are not enough to convey the meaning;
main part (about 20 minutes) can be spent in a virtual classroom for the chosen profession, this part of the lesson uses the main components of SVM, which are Visual Models and Visual Dictionary;
final part (5–7 minutes) is a grammatical training based on maps-tables, fixing the language skills at the appropriate level.

Successful conscious training requires two modes: linear demonstration of patterns to implement them, and random training to fully automate the skill. The first mode shows the linear change of one parameter with fixed other variables. When using the second mode, you can combine linear and random changes to these parameters to create unpredictable situations that require real thinking using language to complete the task.

A video example that briefly explains the meaning of such lessons is provided at the link Video 2.

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

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 rule of how to do it, then he still can not do it, since the area of the brain responsible for speaking is busy thinking about this rule.

However, one of the most effective ways to teach a language is to learn through the simultaneous formation of professional skills. The proposed approach allows you to form a speech zone based on the study of not individual words and grammar, but the use of typical situations, working dialogues, short sentences, phrases, speech patterns, and even slang. The general view of the process of forming a new speech zone is shown in **Figure 10**.

Teaching materials should be presented in about 90 video tutorials and about 60 training exercises. The corresponding Common European Framework of Reference (CEFR) [14] test system is quite suitable as a control test for the transition from one level to another with one reservation the system must be adapted to the planned

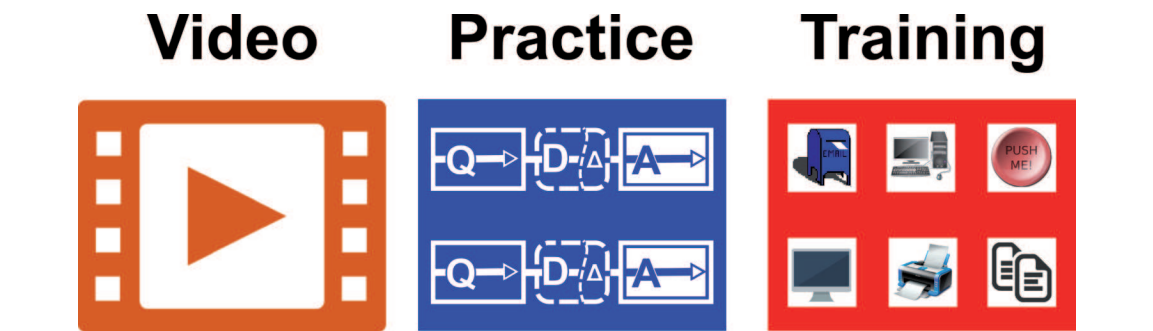


Figure 9.
Schematic drawing of a typical lesson structure in e-AMS.

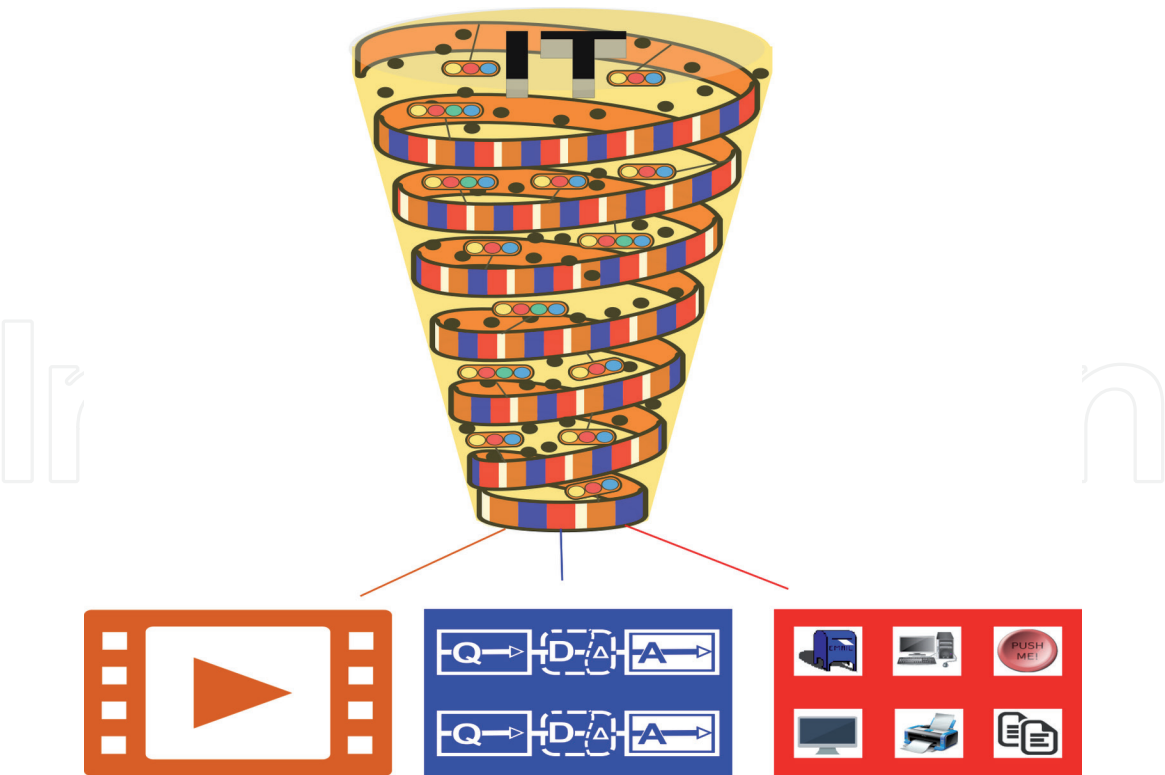


Figure 10.
General view of the process of forming a new speech zone using e-AMS.

CEFR Levels	Cambridge Exams	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
C2	CPE												
C1	CAE												191 178
B2	FCE												
B1	PET												
A2	KET												
A1													
	Lessons												

Figure 11.
Approximate order of using Visual Models according to the learning curve.

professional activity of the student and implemented in two stages at each level (Figure 11). 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 gnoseological roots of SVM are found, which is used in the proposed e-AMS.

3. Electronic system for acquiring language skills

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. E-AMS allows you to manage the process of forming professional and language skills of adults and combines:

- methodological principles justified in the works of Bandura and Galperin [15];
- Structural-Visual Method that accelerates the achievement of linguistic competencies both at the initial stage of learning a foreign language and at the stage of “barrier to overcome”;
- using the achievements of the IT sector as a tool for ensuring the implementation of training goals with continuous monitoring of the current state and obtaining a guaranteed learning result in a finite number of steps.

3.1 Structure e-AMS

The prototype being created is a distributed system for managing the acquisition of professional and language skills by adults. The main components of the system [16] (**Figure 12**) are: Interactive Speech Trainers with Visual Models (IST with VM), a Content Management System (CMS), a Speech Recognition and Modeling System (SRS), a System for Continuous Evaluation (CES) of the level of language skills and a Virtual Assistant (VA).

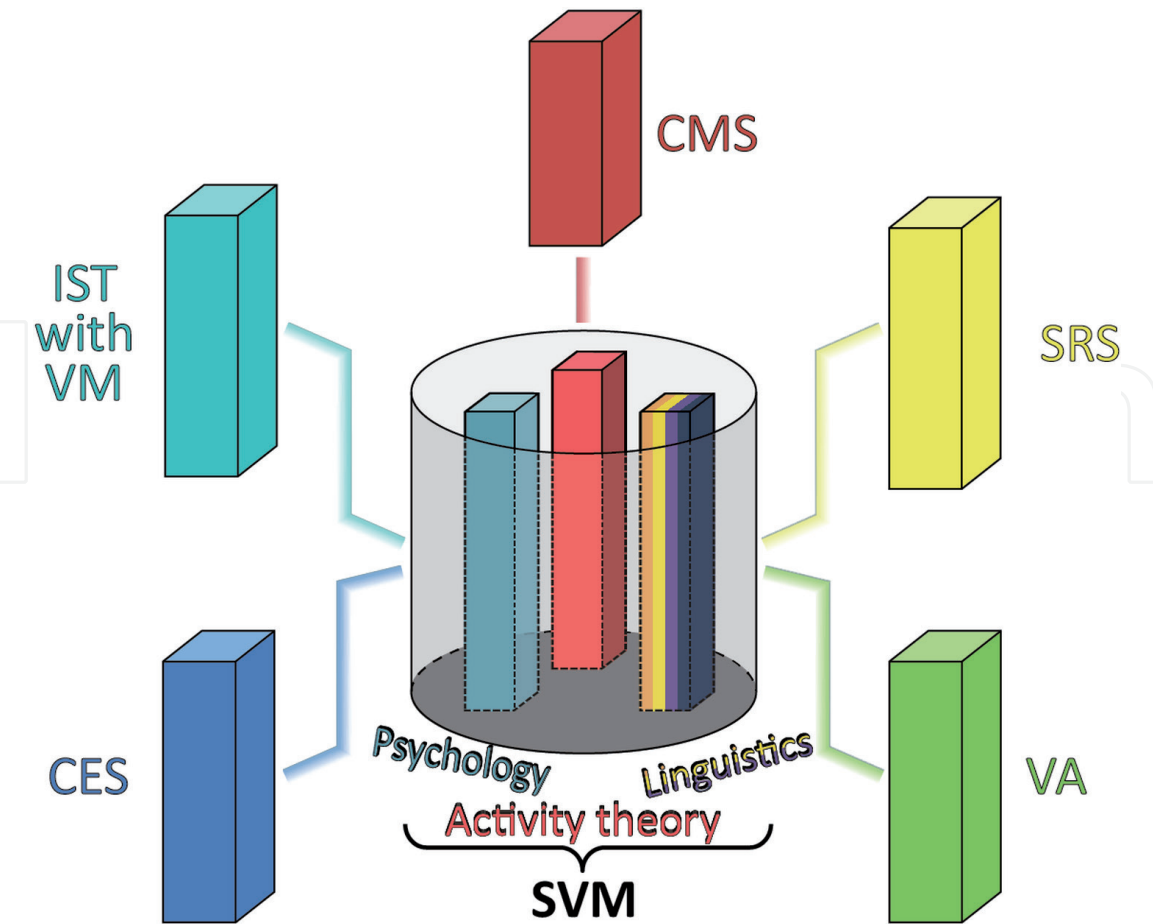


Figure 12.
Generalized structure of e-AMS.

This training system has the properties:

unity of the main goal of learning outcomes for all its elements;
high stability of the entire system and the independent value of each element;
correlation between the elements of the system, providing positive feedback in the process of formation of professional and language skills;
continuous evaluation of the level of competence of the student, which ensures the formation of a logarithmic dependence of the learning curve and compensates for the prerequisites for the degradation of the learning curve in the direction of loss of expected competence;
ability to evaluate and compare the results of similar educational systems and technologies, as well as their individual components;
cross-platform in relation to operating systems and programming languages, and invariance in relation to the student's native language and the foreign language being studied.

Interactive Speech Trainers are a new generation of chat bots that use artificial intelligence mechanisms to configure each student in the system, and Visual Models are in the form of augmented reality elements. This combination will allow you to fully immerse yourself in the process of forming skills and guarantees the maximum concentration of the student's attention.

Content Management System is designed to ensure the formation of educational material based on the most frequent words and semantic structures from the Corpus of the English language, subsequently modified by the subject area of the acquired professional skill. The current frequency is automatically determined using the Google Ngram Viewer resource.

In the course of work of the **Continuous Evaluation System**, a detailed statistical analysis of the results is carried out, the dynamic learning curves of each adult student are derived, the coefficient tables are justified and the indicators of the speed of formation of speech skills are clarified, the levels of speaking from initial to spontaneous are evaluated in accordance with the CEFR scale [14]. Not the curriculum, and the level of professional skills and language proficiency in the current time will be the determining to move forward on the learning curve.

Special methods of using a **Virtual Assistant** will allow you to organize the process of training language skills in such a way that the inclusion of the translation mechanism could not happen physiologically. The system will feed the material at such a speed that the exercise can only be performed without translation. Another option is also possible, which is used now, when the target speed of simple exercises is set such that it is almost impossible to perform them in a transferable way in the allotted time.

In addition, the VA must perform the function of a media aggregator, which provides the ability to connect to various services and find interesting professional content (virtual classes, photos, audio, and video) according to various criteria with reference to the level of current language proficiency of an adult student.

E-AMS continuously operates at three levels:

moderator-programmer who is one of the development team;
teacher who updates content, processes general learning statistics at different levels, and in complex cases decides on the teacher's work through interactive platforms "face-to-face" with the student;
the most important level is the level of an adult student who consciously "transfers" his own consciousness to the control circuit of the educational process.

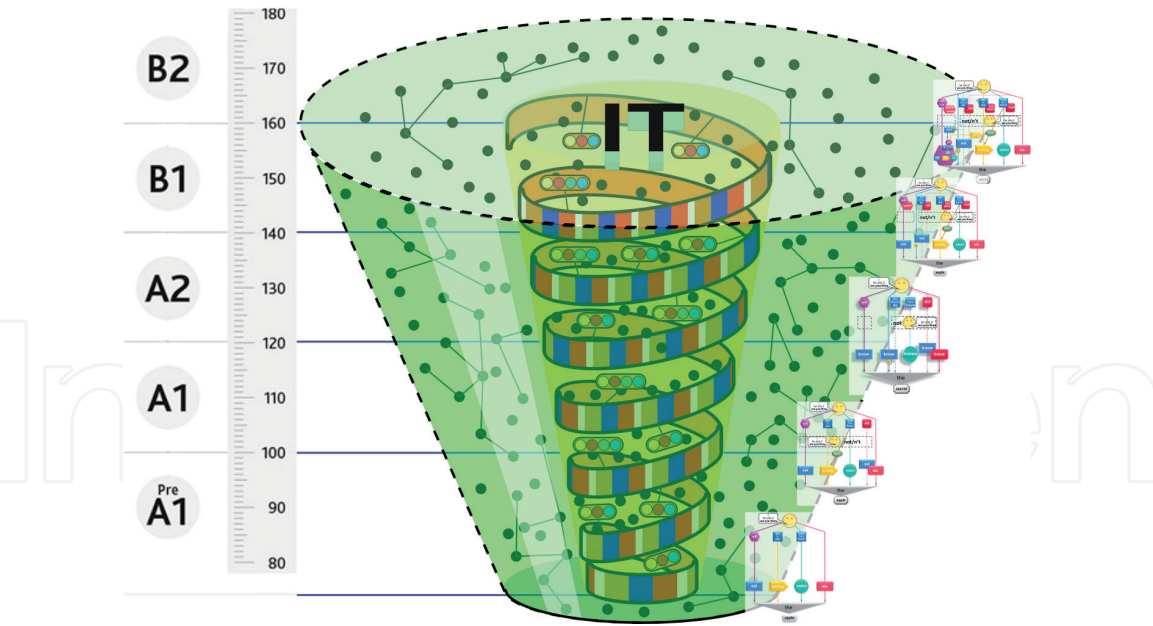


Figure 13.
Visual Representation of e-AMS.

Of interest is the Visual Representation of e-AMS (**Figure 13**), which is an attempt to display all of the above in one figure. In fact, this is a visual representation of the theory of interiorization, or the creation of an indicative basis for mental activity according to Halperin, implemented in the adult learning process using e-AMS.

3.2 System architecture

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

- further improvement of the visual approach that models the structure of the mastered activity based on an 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;
- development of a content management system, formation of repositories of educational materials for video tutorials and mechanisms for managing the synthesis of educational exercises;
- setting up a system of continuous evaluation and management of the learning process in real time.

The last two directions of development of e-AMS 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 addition, a system of continuous evaluation and learning management provides the configuration of the entire system at the levels of:

- 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;

continuous measurement and control of the learning process of each individual point of a learning curve or retraining in real time, which provides an individual approach to individual skill training, as the rate of exercise is not defined by an external statement or interface training program and abilities and competence level of each individual student.

Figure 14 shows the system architecture for the first three main parts of the e-AMS: IST with VM, CMS, and SRS [17].

Implementation of the platform. The Platform will be implemented using the C# and JavaScript APIs. Since the advent of the HTML5 standard, there have been new opportunities to develop robust and efficient APIs that support voice processing, and this powerful, widely accepted standard includes interaction with various media, protocols, and programming languages [18]. The HTML5 page can handle voice and speech recognition recorded directly from devices, possibly available on the user's hardware. In addition, WebGL programs consist of control code written in JavaScript and special effects code (shader code) rendering in HTML, use the development element to draw WebGL graphics for visual programming with the introduction of programmable visual effects (for example, elements of augmented reality in the form of VM) and interact with the web page using scripts.

The **web server** contains a client-side API for transmitting the received data from the database (DB) server to the graphical interface for the client and connecting from the web server to the database using data access layers. These layers contain a connection manager and business layers containing a set of objects (classes) that return data as a set of data for use by web services and JavaScript and WebGel using Google services for speech modeling and speech recognition.

Database design. These are relational data tables that contain information about the lessons, as well as all information about the results of the lessons for each student for further extraction into the system. The results about any student and the lessons conducted with them will be stored in the DB, and dynamic learning curves will be formed on their basis.

Information Request and Display Module (IRDM). In this module, images representing action verbs in sentences are displayed as action and VM images. This

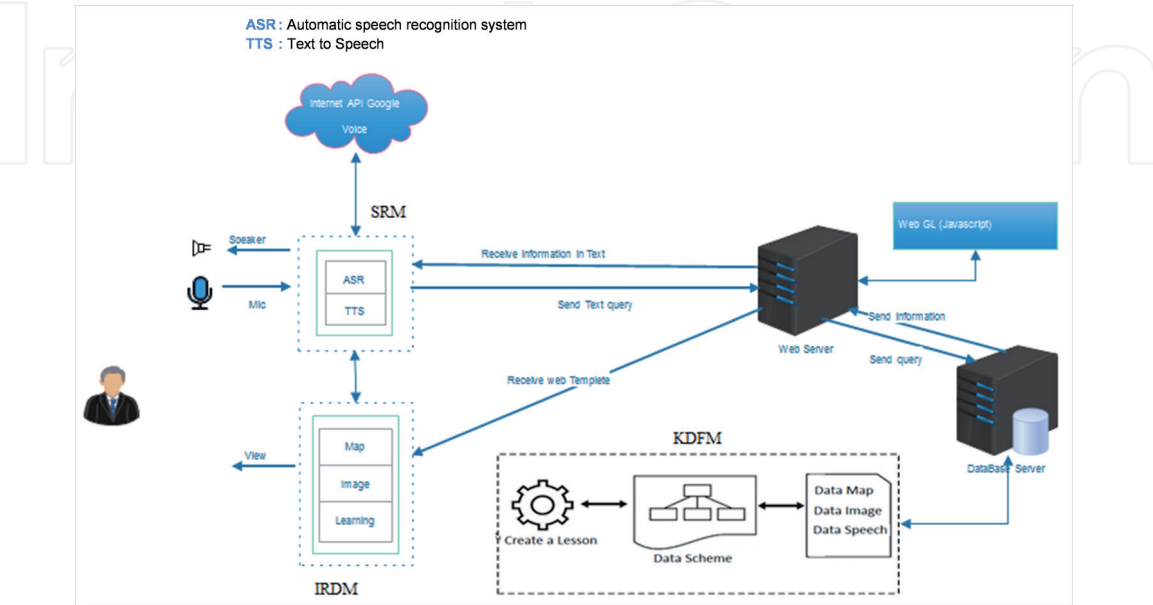


Figure 14.
System Architecture.

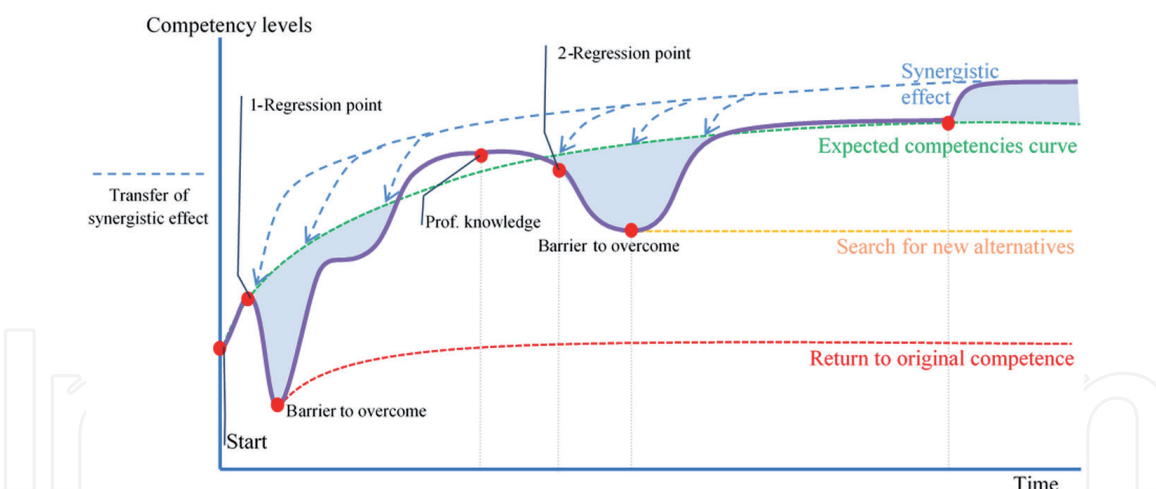


Figure 15.
 The learning curve with the transfer of synergistic effect.

module allows the teacher to control the program parameters via the keyboard and computer screen, and this information is sent to the web server: once the information is processed the selected data is displayed to the teacher as the content of the next lesson.

Knowledge Data Formation Module (KDFM). The module consists of a DB that contains all the relational tables and is used to describe and represent the area of knowledge defined by the topic of the classes. The DB contains stored procedures that provide a way to create lesson content at the teacher's request depending on the selected level of complexity.

Speech recognition module (SRM). This module allows the student to interact in our platform using voice. The system returns the information to the SRM for conversion to speech using Text-to-Speech (TTS). The user speaks into the microphone, and this information is converted into text in the Automatic Speech Recognition (ASR) system. In the web server the java script functions check the correctness of the displayed text in the IRDM from this input data. Finally, the feedback of speaking will be permanently stored in the DB to evaluate and improve the transmitted meaning and pronunciation at the same time.

The introduction of modern ICTs into the structure of the foreign language LMS, along with the use of effective learning models, allows to speed up this process and increases its success by transferring the synergistic effect to all stages of the formation of language skills, especially to the "barriers to overcome" to accelerate the return to the expected competence curve (**Figure 15**). This approach opens up a new scientific direction in the construction of LMS.

4. Conclusions

E-AMS is a unique science-intensive high-tech product. Its use will lead to a synergistic effect in the learning process and, as a result, the accelerated creation of a new language zone in the minds of adult learners. The system provides a process of controlled formation of professional and speech skills, which allows you to move from language learning to its improvement in the process of use. It is created on a modular basis, so each element of the system can be effectively developed and used separately. At the same time, the effect of sharing all elements of the system and integrating additional developments can significantly exceed the capabilities of existing analogues and help solve very important social problems.

In the European Union as part of the Horizon 2020 program, a preliminary assessment of the material and time resources for the creation of a border system combined with the necessary infrastructure for the implementation of the task of training professional personnel and language adaptation of refugees and migrants was carried out. Such expenses amount to approximately 5 million euros, which should be allocated over 2 years, provided that the necessary work is carried out in parallel between 5–6 institutions or organizations.

Within the framework of the current Horizon Europe program, the amount of resources allocated will certainly be increased since apparently the EU leadership does not have a constructive understanding of how to turn the existing migration crisis from a state of humanitarian disaster into a process of managed migration. The consistent appearance of even individual components of e-AMS will contribute to improving the quality of the educational process in the field of foreign language acquisition and expanding international relations.

The work is in its initial stage and researchers from Ukraine, Lebanon, the United States, Japan, and Belarus are involved in the project to some extent. It should be emphasized that it does not contradict the existing system of assessment of language competencies in Europe, but rather contributes to increasing their importance. The role and place of e-AMS in the Cambridge exam system and the assessment systems they have developed is shown on the right side of **Figure 16**.

I would like to note that the documents prepared by the Council of Europe on the basis of the recommendations of Cambridge and other educational institutions of the United Europe, talk in detail about multi-stage levels of language proficiency, but they do not say anything about how to achieve this in the minds of adult

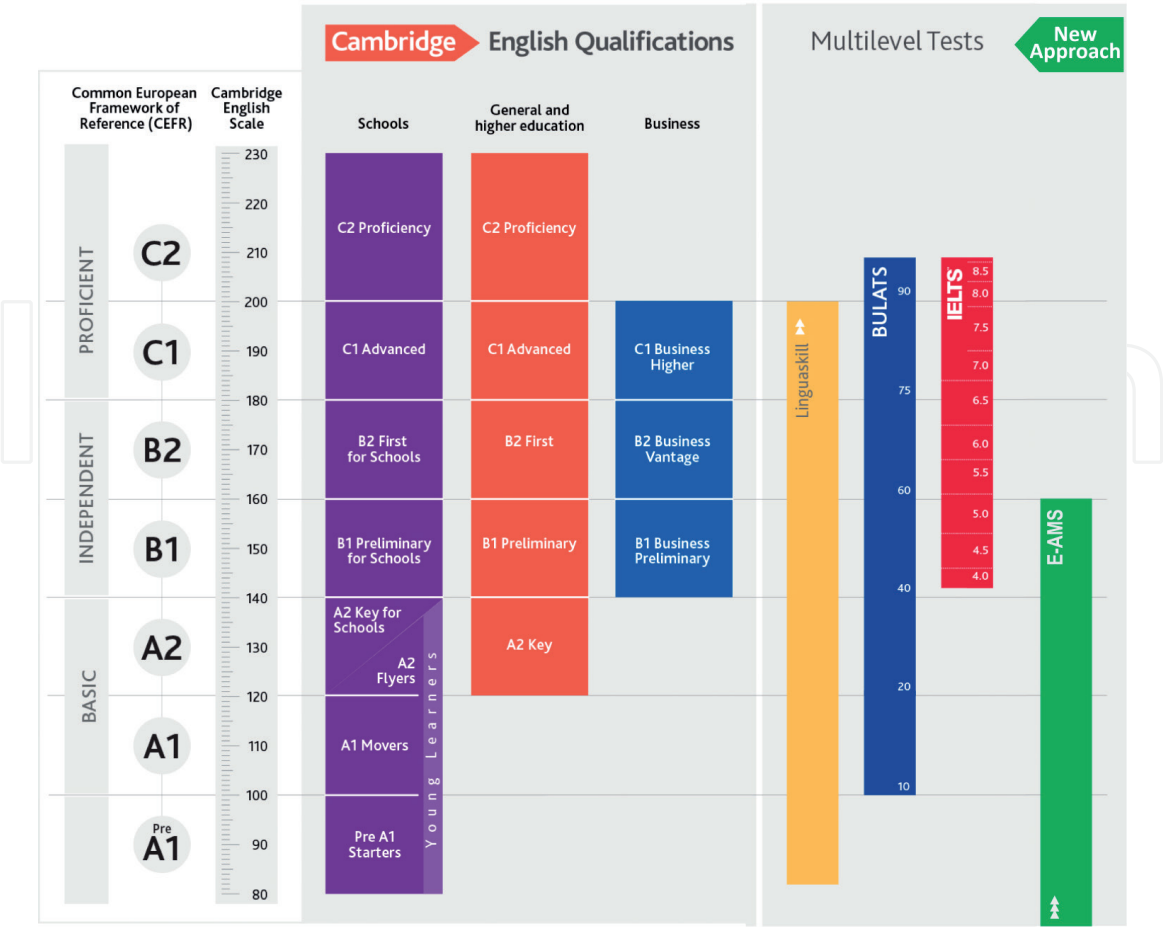


Figure 16.
CEFR and the new approach.

students. It seems that these organizations have a poor understanding of how to do this in relation to adult learners in a fairly short time and on a mass scale.

That is why the problem of refugees and migrants sometimes becomes a disaster in the developed countries of Europe and the United States of America. One of the main reasons why developed countries refuse to accept them is, first of all, a lack of understanding of how to solve the problem of training a large number of adults with their subsequent employment. Therefore, both in Europe and in the United States, instead of destroying walls like the Berlin Wall, they plan and create walls between states, spending huge sums on this, exceeding the cost of creating high-level educational systems by thousands of times (**Figure 17**). Maybe now with the arrival of the new White House administration, the situation will change?

The implementation of such a project is particularly important for refugees and migrants. In a relatively short time, they will be able to get not only all the necessary information about their new profession, but also to acquire stable language skills of the new homeland. Moreover, the learning process will take place remotely, without the work of a teacher directly in the classroom face-to-face with students, and the classes themselves can be held at any point where there is an Internet connection. The resulting solutions and tools will actively contribute to the efforts of state administrations to manage the integration of migrants at the national and local levels. They will also facilitate communication with migrants and their access to services such as vocational and language training, employment, education and social security in host communities.

Expanding the influence of SVM in educational institutions in different countries and especially the widespread introduction of components in the market of electronic educational services will change the trends that have existed for decades and eliminate existing gaps in the ratings of even developed world powers. For example, such a technologically advanced country as Japan, according to the EF EPI Rating [19], is only on the 55th place in the world, which is significantly lower not only, say, Italy (30) or Spain (34), but even Belarus (40). Despite the existence of the project IT-country (**Figure 18**), the implementation of a full e-AMS in Belarus is not planned in view of the utter disinterest of the educational structures to change the current situation for decades, are encouraged to seek independent decisions within the system startups or search for like-minded people abroad.



Figure 17.
The Wall and e-AMS costs.

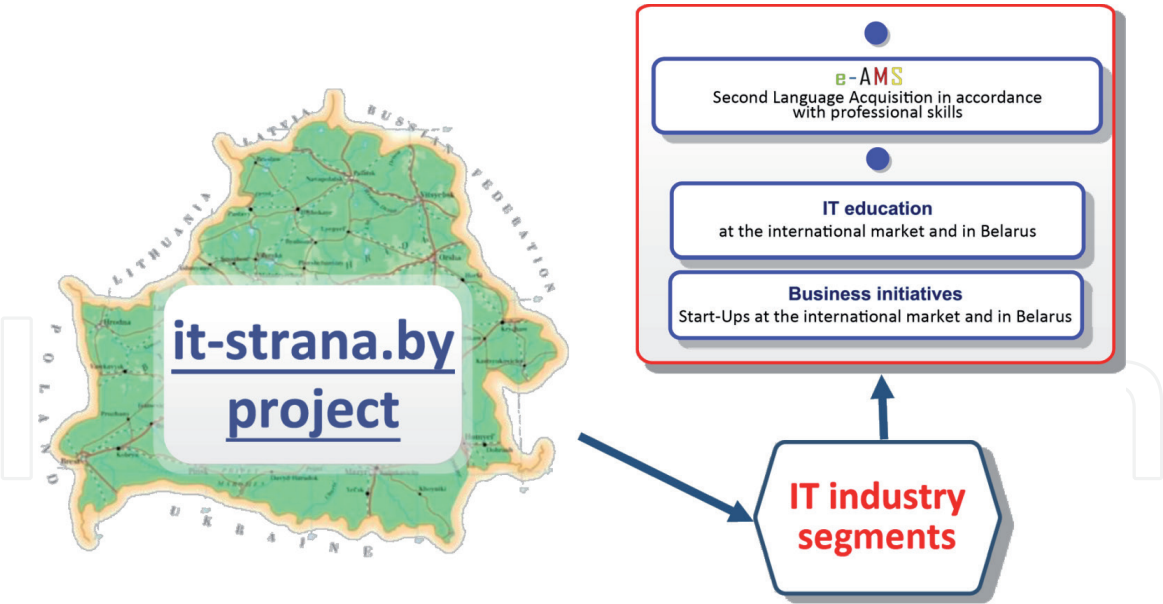


Figure 18.
IT Country Project.

Progress is impossible to stop, however sometimes it is the education system because of the extreme conservatism and focus of their activities primarily on the implementation of government social orders do not contribute to the innovative development of society. An alternative to this is electronic learning systems can quickly implement and put into practice the most advanced technological innovations.

The proposed e-AMS provides the formation of the speech zone of the acquired language in the mind of the learner due to a sharp increase in the effectiveness of exercises by transforming grammatical information from verbal to graphic form. In addition, continuous assessment of the level of competence of the student leads to the formation of a logarithmic dependence of the learning curve and compensates for the prerequisites for its degradation, providing a synergistic effect in the learning process. As the core of the system, it is planned to use the Structural-Visual Method to create non-Verbal means of teaching foreign languages based on modern technologies, teaching new labor skills and new social interaction.

The main result to date can be considered a conceptual solution to the problem of simultaneous interaction of the language system and ICT tools that ensure the sustainable formation of foreign language thinking of adults in the process of developing professional and language skills presented at the system level.

Acknowledgements

I would like to express my gratitude to Anatoly Osipov, Vice-Rector for Scientific Work of the Belarusian State University of Informatics and Radioelectronics (Belarus), for financial support in publishing this chapter.

I would like to express my special gratitude to my co-authors: inventor of visual models Vitaly Dibrova (Studio of Languages, Ukraine) for the provided video materials; Professor Tomokazu Nakayama (Jissen Women's University, Tokyo, Japan) and Professor Boyd Bradbury (Minnesota State University Moorhead, USA) for their sincere support of the idea of creating e-AMS; Professor Igor Schagaev (IT-ACS Ltd., London, UK), whose scientific ideas inspired me to develop e-AMS and write this chapter.

I also thank my graduate students: Imad Tahini (Lebanon) for creating a working prototype that demonstrates the interaction of the three main parts of e-AMS and Artsyom Marzalyuk (Belarus) for creating the drawings in this chapter.

Video materials

All video materials referenced in the text are available at: <https://bit.ly/3ooKHC1>

Author details

Aliaksei Dadykin
Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus,

*Address all correspondence to: alex_05_07@rambler.ru

IntechOpen

© 2021 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Bandura A and Walters R. Social learning and personality development. New York: Holt, Rinehart, & Winston; 1963
- [2] Scherba L. Language system and speech activity. Leningrad; 1974
- [3] Leontiev A. Language and speech activity in General and pedagogical psychology. Moscow Psychological and Social Institute, Moscow; 2004
- [4] Krashen S. Principles and Practice in Second Language Acquisition. University of Southern California; 1982. 202 p.
- [5] Tahini I, Dadykin A and Dibrova V. The Model of Change as the Basis of the Knowledge Structure in the Next Generation E-LMS. In: Proceedings of the 10th annual International Conference of Education, Research and Innovation (ICERI 2017); 16-18 November 2017; Seville, Spain. p. 5022-5032. DOI: 10.21125/iceri.2017.
- [6] Tahini I and Dadykin A. Techniques of new application for acquisition foreign languages: development stages and modern trend. In: Proceedings of the 9th International Conference on Digital Information and Communication Technology and its Applications (DICTAP 2019); 3-5 April 2019; Beirut, Lebanon. France: EDP Sciences – Web of Conferences, Section E-Learning 27; 2019. 7 p. DOI: 10.1051/itmconf/20192706001
- [7] Dadykin A. Information and Communication Technology and Callan Method. In: Proceedings of the 2020 International Conference on Education Development and Studies (ICEDS 2020); 3-5 March 2020; Paris, France. New York: Association for Computing Machinery. p. 44-52. DOI: 10.1145/3392305.3396905
- [8] Dadykin A, Dibrova V and Tahini I. The Visual Approach in Educational Projects. International Journal of Social Science and Humanity. 7, 6; 2017. p. 373-377. DOI: 10.18178/IJSSH.2017V7.851
- [9] Tahini I, Nakayama T, Dibrova V and Dadykin A. Cognitive Psychology Models and Approaches to Develop Language Skills. International Journal of Social Science and Humanity. 8, 4; 2018. p. 110-115. DOI: 10.18178/ijssh.2018.V8.945
- [10] Vygotsky L. Thought and language. Cambridge, MA: MIT Press; 1934/1986.
- [11] Wilt, Miriam E. A study of teacher awareness of listening as a factor in elementary education. Journal of Educational Research, 43, 8; 1950, p. 626-636.
- [12] British Council [Internet]. Five essential listening skills for English learners By Raphael Ahmed. 2015. Available from: <https://www.britishcouncil.org/voices-magazine/five-essential-listening-skills-english-learners>. [Accessed: 2018-11-30]
- [13] University of Missouri Extension [Internet]. Listening: Our Most Used Communications Skill. Available from: <https://extension2.missouri.edu/cm150>. [Accessed: 2018-11-30]
- [14] Council of Europe Language Policy Portal. 2018 Common European Framework of Reference for Languages: Learning, teaching, assessment (CEFR). Available from: <https://rm.coe.int/cefr-companion-volume-with-new-descriptors-2018/1680787989>
- [15] Galperin P. Psychology of thinking and teaching about the gradual formation of mental actions. Research in the thinking of Soviet psychology. Moscow; 1966

[16] Bradbury B, Dadykin A and Tahini I. Fundamentals of New Effective System to Accelerate Language Acquisition Using Visual Approach. International Journal of Information and Education Technology. 8, 11; 2018. p. 768-772. DOI: 10.18178/ijiet.2018.8.11.1137

[17] Tahini I and Dadykin A. Proposed System of New Generation LMS Using Visual Models to Accelerate Language Acquisition. Advances in Science, Technology and Engineering Systems Journal. 3, 5; 2018. p. 277-287. DOI: 10.17781/P002439

[18] Fulton S and Fulton J. HTML5 Canvas. O'Reilly Media Incorporated; 2013

[19] Education First English. Proficiency Index. EF EPI. The world's largest ranking of countries and regions by English skills, 2020. Available from: <https://www.ef.com/wwen/epi/>