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ВЕСТНИК

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

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NAS RK is pleased to announce that Bulletin of NAS RK scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of Bulletin of NAS RK in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential multidiscipline content to our community.

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НАН РК сообщает, что научный журнал «Вестник НАН РК» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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SCIENCE, EDUCATION & COGNITIVE COMPETENCE BASED ON E-LEARNING

Abstract. This article is devoted to the development of the educational process, including in the context of ideas about digital learning. Although in recent years, electronic learning has often become the object of research and practical development, many practitioners and theorists do not fully understand what the concept of "e-learning" really means, does not understand how it can help teachers and educators to achieve success in students' knowledge. The authors of the article consider the historical foundations of digital education and the use of information technologies in education. They believe that the leading changes in education associated with digital learning are that digital learning develops the cognitive competence of schoolchildren and students. Using the example of learning foreign languages, the article shows that the use of e-learning stimulates the development of metacognitive components of cognitive competence, and also activates the declarative and procedural components of cognitive activity.

Key words: education, e-learning, cognitive competence, teaching and students.

Introduction. Nowadays, science, developed technologies for teaching a foreign language such as Content and Language Integrated Learning (CLIL) and Cognitive Academic Language Learning Approach (CALLA) and different equipment and devices for carrying out experiments have become associated with each other in one place, it is even impossible to fix the end where the one ends and the other begins. This means that there is a core of science and technologies. The unique originality of the interaction of the sciences of thinking and information technology is still not clear, it is surrounded by some mysteries. For instance, by means of e-learning we can teach students to speak a foreign language without involvement of native speaker teacher in the lesson and develop students' cognitive competence which is essential after graduating from a university in global market while working.

In the second half of the 19th century, there were four main areas of research of intellectual and spiritual activity [1, p. 7], as figure 1 summarizes:

1. A logical study of the formal rules of thinking, the structure of concepts and statements, forms of evidence-based reasoning.
2. Linguistics focused on clarifying the relationship of language activity and thinking in the framework of natural languages.
3. Analysis of the neurophysiological mechanisms or essential processes with the help of which the thinking and other mental acts are realized.
4. Psychological research focused on the study of all forms of psychological activity in their real empirical manifestations.

These four research directions, interrelating with each other or moving away from each other, existed as more or less independent scientific disciplines with autonomous problems, conceptualization and methodology up to the beginning of the second half of the 20th century. When information technology had broken out in the world of science and technology and the new era started, this has been the era of computers and information technology [1, p. 8].

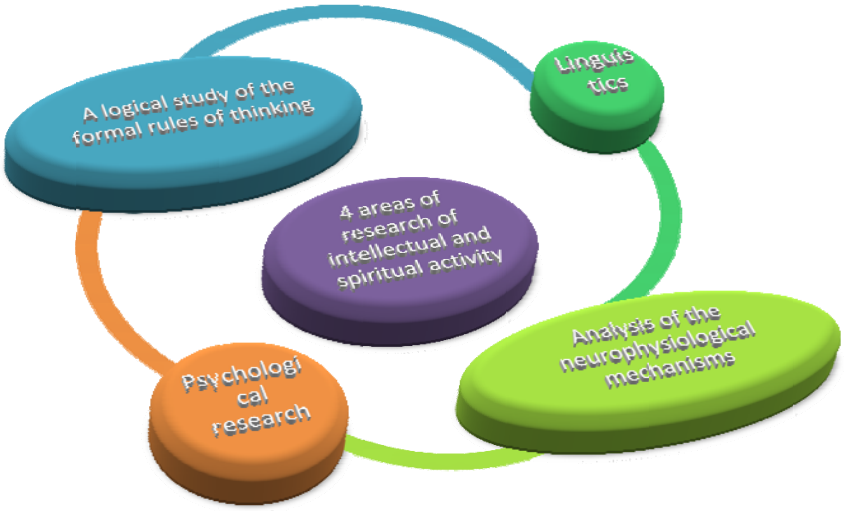


Figure 1 – Four main areas of research of intellectual and spiritual activity

New information technologies (IT) create an environment for computer and telecommunication support for organization and management in various fields of activity, including education. The integration of information technology into educational programs is carried out at all levelseducation system and sciences: school, university and postgraduate education.

The main areas of IT application in the educational system [2, p. 50-51]:

1. development of pedagogical software for various purposes;
2. development of educational websites;
3. development of methodological and didactic materials;
4. management of real objects;
5. organization and conduct of computer experiments with virtual models;
6. implementation of targeted search for information of various forms in global and local networks, its collection, accumulation, storage, processing and transmission;
7. processing the results of the experiment;
8. organization of intellectual leisure of students.

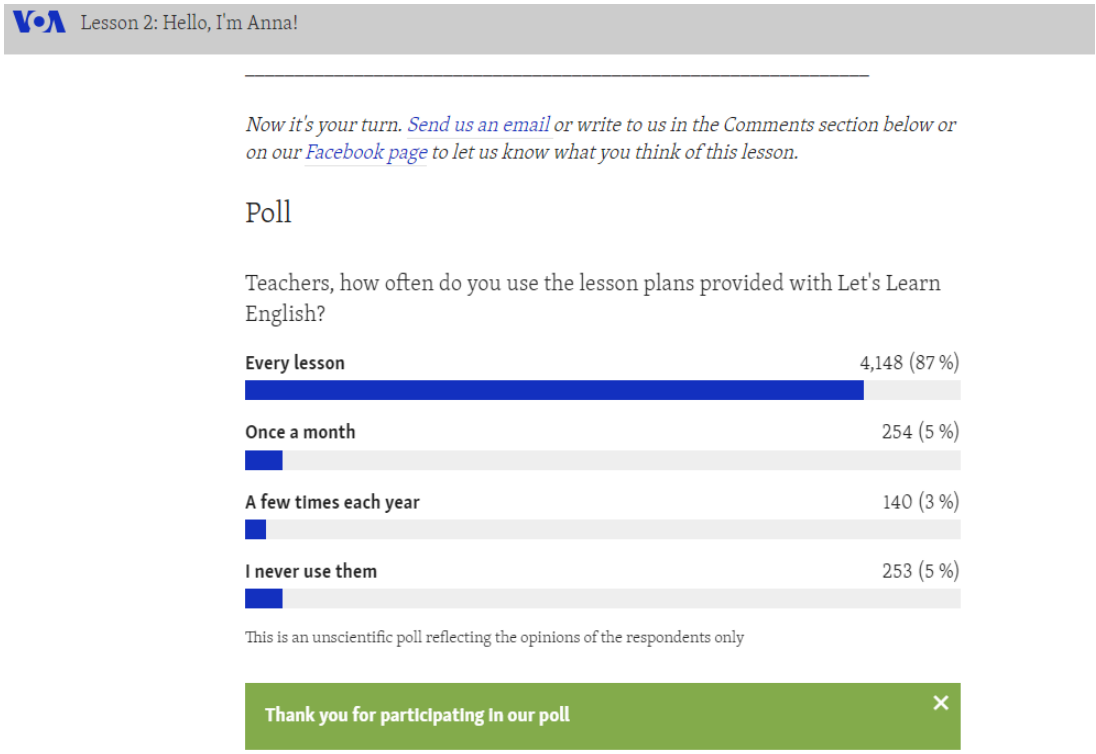
The most widely used at the moment are integrated lessons using multimedia tools. Training presentations are becoming an integral part of learning, and IT are even used in organizing a big international scientific conference or business meeting as well, but these are just the simplest examples of applying IT. The annual International Scientific and Practical Internet Conference "Challenges of Science" by Satpayev University in Almaty, Kazakhstan shows the interest of leading scientists of the world in participating in such a dialogue platform and contributes to the development of innovative and research activities of students, graduate students, undergraduates , executives, managers, analysts and consultants(www.kims-imio.kz).

If we take, for example, only the fact how many sources are offered on the Internet about e-learning: a list of recommended literature, interactive manuals and online tutorials, abstracts, etc. At the user's request "Discipline" E-learning "search engine http://apps.webofknowledge.com gives about more than 9, 000 links.

New technologies have been making educational process more flexible for those students who are very concerned with their extra actions during fixed lesson hours and great possibilities have been developed for both planned and spontaneous independent adult education. These technologies serve for students' benefit as an interactive learning process. For instance, 'Voice of America learning English' Internet program stems from Washington DC and is referred to in variety of teaching ways for non-native speakers (https://learningenglish.voanews.com).

This is ubiquitous web site which is widely used among 87 % of English teachers and learners, as it can be seen in this poll, and it is one of the largest World Wide Web program, which provides learning

language and the latest news about the world. It means students not only learn English as well as they will be aware of what is happening worldwide. In the fast-paced world of e-learning the available technologies to make a course exciting are always changing, and course content can and should be updated quickly to give students the very latest information [17, p.7]. It does not limit their acquiring knowledge and e-learning has huge advantages for students. E-learning offers the ability to share material in all kinds of formats such as videos, slideshows, word documents and PDFs, e-books with audio & transcript for non-native speakers, which is one of the best teaching methods for a foreign language. Another benefit is personal cognitive development. It is very important to develop cognitive competence while studying in the system of higher education. According to the Concise Oxford Dictionary, competence (or competency) denotes the "ability to do" something or the "ability for a task". The Macquarie Concise Dictionary defines competence as "the quality of being competent", where competent means "properly qualified" or "capable". Significantly, in these dictionary definitions the prime focus is on competent people having the ability or capability, which will enable the satisfactory completion of some task(s). A description of the abilities or capabilities required for competent performance of an occupation typically invokes terms such as 'knowledge', 'skills' and 'attitudes' [15; 23] which are on demand of labor market. Nowadays there are many interactive methods for teaching. One of them is CALLA which develops not only language skills but students cognitive competence as well.



https://learningenglish.voanews.com/a/lets-learn-english-lesson-2-hello/3113733.html
(Date of research: 17 Dec. 2018)

CALLA Concepts. Students who are not fluent in English as their main language face a multitude of challenges in their education, but one particular challenge was identified by Dr. Jim Cummins in the late 1970s. Dr. Cummins discovered that many English language learners were being mainstreamed into classes and greatly struggling despite their apparent fluency in English.

CALLA is built on a few key concepts from cognitive psychology and instructional design. The main concept is that of scaffolding, which provides a great deal of instructional support for students handling challenging material and then slowly removes the support as the student becomes proficient and develops necessary skills. CALLA also utilizes the theory that learning is grouped into three different types of knowledge:

- The first type, **declarative knowledge** is factual knowledge, such as the boiling point of water at sea level is 212 degrees Fahrenheit.
- The second type is **procedural knowledge**, which is the ability to know how to do a task, such as hard boiling an egg in the water.
- The final type is **metacognitive knowledge**, or the ability to relate current tasks to previous experiences, such as knowing that when you've boiled eggs in the past you can't cook them too long because then they become hard and rubbery [16].

E-learning& its advantages according to B. F. Skinner. In 1924, Ohio State University professor Sidney Pressey invented the "Automatic Teacher", the first device in electronic learning. The "Automatic Teacher" was designed to let students drill and test themselves. However, this first try wasn't successful. In 1954, Harvard professor B. F. Skinner creates the "Teaching Machine" for use in schools. The teaching machine was a mechanical device whose purpose was to administer a curriculum of programmed instruction. From B.F. Skinner experimental study of learning come devices which arrange optimal conditions for self-instruction [4]. For more information, please, visit'B.F Skinner. Teaching machine and programmed learning in this video': https://www.youtube.com/watch?v=jTH3ob1IRFo. …B. F. Skinner, a psychologist professor, states that immediate knowledge has 2 principal effects. It made the most rapidly to the formation of correct behavior and there is also motivation effect, the student is free of anxiety about being successful or failed, because the work is pleasurable. He does not have to force himself to study.One function of the teaching machine to give students a quickly afford in the adequacy of his response. It is important not only for efficient learning, it generates a high level of interest and enthusiasm. An another advantage is that students work on own pace, so there is no force to work on the machine in the same time equally with one another.Students who work on the machine, make progress which is the most effective for him. Fast student can do the task in short time while slow students do it at their pace and reaches the same rank as a fast student by learning the material in subject. Both types of students learn the material thoroughly. If a student is absent, he does not miss any words, he can do tasks in other time. B. F. Skinner also outlines that by means of machine teacher can cover twice as much materials at same amount of time and effort as at traditional lessons with additional classroom techniques. It is not magic and simply convenient way for students tocontact with a man who writes the program. Writers offer the program not like a machine, but like a teacher. He remains in the same position like teacher and students stay constantly interactive, according to the psychologist, Burrhus Frederic Skinner's opinion in the video mentioned above [4].Thank to the scholar, B. F. Skinner, modern teachers have got benefit to bring education to a wider audience. There is no boundaries and no restrictions to organize e-learning. Everyone who is interested in a course can be present.

Submission of conventional learning that relies on the transfer of knowledge in the classroom and teacher-centered learning already is not possible where the learning outcomes wants to appropriate use of technology in the world of work. Speed and ease as well as present information as teaching materials can be obtained easily if the learning using computer-aided media. Computer-aided multi-media rich changes obtained only by using internet service. Through learning program that is loaded on the e-learning package is very possible that the interaction of information very quickly as required [3; 18].

Didactical models in e-learning. If we look at didactical models used within education we can distinguish 3 main models [5]:

- Behaviorism
- Cognitivism
- Constructivism

Behaviorism. This model based by Skinner is based on the assumption that learning is a function of change with stimuli and responses. Regarding this model it is not relevant to know the process of learning is happening within the brain because the focus is on the results of learning, not the process itself. A strong element of behaviorism is positive and negative feedback, which can condition the learner. A result of this attitude of learning is the de-contextualizing of learning content. Knowledge is offered in a fragmentized way. In a behavioristic environment didactical aspects like knowledge tests, homework and highly structured learning are common. Behaviorism can be easily combined with computer aided learning. The first e-learning lessons were mostly labelled as 'Drill-and-practice'. The lessons are build up on practicing.

Cognitivism. This model based on the idea that the process of learning is comparable with the way a computer is working. Cognitivists are using words like short term memory, long term memory and stimuli. Cognitivism is about:

- ✓ collecting;
- ✓ adapting;
- ✓ and integrating information.

The focus is on the way we are learning, not only at the outcome of the learning process. Techniques like mind mapping are used to anchor the information.

Constructivism is an epistemic belief about how students learn. Constructivists proffer that knowledge acquisition develops through interactions with the environment. During the 1980s, the development and distribution of multimedia personal computers offered such an interactive method of learning [6 p.5]. This means that computers turned into teaching tool which make students be active during learning.

Interrelation of electronic devices and learning. … From a study of the literature, it appears that pedagogy, technological devices, context, and social interactions are the four central constructs [6 p.3] in high education because any sort of learning may take place anywhere and anytime by means of e-learning. Mobile phone apps might be an excellent example for it. Let us say if a person learns a foreign language, he can improve his or her listening skills by using some mobile phone apps such as TED talk or simple radio,i.e. according to Crampton et al. (2013) definition for mobile learning (m-learning) is "learning across multiple contexts, through social and content interactions, using personal electronic devices." To be clear, the word "context" in this definition encompasses m-learning that is formal, self-directed, and spontaneous learning, as well as learning that is context aware and context neutral. In other words, the learning may be directed by others or by oneself, and it can be an unplanned, spontaneous learning experience; learning can happen in an academic setting, or any other non-academic setting; and the physical environment may or may not involved in the learning experience[6 p.4]."

Here we can consider m-learning as e-learning since smartphones belong to electronic device. In essence, e-learning is a computer based educational tool or system that enables you to learn anywhere and at any time. Today e-learning is mostly delivered though the internet, although in the past it was delivered using a blend of computer-based methods like CD-ROM.Technology has advanced so much that the geographical gap is bridged with the use of tools that make you feel as if you are inside the classroom [17, p.5-6]. Nowadays smartphones have got all the advanced features of personal computer, that is why they can replace each other and offer educational program. E-learning can occur inside or outside the classroom, it can be self-directed or spontaneous as Crampton mentioned above. For instance, if a person wants to obtain further information about something he or she can surf online for more knowledge and be content by oneself.

Pedagogical shifts from teacher-dominated method to learner-centered education. Throughout history, learning has been of paramount importance in all cultures. In simple terms, learning is essential to personal and professional survival, and a culture's pedagogical choice is often driven by social behavior, expectations, and values. For example, Western pedagogies during the 1930s did not encourage autonomy and self-direction. A student was to learn facts without question. Even into the 1950s, pedagogies typically emulated the *tabula rasa* approach, teaching the students as though they were empty vessels waiting for the teachers to impart knowledge [6 p.5].**Tabula Rasa** (from the Latin is a smooth, clean writing board) is a term of sensationalism, meaning a state of consciousness of a person who does not yet possess any knowledge (for example, a newborn) due to the lack of external feelings. This word is a Latin common expression. Itis used to denote the epistemological thesis that a separate human individual is born without innate or embedded mental content. It is pure person's knowledge resource is fully built from experience and sensory perception of the external world (see The Experience of the Human Mind, in the book: Favorite Philosophical Works, Vol. 1, M., 1960) [7].

Another good example for teacher-dominated method is the American **audio-lingual**or **army** method advised that students should be taught a language directly, without using the students' native language to explain new words or grammar in the target language.This method is the product of three historical circumstances. The prime concern of American linguists in the early decades of the 20th century had been to document all the indigenous languages spoken in the US. At the same time, behaviourist psychologists such as B.F. Skinner were forming the belief that all behaviour (including language) was learnt through

repetition and positive or negative reinforcement. The third factor was the outbreak of World War II, which created the need to post large number of American servicemen all over the world. It was, therefore, necessary to provide these soldiers with at least basic verbal communication skills [8].Disadvantages of this teaching approach is that it is a mechanical method since it demands pattern practice, drilling, and memorization over functional learning and organic usage and the learners are in a passive role; theyhave little control over their learnt information [9]. That means students are unconscious about how they are learning language skills.

Every historical event has its own impact on education. For instances in 1930s and 1940s [11 p.149, 151] in Kazakstan, there were an artificial famine and World War II. Historically, the 1930s were tragic for Kazakhstan due to the policy of collectivization which had very negative consequences, with a wave of famine that reduced by half the native population. In 1932-1933:

over 50 thousand Kazakh children lost their parents. The famine in Kazakhstan significantly decreased the number of schoolchildren in Kazakh primary schools; in 1932-1933 one million 750 thousand people became direct victims of the famine and the associated diseases, that is 42% of the Kazakh population of Kazakstan, many of them being children [10 p.45].

During World War II, the number of school hours for physical training increased in the school curricula and the studies of the foundations of agriculture were introduced. The education content became more oriented for the development of patriotic feeling of pupils and for the applied aspects of sciences, for the practical links of theory and life. Schools were involved in public life, their pupils working at plants and gathering the crops.

Early learning aid in Europe

This image above is dated from 200 A.C. and shows a school where the teacher is sitting in the middle and two students are sitting around him, reading a parchment role. At the right a student is arriving with his tablet on which he could write. This technique was used within European schools till around 1950 [13].

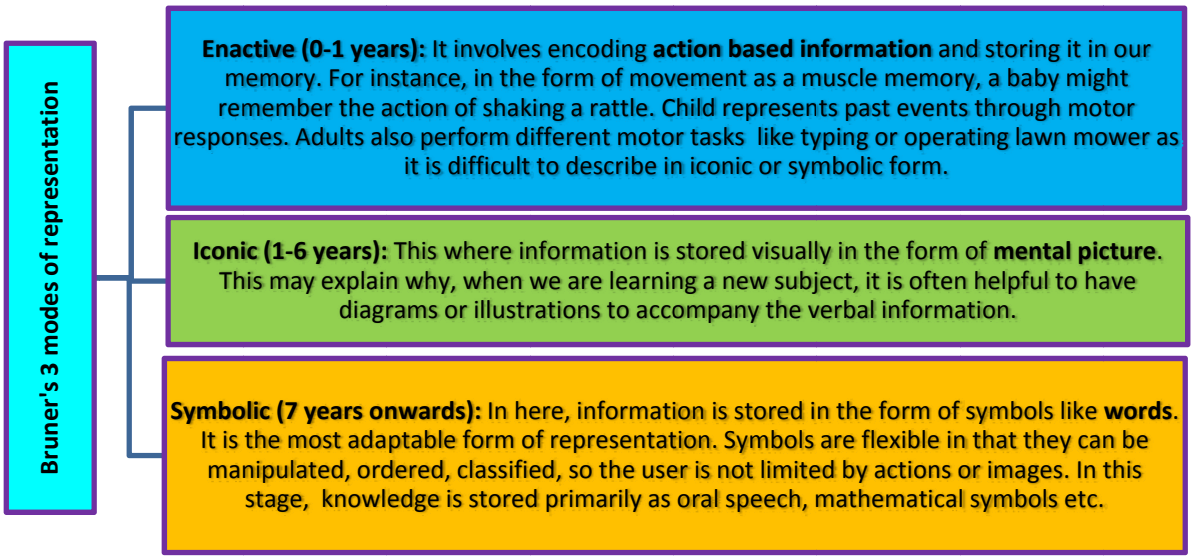
Nowadays, thank to IT, learners are viewed very differently: students are encouraged to be active in their own learning, to be self-thinking and active consumers of knowledge. Shifts in educational philosophy have been led by calls for change toward active learner-ship [6 p.5] and pedagogical shift has been led to individualized learning by means of e-learning. For instance, there are many online programs such as CALLA or CLIL technologies for self-learning which encourages learners to study something new cognitively by themselves; learners must also be given considerable control over their own learning; during e-learning some may need more time than others to deal with the same material and approach the same problem in different ways.

According to Herbert P. Ginsburg and Sylvia Opper's concept that children – or individuals of any age – learn best from self-initiated activity is vital for the guidance of education. Teachers (and the public at large) usually consider that the aim of education is to impart existing knowledge, often of a factual type, as efficiently as possible to the pupil, who will then absorb it in the form presented. In this view, if students were allowed to design and conduct experiments, there would not only be chaos in the classroom, but there would also be no learning. According to Piaget's theory, these beliefs and attitudes are erroneous for several reasons. Teachers can in fact impose very little knowledge. It is true that they can convince the

child to say certain things, but these verbalizations often indicate little in the way of real understanding. Moreover, it is seldom legitimate to conceive of knowledge as a thing which can be transmitted. Certainly the child needs to learn some facts, and these may be considered things. Sometimes, drill or programmed instruction may assist in learning of this type. But often the child does not learn even facts when imposed; the student may have to discover them himself [13 p.320].

Bruner's 3 modes of representation and cognitive development. According to Bruner, the outcome of cognitive development is thinking. The intelligent mind creates from experience "generic coding systems that permit one to go beyond the data to new and possibly fruitful predictions".So he states that important outcomes of learning include not just the concepts, categories, and problem-solving procedures invented previously by the culture, but also the ability to "invent" these things for oneself [14]. It means that there is interaction between human capabilities and culturally invented technologies which are similar like engines of these abilities.

Modes of representation are the way in which information or knowledge are stored and encoded in memory [14]:



Bruner suggests it is effective when faced with new material to follow a progression from enactive to iconic to symbolic representation; this holds true even for adult learners [14]. Learning the heuristics of discovery through active participation was Bruner's recipe for increasing intellectual potency. He believed students are more likely to remember concepts they deduce on their own. This philosophy led to the discovery-learning movement, with the focus on how students acquire, retain, and recall knowledge, a transition from the behaviorist stimulus-response approach [6 p.5].

E-learning is based on student-centered education. It provides for such an organization of education of subjects of the educational process, which is focused to the maximum extent on their individual characteristics and the specifics of the personal understanding of the world. In these conditions, there is not only the transfer of knowledge, development of skills, but also the formation of the orientation of the student's cognitive interests, life plans, value orientations, development of the personal potential of subjects of the educational process of the university [28, p.102-103]. In recent years, Kazakhstani education system undergoes educational reform and students have already started toprofoundly learn English which is considered to be business language. And there have also been research on psycholinguistic works [29]. Which means that students earn psychological benefit while acquiring foreign language knowledge by means of interactive technologies.

Conclusion. Overall, traditional learning is expensive, takes a long time and the results can vary. E-learning offers an alternative that is faster, cheaper and potentially better [17, p.7]. Although there are many benefits of e-learning, some students might face with challenges such as carrying out experiences in laboratories if they are students who study chemistry or engineers who need to invent new technologies

for mechanical sciences [24-27]. Some psychologists also claim that internet gets learners addicted. Some educational psychologists also claim that internet gets learners addicted and stressed because of some internal and external factors. However, there are many ways to cope with stress [19-22] and it should be advised when running an online course it's a good practice to send out guidelines about correct sitting posture, desk height, and regular breaks.

Most researchers tend to conclude that there is no perfect teaching method. The one which is selected to teach a unit needs to be critically selected and applied. A review of a few theories of teaching and learning provides us with a history of how both activities are intimately linked to the social, economic and cultural contexts and most importantly technological development. CLIL and CALLA are innovative and blended eclectic approach into teaching for formation students' cognitive competence. They provide both teachers and learners with real-life materials and very innovative teaching materials such as computers, tablets and smartphones. As a results of resorting to such active teaching aids, roles and positions in the teaching undertaking are reshaped. The teacher is more of a mediator who facilitate the quite autonomous interaction between learners, learning materials and the knowledge. With a world where IT are at the center of human life(ubiquitous), these two approaches to language teaching specifically can reveal themselves as being reliable tools and partners in the communication acquisition and development of knowledge. In the modern world, we are witnessing the integration of educational models, their technologies and ideologies. Modern digital education is enriched by the ideology of traditional education. A culture of digital education and a culture of human interaction with digital devices (digital culture) as a whole are being formed and developed. Classical, traditional education, enriched by the technologies of digital education, becomes more effective, more focused on the development of different side of cognitive competence (its metacognitive, declarative and procedural components).

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ҒЫЛЫМ, БІЛІМ ЖӘНЕ E-LEARNING ЖҮЙЕСІ НЕГІЗІНДЕГІ КОГНИТИВТІК ҚҰЗІРІТ

Аннотация. Мақала оқу үрдісін дамытуға, оның ішінде цифрлық оқыту туралы идеялар контексіне арналған. Соңғы жылдары цифрлық оқыту зерттеу және практикалық даму объектісіне айналса да, көптеген практиктер мен теоретиктер «электрондық білім» беру жүйесі туралы түсінікті шынымен де түсініне алар емес, e-leraning жүйесі мұғалімдер мен тәрбиешілердің оқушылар мен студенттерге білім беруде табысқа жетуіне қалай көмектесетінін түсінбейді. Мақала авторлары цифрлы білім берудің тарихи негіздерін және білім берудегі ақпараттық технологияларды пайдалануды қарастырады. Олар цифрлы оқытуға байланысты білім берудегі жетекші өзгерістер саналы оқыту оқушылар мен студенттердің когнитивтік құзыреттілігін дамытады деп санайды. Шет тілдерін үйренудің мысалын пайдаланып, мақала цифрлы оқытуды қолдану когнитивті құзыреттілік метагнитивтік компоненттерінің дамуын ынталандырады, сондай-ақ когнитивтік қызметтің декларативтік және процедуралық компоненттерінің қызметін белсендіреді.

Түйін сөздер: білім беру, электрондық оқыту, когнитивтік құзыреттілік, оқыту және студенттер.

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НАУКА, ОБРАЗОВАНИЕ И КОГНИТИВНАЯ КОМПЕТЕНТНОСТЬ НА ОСНОВЕ E-LEARNING

Аннотация. Статья посвящена развитию образовательного процесса, в том числе в контексте представлений о цифровом обучении. Хотя в последние годы цифровое обучение часто становится объектом научных исследований и практических разработок, многие практики и теоретики до конца не понимают, что на самом деле означает понятие «цифрового образования», не понимает, как оно может помочь учителям и преподавателям достичь успехов в образовании в знаниях учащихся. Авторы статьи рассматривают исторические основы цифрового обучения и применения информационных технологий в образовании. Они полагают, что ведущие изменения в образовании, связанные с цифровым обучением состоят в том, что что цифровое обучение развивает познавательную компетентность школьников и студентов. На примере изучения иностранных языков, в статье показано, что применение цифрового обучения стимулирует развитие метакогнитивных компонентов познавательной компетенции, а также активизирует деятельность декларативных и процессуальных компонентов познавательной активности.

Ключевые слова: образование, электронное обучение, познавательная компетентность, обучение и студенты.

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