USE OF ICT IN TEACHING AND LEARNING LATIN

Balalaieva O. Yu.

INTRODUCTION

At the beginning of the 21st century, with the support of the European Commission, the *CIRCE* (Classics and ICT Resource Course for Europe) project was launched; it combines the efforts of European scholars and teachers to develop effective methods for using ICTs in the teaching classical languages. As the authors of the project emphasize, traditional methods of teaching Latin and Greek should be revised in the 21st century. The goal of the project is to support and provide classical teachers with effective methods for using computer technology in the learning process. Within the framework of the project, the manual for teachers containing generalization and systematization of best practices in this field, theoretical and practical advice on the use of existing and the creation of new electronic resources for the study of Latin, as well as the results of research in this area have been published in six languages[1].

The website *CIRCE* offers a list of web resources for teaching and learning Latin and Greek such as *The Classical Art Research Centre database of University of Oxford, Cambridge museum of classical archaeology database, Packard Humanities Institute, Greek Inscriptions, Fitzwilliam Museum Online Collections Database, Ashmolean Museum Online Collections Database, British Museum Online Collections Database Chiron* (CC images of the classical world), *The Digital Classicist* (advanced digital methods applied to the study of the ancient world), *Perseus Latin word study tool, The Latin Quarter (allow hearing Latin read aloud, access online supports for The Complete Latin Course, watch films with Latin spoken), Classics stuff* (line-by-line vocabulary lists for classical texts)*, Pelagios Digital Map of the Roman Empire* (interactive map of the ancient world), etc.

However, in Ukraine the development of digital content for learning Latin is gaining momentum, but already has a certain experience, not covered in project CIRCE as well as the experience of American, Asian, Australian teachers. Most of the useful links are accumulated on various domestic sites devoted to the study of Latin. Many foreign scientists and teachers simply do not know about their existence.

---

[1] Morgan J. Classics & ICT resource course for Europe: a manual for teachers of classical subjects in secondary schools throughout Europe. Brussel: CIRCE Project, 2006. P. 3.

From time to time, attempts are made to summarize information and provide content for studying classical languages in scientific works (Balalaieva[2], Hardwick[3]; Hinke[4]; Hunt[5]; Lister & Smith[6]; Lister[7]; Pantelia[8] et other), but such information quickly becomes outdated and needs to be regularly updated. There is a shortage of scientific works of a general character, in which information on this issue is systematized.

The purpose of the study is to analyze foreign and domestic experiences using ICT in teaching and learning Latin, review electronic resources on Latin, analyze their didactic potential to help teachers effectively organize the educational process, diversify the set of tools, and enhance their work.

1. E-libraries and databases

One of the best e-libraries is *Perseus Digital Library,* Tufts University, which has the largest database of Latin and Greek stuff, consisting of texts (original language, translations) and images. The digital collection contains about 4 million Latin materials, over 64 thousand images and presentations, but the most important characteristics of the library are the rational structuring of materials and database architecture.

The huge resources of the original antique and medieval texts are offered by *TLG – Thesaurus Linguae Graecae: Greek Texts*, *PHI5 – Packard Humanities Institute: Latin Texts and Bible Versions*, *BTL – Bibliotheca Teubneriana Latina, TLL – Thesaurus Linguae Latinae,* etc.

Brepolis, or *Brepols' Online Databases* consist of 4 parts: *Source Collection (Brepolis Latin: Library of Latin Texts, Archive of Celtic-Latin Literature, Aristoteles Latinus Database, Patrologia Orientalis, Database of Latin Dictionaries, Dictionary of Medieval Latin from British Sources), Stand-alone Database (Vetus Latina Database), Bibliographies and Encyclopaedias.*

A part of the *Forum Romanum,* Harvard, – *Corpus Scriptorum Latinorum* – contains a digital library from the earliest epigraphic writings to the Neo-

---

[2] Balalaieva O. Online resources and software for teaching and learning Latin. *Texto Livre: Linguagem e Tecnologia.* 2019. Vol. 12, No 3. P. 93-108.

[3] Hardwick L. Electrifying the canon: the impact of computing on Classical Studies. Computers and the Humanities. 2000. Vol. 34, No 3. P. 279–295.

[4] Hinke C. J. Internet resources for the classics. *The Classical Outlook.* 2009. Vol. 86, No 2. P. 67-71.

[5] Hunt F. Teaching and Learning Latin in the Key Stage 3 Classroom: Using the Cambridge Latin Course Explorer Tool. *Journal of Classics Teaching.* 2018. Vol. 19. P. 42-49.

[6] Lister B., Smith T. Learning Latin by Electronic Media: Edging into the Future. *CALICO Journal.* 2001. Vol. 18, No 2. P. 235-248.

[7] Lister B. Changing Classics in Schools. Cambridge: Cambridge University, 2007. 176 p.

[8] Pantelia M. Electronic Resources for Classicists: The second generation. *New England Classical Journal*, 1995. Vol. XXII, No 3. P. 117-126.

Latinists works of the 18th century, which is distinguished not only by the large volume of Latin sources but also by a convenient search engine (by author, title, year, genre).

Bibliotheca Latina IntraText, Èulogos SpA, is a full-text digital library offering books and corpora as lexical hypertexts on Creative Commons License, under headings *Latinitas Romana* (antiqua, classica), *Latinitas Mediaevalis* and *Latinitas Nova*.

An analytic bibliography of online Neo-Latin texts contains 63,210 entries on Latin texts written during the Renaissance and later that are freely available on the Web.

The platform *Textkit* provides free of charge downloads of Greek and Latin grammars, readers, lexicons and dictionaries, offers a large library of over 180 of the best Greek and Latin textbooks, for instance, *Latin for Beginners*, *New Latin Grammar*, etc.

2. Online courses, software, e-textbooks, tutorials

Users are also offered various courses for learning Latin online and offline. One of the most famous Latin courses for beginners is the *Cambridge Latin Course*, which has proved effective in teaching practice for over 50 years. Besides the traditional printed edition, this course is now available online. Under a project approved by the British government, *Cambridge Latin Course E-Learning Resources*, which contains selected texts, video, and audio materials, was created to raise the standards of learning Latin and provide greater access to this subject.

Another authoritative textbook for beginners with a good track record and more than 60 years of practice of using in American schools is the *Wheelock's Latin*, which continues to exist on the *Official Wheelock's Latin Series Website*. The site provides all materials based on this manual: audio files, workbooks, flashcards, drill-and-practice programs *Latin Vocab Drill 4.0 and Latin Flash Drill 4.0,* etc.

The *Rosetta Stone Latin course* is a multimedia program for learning Latin from a zero level. The training uses a flash technique with a combination of text, image, and sound so that the user intuitively memorizes the words from which phrases and sentences are built in a systematic progression. Such kinds of speech activity, like listening, reading, speaking are used in lessons. The technology developed by the company is called Dynamic Immersion, which involves learning the language through multiple repetitions and the formation of associative series on various topics. This technique teaches to perceive and automatically reproduce the most common speech constructs.

The multimedia product *Lingva Latina per se illvstrata* by Hans H. Ørberg deserves particular attention because this is a Latin written in Latin based on

Latin-only approach. It consists of two parts: *Familia Romana* (main course) and *Roma Aeterna* (additional course) and contains textbooks, their parts in the author's reading in mp3 format, interactive grammar exercises, additional texts collection, Latin-English dictionary.

An interactive Latin course for beginners *Latinum Electronicum* was developed within the framework of the Swiss Virtual Campus project, which aims to develop modules that incorporate distance learning courses through the active use of information technology in the higher education system. The course is presented in three languages – German, French, Italian.

The *Latein Online* contains an electronic Latin course, developed within the framework of the Studierplatz Sprachen project. The general self-study course consists of three consecutive modules with control tasks and texts. The modules correspond to the structure of the Latin course in many German universities, so the transition from an online course to university and the other way around is possible.

The website *Latin Teaching Materials at Saint Louis University* has been operating for 12 years. Besides SLU Classical Program Information it contains set of Latin e-books for Kindle and other devices, *Grammar and Vocabulary Helps*, which presents the essentials of beginning and intermediate Latin morphology, *Latin Praxis* – series of exercises and Explanation Pages, *Verbal Brilliance in Latin* – set of handouts in pdf format, *Rudimenta in Motu* (Flash movies), *Timelines for Roman History, Reading Acceleration Machine* – a tachistoscope that supports efficient and rhythmic reading, rehearsal of text-comprehension, and acceleration in reading speed.

The platform *Latinitium* is a for anyone wanting to learn to read and speak Latin, contains audio/video podcasts in Latin, articles on learning Latin, various resources, from texts to online dictionaries.

Transparent Language proposes a two-level Latin course, each level has 8 units, including 3-5 vocabulary lessons (accompanied by images and sounds) and 1 grammar lesson (accompanied by additional instructions and drills on topics).

A well-organized and comprehensive tutorial *Latin Online* is proposed by The Linguistics Research Center at the University of Texas at Austin.

The *Power-Glide Latin Ultimate* proposes 2-year courses for learners 7th–12th grade and adult. Activities in the course are diverse enough to accommodate many learning styles using music, stories, memory aids, diglot weaves, kinesthetic, visual, audio activities, and more. *Medieval Latin by UK National Archives* is a two-stage beginners' guide to medieval Latin.

Among the well-known courses we should also point out: *Oxford Latin Course: Online*, *KET's Distance Learning Latin Program,* Kentucky Educational Television, *Ecce Romani*, *Evan der Millner's Latin Language*

Course, *Linney's Latin Class*, *Mundus Latinus*, *Schola Latina Europaea & Úniversalis*, *Latin pour debutant,* etc.

In learning Latin, algorithmic learning activities, such as developing abilities and skills on the definition of the type of syntactic construction, the translation of the word/term, are very important. Some students need more training, repetitions and verifications for the correct execution of these actions than a teacher can provide in the classroom face-to-face studies, while interactive guides and manuals are able to provide such an opportunity. There are numerous resources available on the Internet which include tests on and exercises of varying difficulty levels to test grammar and translation skills, for example, *Latin Flash Drill 5.0* and *Latin Vocab Drill 5.0, Centaur Systems*, *Latin Games and Learning, Latin Product Quizzes*, based on *Transparent Language's LatinNow! Program*, *Lingua Latina/WinLatin*, *Latin Trivia and Quizzes*, *Nugae Latinae*, *Interactive Vocabulary and Grammar quizzes, LatinTest.net*, *Latein haut rein*, *Language Software to Teach Latin & Homeric Greek Vocabulary*, *Verbix* – a conjugator that shows verb inflections of Classic Latin.

The website *Navigium* contains educational software, grammar exercises, vocabulary, and the lexical simulator *Latein-Vokabeltrainer* – an optimal tool for effectively memorizing Latin vocabulary, while *Haudenverres* teaches the very mechanism for translating Latin texts.

Among Ukrainian sites, *Pinax* stands out. It provides materials from the courses on Latin, Ancient Greek and Culture of Ancient Greece and Rome by teachers of the Department of General Linguistics and Classical Philology of the Institute of Philology of the Taras Shevchenko National University of Kyiv. Latin course contains Latin grammar tables, analysis of nouns and adjectives, samples of exercises and tests, various articles, Latin phrases, versions of the anthem Gaudeamus translated by famous Ukrainian poets and university students, etc.

In 2009, the *Medievist. Ukrainian Latin Literature* project was launched to combine the scientific works of modern authors, original Latin texts and translations on the one resource. The site is a platform where scholars can share their own works, communicate with colleagues, it's designed to carry out informational, innovative, and scientific missions. However, site also offer educational services: Latin courses, consultations on topics of normative grammar and syntax as well as in the field of medical, pharmaceutical, biological terminology.

3. Dictionaries and translators

Online dictionaries and translators occupy a separate niche among electronic resources.

The Thesaurus Linguae Latinae Online is the largest and most detailed Latin dictionary in the world, based on the renowned print dictionary, designed to serve as a tool for both research and teaching preparation at the primary and university school levels, supported by 31 academies and scholarly societies from over 23 countries.

William Whitaker's WORDS is an electronic dictionary for translating from Latin to English and vice versa. The computer program can parse variations of the forms of Latin words, give the various possible interpretations (case, person, gender, tense, mood, etc.), translate roots. The purpose of this dictionary in the overall scheme was to have a variety of words and types, from which the algorithms for the codes could be developed, and with which they could be exercised. The dictionary is intended for beginning Latin students or amateur, but it has become very popular due to the wide coverage of the Latin vocabulary (about 39,000 entries) and accurate translation.

William Whitaker's WORDS provided the basis for many other dictionaries, for instance, *John Madsen Latin-English Dictionary* (about 42,000 entries), *Marco Waclawek Latein-Wörterbuch* (about 48,000 entries), etc.

One more product based on *William Whitaker's WORDS* is *NoDictionaries* – a Latin dictionary look-up tool which generates an interlinear word list. The module *NoDictionaries: Latin Literature* contains literal translations of 49 classic authors, the module *NoDictionaries: Novifex* allows generating interlinear word lists of any text entered by the user.

Another product *Blitz Latin*, designed by White & Whitaker, is able to translate automatically not only words but also texts from Latin to English. It contains about 9,500 Latin standard phrases and more than 43,000 words. The specific feature of the dictionary is its flexibility – for the accurate translation, the user can choose the period (classical or medieval), the sphere of language use (biological, medical, linguistic, law, and technical), to review all alternative meanings of the word. The dictionary offers three additional modules: *HTMStrip* – provides formatting of texts from HTML pages into text ready for translation; *Inscript* – a quick search tool for the database of inscriptions of Frankfurt University; *Counter* – counts Latin words in the text and provides statistical analysis.

The *Latin Lexicon. Numen* is an online Latin dictionary based on some authoritative sources, in particular, *An Elementary Latin Dictionary* by Charlton T. Lewis, *A Latin Dictionary* by Lewis & Short and *Latinitas Recens*. This online dictionary has the fastest, efficient user interface and well-designed navigation system. The program offers not only the translation of the word but also its whole derivational paradigm and examples of use in the

classical authors' works. The built-in tutorial *Word study tool* provides the ability to grammatically analyze words.

Classic dictionaries are also available online in a fully digitized and searchable form: *A Copious and Critical English-Latin Dictionary* by Smith & Hall), *A Latin Dictionary* by Lewis & Short), etc.

Mention should also be made of online Latin-German dictionaries: *Albert Martin Latein Wörterbuch* contains 36,500 entries, *Auxilium Lateinwörterbuch* contains 16,000 entries, is able to translate and parse forms of Latin words; Latin-Italian: *Olivetti Dizionario* – the largest online Latin-Italian dictionary with a conjugator and declination tool included, *Dizionario Latino Italiano;* Latin-French: *Olivetti Dictionnaire Latin-Français*, *Lexilogos*, *Traducteur Latin Français en ligne*; Latin-Spanish: *AULEX*, *ePrevodilac Latin-Spanish translator*; Latin-Dutch: *Woordenboek Latijn-Nederlands*; Latin-Portuguese: *Dicionário de Latim* – online Latin word and phrase dictionary with meanings and definitions in Portuguese, etc.

Latin became the 58th language proposed by *Google Translate* for direct and reverse translation. However, as our practice shows, translations from Ukrainian to Latin by *Google Translate* are far from perfect, as well as translations by other tools, such as the translator *Pragma 6, The Ukrainian-Latin online dictionary* on *glosbe.com* (8,260 phrases in the Latin-Ukrainian translation and 7,765 in reverse offers a translation from Latin to Ukrainian, possible word combinations, examples), etc.

Many Ukrainian universities and other higher educational establishments propose their own Latin courses developed on Moodle.

4. Experience of the using e-learning tools based on visualization in veterinary students' training

Researchers have repeatedly drawn attention to the fact that modern e-learning tools have advanced features for better implementation of the didactic principle of visualization. The feasibility of the use of such tools is determined, primarily, by the opportunity to use them for the visualization of educational information, the formalization of knowledge about the objective world. However, modern studies mainly focus on the benefits of e-learning tools as for the implementation of the principle of visualization comparing to the traditional ones.

In this research, we understand visualization in the broad sense as "presentation of pictures showing easy to recognize objects that are connected through well-defined relations. It means the translation of mental, abstract, formal concepts into images by looking and seeing objects and processes"[9].

---

[9] Ursyn A. *Visual Approaches to Cognitive Education with Technology Integration.* Hershey PA: IGI Global, 2018. P. 1.

Visualization is interpreted as an indicator of simplicity and clarity for the subject of a mental image created in the process of perception and subsequent mental processing of real objects; a tool based on visualization is considered as an external support of internal actions carried out in the learning process.

According to Gooding, visual modes of representation are essential to the generation, communication, and dissemination of new knowledge[10].

Researchers, exploring the scientific basis of visualization principle in universities, emphasize the need to include the activities related to modeling, idealization, imaginary experimentation into the learning process. The teacher has visual tools at his disposal that would provide an opportunity to show and find the very essential links and relations between the objects and phenomena under study and the values that describe them (not their individual minor manifestations), and the degree of influence of various factors and conditions on the natural phenomenon under study.

Shah and Freedman consider that the benefits of using visualization in learning environments are: promoting learning by providing an external representation of the information, deeper processing of information; and maintaining learner attention by making the information more attractive and motivating, hence making complex information easier to comprehend[11].

Shatri & Buza proved, that the use of visualization in the teaching and learning process has a positive influence in increasing and developing the critical thinking of students[12].

Sankey, Birch and Gardiner noted that the "increasing use of multimedia in teaching has provided many opportunities to present multiple representations of content (text, video, audio, images, interactive elements) to cater more effectively to the different learning styles and modal preferences of an increasingly diverse student body"[13].

If traditional learning visual aids required the specifics of the object under study, then use of ICT allows the dynamic interpretation of essential properties not only of real objects, but also scientific laws, theories, concepts. According to research, such multimedia visualization allows creating a more progressive nature-like environment to display educational content, its visual

---

[10] Gooding D. Visualization, inference and explanation in the sciences. *Studies in Multidisciplinarity*. 2004. Vol. 2. P. 2.

[11] Shah P., Freedman E. G. Visuospatial cognition in electronic learning. *Journal of Educational Computing Research*. 2003. Vol. 29, No 3. P. 316.

[12] Shatri K., Buza K. The use of visualization in teaching and learning process for developing critical thinking of students. *European Journal of Social Sciences Education and Research*. Vol. 4, No 1. P. 72.

[13] Sankey M., Birch D., Gardiner M. Engaging students through multimodal learning environments: The journey continues. *Curriculum, technology & transformation for an unknown future*. Sydney, 2010. P. 853.

interactive modeling and research; hypermedia architecture provides a person-focused, developing nature of education. The extraordinary expressiveness and visual appeal of multimedia are important in dealing with a new video-generation which easily absorbs knowledge through the works of computer culture. It forms students' tendency to perceive, to know the world through figurative and visual information presentation based on ICT, the readiness to work in the information society. Multimedia visualization is characterized by much greater informational density, the merge of conceptual and visual that organically embraces both verbal and creative thinking[14].

Also, e-tools provide the subjects of learning with the opportunity to perform transforming activity with the objects of learning, to observe and analyze its results, thus achieving a significant improvement of gnosticism models of objects under study[15]. Thus, the principle of visual aids using is interpreted not only with the availability of the object under study to perceive via observation but is supplemented by the requirements to attract the subject of learning to transform activity, accompanied by the visualization of its results[16].

As Voloshynov, Kostyuchenko, Osipova have proved, "the results of the accomplished experimental work on visualizers implementation in the process of algorithmic training students show not only the enhance of the cognitive processes of learning activities and mechanisms of student self-de[17]velopment, but also that there are some changes in the pedagogical activity, which are based on the integration technology of cognitive visualization of knowledge with training technology. The changes are the raise of learning motivation and creativity, activation of students' searching activity".

Henderson to explain why visual representations are so powerful, develops the concept of "metaindexicality" – the ability of visual representation, used interactively, to combine many diverse levels of knowledge and thus to serve

[14] Волошинов С.А. Реалізація дидактичного принципу наочності в алгоритмічній підготовці студентів засобами інформаційно-комунікаційного педагогічного середовища. *Інформаційні технології в освіт*і. 2011. № 10. Р. 173.

[15] Лапінський В. В. Принцип наочності і створення електронних засобів навчального призначення. *Народна освіта*. 2009. Вип. 3(9). URL: https://www.narodnaosvita.kiev.ua/Narodna_osvita/vupysku/9/statti/lapinskiy.htm

[16] Мадзігон В. М., Дорошенко Ю. О., Лапінський В. В. Педагогічні аспекти створення і використання електронних засобів навчання. *Проблеми сучасного підручника.* 2003. Вип. 4. С. 70.

[17] Voloshynov S., Kostyuchenko O., Osipova N. Realization of visual technique didactic approach in algorithmic training of students through information and communication technologies of educational environment. *Інформаційні технології в освіті.* 2016. № 4 (29). Р. 63.

as a meeting ground (and sometimes battleground) for many types of workers[18].

Other researchers believe that the damage from using multimedia tools in education is more apparent than the benefit. So, use of visual aids in education is harmful when they replace students' independent imagination and thinking. The overuse of visual aids can cultivate "comics-thinking" as a dangerous form of mind control. In general, visual aids often initiate not the intellect but emotions, and therefore, they are convenient means of imposing opinions from the outside, while the education goal is to teach students to do it on their own. Useful visual aids should not replace, but rather initiate both imagination and human intelligence, expand and enrich the current experience.

Didactic risks of visualization principle are the most predictable and are mentioned in the works of many contemporary scholars. While analyzing the e-learning tools the attention was repeatedly drawn to the typical overuse of visualization at the price of its content, semantic plan substitution with illustrations, eye-catching techniques, animation. The redundancy of illustrative component dissipates students' attention, distracts them from tracking the logic of content deployment.

In our opinion, the potential of modern e-learning tools not only allow the implementation of visualization principle on a whole new level but also significantly increase the didactic risks of its realization[19].

Users hold a dialogue through the display in a static working position, in the conditions of time shortage, which requires higher attention concentration and intense mental activity in the process of multi-dimensionless analysis of display formats and processing algorithms of visual information arrays, that are large in size and different in structure.

The ergonomic requirements for e-learning tools determine the necessity to consider the age and the individual characteristics of users, different ways of thinking and nervous activity organization, and the patterns of intellectual and emotional rehabilitation. To reduce the load on visual analyzers while designing an e-learning tool it is necessary to consider physiological and ergonomic requirements for material visualization (colors, the spatial layout of information on the screen, the organization of alphanumeric characters, and symbols on the screen, image legibility and resolution, etc.).

Equally important is the danger which lies in pedagogically unjustified use of modern information technologies. The use of e-learning tools, developed

---

[18] Henderson K. On line and on paper: Visual representations, visual culture and computer graphics in design engineering. Cambridge: M.I.T. Press, 1999. P. 35.

[19] Balalaieva O. The effect of using e-learning tools based on visualization in teaching and learning Latin. *Revista Conhecimento Online*. 2020. Vol. 3. P. 4-29.

with the violation of design-ergonomic and hygiene requirements, put the physical and mental health of users at risk.

The researchers note that attempts to interest via excessive use of animation and gaming tools do not achieve the desired goal primarily due to the "contrast effect", when the student is familiar with dynamic computer games and simulators and expects the same dynamics from the e-learning tools.

The desire to make e-textbook bright and eye-catching out of ignorance of basic rules of font science, chromatics, composition, design leads to the opposite effect – it complicates the perception and understanding of information (sometimes to complete unreadableness). We also note that e-learning tools often use ready-made illustrative materials from different databases, resulting in that the manual includes various pictures, photos, video clips of questionable didactic potential; they are all different in technique, quality and purpose. Illustrative material should not contain extra information that distracts the students from absorbing the knowledge; the same-type illustration should be performed in the same technique.

Researchers set out the requirements for e-learning tools that complement and extend the principle of visualization:

– tools should contain such a visual model of the object that best contributes to the learning goal, without excessive details or simplifying the overall image plans;

– a model should be presented in a form that allows most clearly identify and distinguish between the essential features of the object under study, links and relationships and its components;

– cognition (stimulation of guessing) of educational material with visual aids should be implemented so as to enable the teacher to use the methods of active learning, and to make the learning process really interactive;

– gnosticism of presenting educational models cannot be a goal in itself: it is necessary to use models of objects under study that do not present knowledge in a completed form but include research, the independent cognitive activity of students, encouraging their skills for such activities[20].

Scholars believe that modern understanding of visualization principle with using educational software creates significant didactic prerequisites for success in learning through emotional inclusion, gnosticism, the visualization of the information perception process, a dosage of multimodality of educational influences that encourage voluntary attention and use suggestive memory, individualization of educational information presentation pace. When creating and analyzing visual models, the subjects of learning have to undergo phases of scientific knowledge – to carry out system decomposition,

---

[20] Лапінський В. В. Принцип наочності і створення електронних засобів навчального призначення. *Народна освіта.* 2009. Вип. 3(9). URL: https://www.narodnaosvita.kiev.ua/ Narodna_osvita/vupysku/9/statti/lapinskiy.htm

the analysis of its components, the selection of essential features of objects and essential connections between them – with the subsequent determination of model's structure or the object and its synthesis[21].

Thus, the major advantages of e-learning tools for the implementation visualization principle are: the opportunity of abstract visual-figurative interpretation of essential properties of real objects, scientific laws, theories, concepts, providing a poly-sensorial perception of educational information, and the opportunity to carry out the transforming activity with objects or their models. However, the potentials of modern e-learning tools not only allow the implementation of the visualization principle on a whole new level but also significantly increase the didactic risk of its realization. To prevent such risks while designing the e-learning tools it is necessary to be guided by the requirement of reasonable visualization sufficiency – a necessary optimal minimum of illustrative material which has to be determined individually for each tool, depending on its purpose, functions in the learning process, target audience, and other factors[22].

So, using visualization in teaching and learning remains an open problem in the area. A number of questions regarding the use of e-learning tools based on visualization remain to be addressed.

Ursyn et al. researched knowledge visualization and visual literacy in science education, in particular in biology, math, digital media, and music[23]; Volohsinov et al. – for algorithmic training[24], Eilks – the role of visualization and its potential danger for teaching and learning chemistry[25].

And although many scholars (Hashemi & Pourgharib[26]; Kolodii et al.[27]; Hsiao et al.[28]) have studied the use of visualization in foreign language

---

[21] Мадзігон В. М., Дорошенко Ю. О., Лапінський В. В. Педагогічні аспекти створення і використання електронних засобів навчання. *Проблеми сучасного підручника.* 2003. Вип. 4. С. 72.

[22] Balalaieva O. The effect of using e-learning tools based on visualization in teaching and learning Latin. *Revista Conhecimento Online*. 2020. Vol. 3. P. 4-29.

[23] Ursyn A. *Knowledge Visualization and Visual Literacy in Science Education.* Hershey PA: IGI Global, 2016. 458 p.

[24] Voloshynov S., Kostyuchenko O., Osipova N. Realization of visual technique didactic approach in algorithmic training of students through information and communication technologies of educational environment. *Інформаційні технології в освіті.* 2016. № 4 (29). P. 63

[25] Eilks I. The role and potential danger of visualisation when learning about sub-microscopic explanations in chemistry education. *CEPS Journal*, 2012. Vol 2, No 1. P. 125-145.

[26] Hashemi M., Pourgharib B. The effect of visual instruction on new vocabularies learning. *International Journal of Basic Science and Applied Research.* 2013. Vol. 2, No 6. P. 623-627.

[27] Kolodii O., Kovalchuk I., Syvak O. The impact of visualization techniques on student's learning vocabulary. *International journal of new economics and social sciences.* 2017. Vol. 6, No 2. P.359-367

[28] Hsiao I. Y. T., Lan, Y.-J., Kao C.-L., Li P. Visualization analytics for second language vocabulary learning in virtual worlds. *Educational Technology & Society.* 2017. Vol. 20, No 2. P. 161-175.

teaching and learning, most of these studies dealt with living foreign languages.

Despite the large numbers of studies examining various aspects of ICT use in teaching and learning Latin, only a few studies to date have focused on using visualization in this field, among which we should mention the work devoted reading proficiency in Latin through expectations and visualization[29], and research of improving engagement and accuracy with the visualization of Latin for language learning. In particular, Zhou developed a special tool *Ingenium*, an interactive visual representation of grammatical concepts in Latin that focuses on grammatical forms over word order, redirecting students' attention from the meanings and functions of words in isolation to the grammatical interactions among all words in a sentence. And after an experiment, researcher concluded that using *Ingenium* "not only improves students' understanding and translating of Latin sentences through its visual emphasis on grammatical concepts and structures, but also increases student engagement by providing a dynamic environment for experimentation"[30].

To our knowledge, no prior studies have examined the use of e-learning tools based on visualization in teaching and learning Latin in professional training.

Since the 2010s, the National University of Life and Environmental Sciences of Ukraine has continued a long-term pedagogical experiment on the effectiveness of the use of e-learning tools in the veterinary students' training. The aim of the experimental research work was to carry out the system of pedagogical influence by means of e-learning tools, which has to increase the retention level of learning material, minimize didactic risks and improve the quality of the educational process in Ukrainian agrarian universities.

The consisted of three stages. At the first stage, we examined the status and trends in teaching with using e-learning tools in agrarian universities, diagnosed students' needs on the use of e-learning tools and defined experimental and control groups. A total 247 students (109 male and 138 female) of the faculty of veterinary medicine of Ukrainian agrarian universities participated in the experiment (traditionally, this faculty is one of the largest in agrarian universities in terms of student numbers). 6 teachers (2 senior lecturers and 4 associate professors) were involved in experimental work.

Defining the research problem, methodology, experimental design, developing instruments, data collection and analysis were carried out by the author in the framework of Ph.D. thesis[31].

---

[29] Markus D. D., Ross D. P. Reading proficiency in Latin through expectations and visualization. *The Classical World*. 2004. Vol. 98, No 1. P. 79-93.

[30] Zhou S. Engineering Ingenium: Improving engagement and accuracy with the visualization of Latin for language learning. Harvard College, 2015. P. 69.

[31] Балалаєва О.Ю. Проектування електронних посібників з латинської мови для вищих аграрних навчальних закладів: дис. ... канд. пед. наук. : 13.00.10. Київ, 2016. 269 с.

The following criteria have been established for the effectiveness of learning:

− motivation (indicators: focus and level of academic motivation),

− cognition (indicators: quality and amount of knowledge),

− activity (indicators: mastering practical skills, speed of execution of training tasks).

At the beginning of the experiment, there were not any considerable differences between levels of indicators among students of the control and experimental groups, because they did not have a background and prior knowledge in the Latin (this language is not studied in secondary schools in Ukraine), that made it possible to ensure the homogeneity of the group composition.

At the second stage, under the experimental conditions, students of the control group (n=124) were trained in traditional ways; students of the experimental group (n=123) were trained with a new technique, providing for the complex use of traditional learning tools, some online resources and software as well as special e-textbook «Elementa Linguae Latinae», based on visualization.

Online resources and software were selected by such criteria as accuracy, credibility, reasonableness, support, interactivity, aesthetics, accessibility, communicative value, pragmatic value, cognitive value and described in a separate article[32].

The e-textbook "Elementa Linguae Latinae" was designed based on systematic approach[33], taking into account major principles of teaching Latin at the Faculty of Veterinarian Medicine[34], structural an objective factors (students' provision of learning materials, academic performance and motivation, normatively defined goals with defined priorities in developing competencies) and subjective factors (student preferences).

This tool has a modular structure and there are two basic modules (*Guide* and *Dictionary*) and *Help* module.

The *Guide* module contains a short course in Latin, in which basic phonetics and grammar knowledge required for mastering the skills of reading, writing, translation, and analysis of veterinary terms is provided in a

---

[32] Balalaieva O. Online resources and software for teaching and learning Latin. *Texto Livre: Linguagem e Tecnologia.* 2019. Vol. 12, No 3. P. 93-108.

[33] Балалаєва О.Ю. Структурно-організаційні та процесуально-організаційні характеристики проектування електронних освітніх ресурсів. *Інформаційні технології і засоби навчання.* 2016. Т. 54, № 4. С. 117.

[34] Balalajeva O. Major principles of teaching Latin at the Departments of Veterinary Medicine in Ukrainian agrarian universities. Edukacja – Technika – Informatyka. Wybrane problemy edukacji techicznej i zawodowej. № 4, Część 1. Rzeszów : Wyd. Oświatowe FOSZE, 2013. P. 530.

concise and accessible form. The module provides the implementation of information, systematization and self-control functions. The information function is provided by fixing the substantive content of training at the level of grammatical material, is realized through the availability of information on Latin phonetics and grammar, as well as some professional topics; the systematization on is implemented at the language level – the training material is structured according to the subsystems of the language and presented in the format reference manual with cognitive-graphic models.

The *Dictionary* module consists of three sections: "Dictionary" itself (4000 entries), "Terminological elements" (300 entries), and "Phrases" (300 entries). The information function of the module is provided by fixing the substantive content of training at the level of terminology material, is realized through the availability of Latin/Ukrainian term's equivalent, information about the origin of terminological elements, semantization, and partial term interpretation. The dictionary in this aspect is considered as a source of information, a means of access to accumulated empirical knowledge in the subject field. The systematization function is implemented at two levels: language and terminology (a term itself by its very nature is systematic and the semantization of the term in the dictionary implies a description of a certain fragment of the terminology system).

The *Help* module contains general information about the textbook and program, a description of the structure of the dictionary and entry, the user's guide, a list of conditional abbreviations, references.

One of an important feature of this e-textbook is the consistent use of cognitive visualization tools in the delivery of the training material, such as cognitive-graphic models, schemes, etc. The use of cognitive visualization techniques is relevant specifically for electronic guides designed to help master the discipline and provide solutions to local pedagogical problems: supplementing the material of the basic textbook, repeating and systematizing the acquired knowledge, providing additional or reference information on a specific topic.

At the third stage, quantitative and qualitative analysis of empirical data were carried out, results of the research were systematized and generalized.

The experiment was conducted under the conditions of a real educational process, all samples are based on homogeneous student contingent, the classes in control and experimental groups were given by the same teachers by single work program, measurements in control and experimental groups were carried out synchronously with unified instruments and were evaluated on the same criteria, that in the complex contributed to ensuring the reliability of the results of experimental research. In general, the reliability of the results of research is ensured by the theoretical reasonableness of the research positions, the

application of a complex of valid methods that are adequate to its purpose and objectives, quantitative and qualitative analysis of theoretical material and empirical data, mathematical-statistical methods for processing and interpretation of the results of the formative stage of the experiment.

The instrument to examine the motivational orientation in the learning Latin was developed. The developed survey consisted of 20 statements (Examples: "I need Latin for my future profession", "I see no prospect of studying dead language; in practice I do not need it", "There is no need for academic subject "Latin language" because Latin terminology is studied at lectures and lab works on special subjects", "The Latin is interesting to me, and I want to know as much as possible about it", "Latin grammar and exercises are uninteresting to me; I do them, because the teacher requires it", "The desire to pass an examination and receive grants is a main stimulus of studying Latin for me", "I can do tasks by myself, but I have to force myself to do it", "Auxiliary explanations of difficult cases in Latin grammar could be raised my interest in this subject", "I often do not understand teacher explanations and am ashamed to ask again, although I wish to know as much as possible", etc.).

The pilot survey was conducted in a representative group (n=12). Students were asked to indicate their level of agreement or disagreement with statements on a 4-point Likert scale: strongly disagree, disagree, agree, and strongly agree.

Item reliability has been assessed by calculating Cronbach's alpha (α=0.82, SPSS). After revising problematic items, a survey was proposed to students at the beginning and at the end of the experiment. Data were correlated. The results are described below.

Also, students of experimental and control groups were evaluated through a system of standardized achievement tests in the Latin language. Based on the results of the three tests (by different modules), the student average scores were calculated, which formed the basis of two independent samples (total sample size – 247). To test the hypothesis about the coincidence of the characteristics of the two groups, in particular, to determine whether there is a significant difference between the values of indicators of academic progress of students in control and experimental groups, as these differences are reliable and whether they could be extrapolated to the whole population t-test was applied.

To evaluate the learning effectiveness, the methodology for determining the coefficient of mastering the educational material (K_a) with standard values for 3 levels: low ($K_a < 0.7$), medium ($0.7 \leq K_a < 0.85$), high ($0,85 \leq K_a \leq 1$) was used.

The measurement of the speed of execution of training tasks was carried out according to the actual time required for a student to complete one test. To determine the levels of test execution speed (V_t) following limits were accepted: low ($V_t \geq 80$ min), medium (60 min $< V_t < 80$ min), high $V_t < 60$ min. Data reliability was checked by using statistical analysis with Pearson's chi-squared test.

Comparative analysis of the dynamics of educational motivation showed that the difference in the growth of the number of students with dominating intrinsic motives is 10.4% for the experimental group.

It is proved that positive changes have occurred in the redistribution of motivation levels: in experimental group number of students with a low level of motivation decreased by 1.4%, with a high level of motivation increased by 9.4%; in control one the number of students with a low level of motivation decreased by 0.4%, with high level increased by 0.8% (see Fig. 4.1).
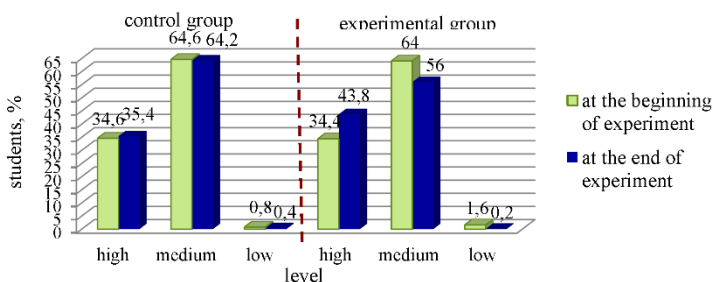

Fig. 4.1. Comparative diagram of the distribution of intrinsic motivation levels in the control and experimental groups at the beginning and end of the experiment

To test the hypothesis about the coincidence of the characteristics of the two groups, in particular, to determine whether there is a significant difference between the significant values of indicators of academic progress of students in control and experimental groups, as these differences are reliable and whether they could be extrapolated to the whole generation was applied *t*-test.

The positive difference in learning was ascertained in the experimental group: the number of students with medium and high levels of academic progress increased. In particular, the number of students with low progress in the experimental group is 14.2% less than in the control one, but the number of students with medium and high levels of academic progress higher by 9.2% and 5% respectively.

17

In general, by the results of the statistical analysis, the average score in the experimental group is 0.51 higher than in the control one (see Fig. 4.2).
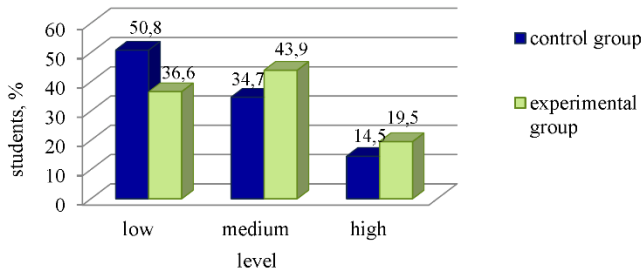

**Fig. 4.2. Comparative diagram of levels of academic progress
in the control and experimental groups**

Also it was determined that most of the students both in control and experimental groups demonstrated low speed of execution of training tasks; but in experimental group the number of students with medium speed of execution of training tasks is 9.2% greater than in control one, as well 6.4% of students showed a high speed of execution of training tasks (see Fig. 4.3).
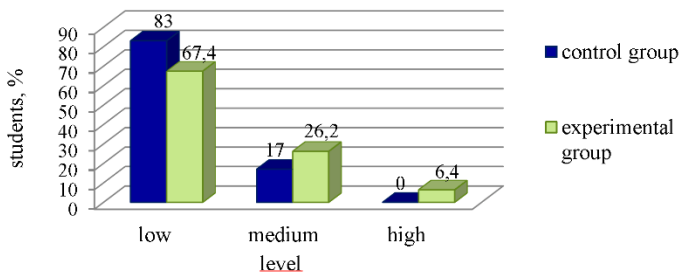

**Fig. 4.3. Comparative diagram of levels of speed of execution
of training tasks in the control and experimental groups**

It was found that the overall speed of execution of training tasks in the experimental group is 7.8% higher than in the control one.

The results of the pedagogical experiment give the grounds to state that training veterinary students with using e-learning tools based on visualization is more effective than traditional one.

The pedagogical experiment has proved the positive significant effect of using e-learning tools based on visualization on teaching and learning Latin by all criteria: motivation, cognition and activity. In particular, positive changes dynamics has been discovered in learning motivation focus and in intrinsic motivation levels redistribution. The effectiveness of e-learning tools using has been proved by a statistically significant increasing academic performance in experimental groups (in general, the average score in the experimental array is 0.51 higher than in the control one) and speed of execution of training tasks.

The results of this study are in line with the findings of a research performed by Zhou, which conducted the experiment with 67 beginning Latin students, measuring objective engagement, emotional and cognitive engagement, learning, change in self-efficacy, cognitive load, accuracy in sentence translation and concluded, that students, when using *Ingenium* (interactive visual representation of grammatical concepts in Latin) showed considerably higher levels of engagement and learning, opted to perform more optional problems, and completed translation exercises with substantially greater accuracy than when using the traditional interface[35].

The main results of the research were discussed and implemented into the educational process of Podilsky State Agrarian and Technical University (Certificate No 75-01-388), Poltava State Agrarian Academy (Certificate No 01-06/73), National University of Life and Environmental Sciences of Ukraine[36].

Despite all disadvantages and risks, we agree with modern researches, that visual approach to learning is objective necessary today and fully share the opinion, that notwithstanding individual differences in intelligence and learning style, this generation of children needs to be taught the way they learn best – with visual stimulation accompanied by active learning strategies[37].

CONCLUSION

The general trends of implementation of information and communication technologies in the educational space have considerably expanded the possibilities of studying Latin, opened access to vast resources of libraries, allowed using the scientific and educational potential and experience of teaching Latin in the leading world universities.

---

[35] Zhou S. Engineering Ingenium: Improving engagement and accuracy with the visualization of Latin for language learning. Harvard College, 2015. P. 6.

[36] Балалаєва О.Ю. Проектування електронних посібників з латинської мови для вищих аграрних навчальних закладів: дис. ... канд. пед. наук. : 13.00.10. Київ, 2016. 269 с.

[37] Ursyn A. *Visual Approaches to Cognitive Education with Technology Integration.* Hershey PA: IGI Global, 2018.

The development of various electronic resources for learning Latin is more advanced in European countries that have a strong educational tradition of teaching classical languages, as evidenced by the variety of products presented online (from entire platforms and websites to particular online courses, e-textbooks, tutorials, interactive tests, drill-and-practice programs, conjugators, dictionaries and translators etc.). In Ukraine the development of digital content for learning Latin is gaining momentum. Using best practices of colleagues could help classics teachers to effectively organize an educational process, diversify the set of tools, enhance their work, design domestic products for learning Latin.

Although our research has reached its aims, there were some unavoidable limitations. First, the experiment was conducted only in Ukrainian agrarian universities. To make a greater contribution to practical experience the result should be compared with similar studies in different countries, because our findings may not be applicable to other universities.

Second, the sample size was large enough for our local study, but it may be too small and non-representative for the larger population. Also, the sample was too homogeneous (all participants were students of the same faculty of veterinary medicine) and may not be representative of students at other faculties.

Finally, the study was focused on Latin language teaching; this methodology is rather specific and has certain limitations in the formation of linguistic competencies in comparison with teaching live foreign languages that involve active communicative activity. Further research should have a greater number of participants of different ages, from different faculties and universities and be conducted based on different languages to yield more generalizable results.

SUMMARY

This study aims to analyze foreign and domestic experiences using ICT in teaching and learning Latin, review electronic resources on Latin, analyze their didactic potential to help teachers effectively organize the educational process, diversify the set of tools, and enhance their work. It provides an overview of the current most popular resources on Latin: digital libraries and databases, online courses, electronic textbooks, dictionaries, translators etc.; describing the current state of the development of e-learning tools and websites for the study of this language in Ukraine.

The paper presents the results of the pedagogical experiment using e-learning tools based on visualization in veterinary students' training. The results of the experiment give the grounds to state that training veterinary students with using e-learning tools based on visualization is more effective

than traditional one. It has proved the positive significant effect of using e-learning tools based on visualization on teaching and learning Latin by all criteria: motivation, cognition and activity. In particular, positive changes dynamics has been discovered in learning motivation focus and in intrinsic motivation levels redistribution. The effectiveness of e-learning tools using has been proved by a statistically significant increasing academic performance in experimental groups (in general, the average score in the experimental array is 0.51 higher than in the control one) and speed of execution of training tasks.

Bibliography

1. Балалаєва О.Ю. Проектування електронних посібників з латинської мови для вищих аграрних навчальних закладів: дис. ... канд. пед. наук. : 13.00.10. Київ, 2016. 269 с.

2. Балалаєва О.Ю. Структурно-організаційні та процесуально-організаційні характеристики проектування електронних освітніх ресурсів. *Інформаційні технології і засоби навчання.* 2016. Т. 54, № 4. С. 108–118. DOI: https://doi.org/10.33407/itlt.v54i4.1441

3. Волошинов С.А. Реалізація дидактичного принципу наочності в алгоритмічній підготовці студентів засобами інформаційно-комунікаційного педагогічного середовища. *Інформаційні технології в освіт*і. 2011. № 10. P. 173-182.

4. Лапінський В. В. Принцип наочності і створення електронних засобів навчального призначення. *Народна освіта.* 2009. Вип. 3(9). URL: https://www.narodnaosvita.kiev.ua/Narodna_osvita/vupysku/9/statti/lapinskiy.htm (дата звернення: 12.01.2024).

5. Мадзігон В. М., Дорошенко Ю. О., Лапінський В. В. Педагогічні аспекти створення і використання електронних засобів навчання. *Проблеми сучасного підручника.* 2003. Вип. 4. С. 70–82.

6. Balalaieva O. Online resources and software for teaching and learning Latin. *Texto Livre: Linguagem e Tecnologia.* 2019. Vol. 12, No 3. P. 93-108. DOI: https://doi.org/10.17851/1983-3652.12.3.93-108.

7. Balalaieva O. The effect of using e-learning tools based on visualization in teaching and learning Latin. *Revista Conhecimento Online*. 2020. Vol. 3. P. 4-29. DOI: https://doi.org/10.25112/rco.v3i0.2323

8. Balalajeva O. Major principles of teaching Latin at the Departments of Veterinary Medicine in Ukrainian agrarian universities. Edukacja – Technika – Informatyka. Wybrane problemy edukacji techicznej i zawodowej. № 4, Część 1. Rzeszów : Wyd. Oświatowe FOSZE, 2013. P. 529–534.

9. Eilks I. The role and potential danger of visualisation when learning about sub-microscopic explanations in chemistry education. *CEPS Journal*, 2012. Vol 2, No 1. P. 125-145.

10. Gooding D. Visualization, inference and explanation in the sciences. *Studies in Multidisciplinarity.* 2004. Vol. 2. P. 1-25. DOI: https://doi.org/10.1016/S1571-0831(04)80029-7

11. Hardwick L. Electrifying the canon: the impact of computing on Classical Studies. *Computers and the Humanities.* 2000. Vol. 34, No 3. P. 279–295.

12. Hashemi M., Pourgharib B. The effect of visual instruction on new vocabularies learning. *International Journal of Basic Science and Applied Research.* 2013. Vol. 2, No 6. P. 623-627.

13. Henderson K. On line and on paper: Visual representations, visual culture and computer graphics in design engineering. Cambridge: M.I.T. Press, 1999. 250 p.

14. Hinke C. J. Internet resources for the classics. *The Classical Outlook.* 2009. Vol. 86, No 2. P. 67-71.

15. Hsiao I. Y. T., Lan, Y.-J., Kao C.-L., Li P. Visualization analytics for second language vocabulary learning in virtual worlds. *Educational Technology & Society.* 2017. Vol. 20, No 2. P. 161-175.

16. Hunt F. Teaching and Learning Latin in the Key Stage 3 Classroom: Using the Cambridge Latin Course Explorer Tool. *Journal of Classics Teaching.* 2018. Vol. 19. P. 42-49. DOI: 10.1017/S2058631018000211.

17. Kolodii O., Kovalchuk I., Syvak O. The impact of visualization techniques on student's learning vocabulary. *International journal of new economics and social sciences.* 2017. Vol. 6, No 2. P. 359-367. DOI: https://doi.org/*10.5604/01.3001.0010.7649*

18. Lister B. Changing Classics in Schools. Cambridge: Cambridge University, 2007. 176 p.

19. Lister B., Smith T. Learning Latin by Electronic Media: Edging into the Future. *CALICO Journal.* 2001. Vol. 18, No 2. P. 235-248.

20. Markus D. D., Ross D. P. Reading proficiency in Latin through expectations and visualization. *The Classical World*. 2004. Vol. 98, No 1. P. 79-93. DOI: http://dx.doi.org/10.2307/4352905

21. Morgan J. Classics & ICT resource course for Europe: a manual for teachers of classical subjects in secondary schools throughout Europe. Brussel: CIRCE Project, 2006. 122 p.

22. Pantelia M. Electronic Resources for Classicists: The second generation. *New England Classical Journal*, 1995. Vol. XXII, No 3. P. 117-126.

23. Sankey M., Birch D., Gardiner M. Engaging students through multimodal learning environments: The journey continues. *Curriculum, technology & transformation for an unknown future.* Sydney, 2010. P. 852-863.

24. Shah P., Freedman E. G. Visuospatial cognition in electronic learning. *Journal of Educational Computing Research.* 2003. Vol. 29, No 3. P. 315–324.

25. Shatri K., Buza K. The use of visualization in teaching and learning process for developing critical thinking of students. *European Journal of Social Sciences Education and Research.* Vol. 4, No 1. P. 71-74.

26. Ursyn A. *Knowledge Visualization and Visual Literacy in Science Education.* Hershey PA: IGI Global, 2016. 458 p.

27. Ursyn A. *Visual Approaches to Cognitive Education with Technology Integration.* Hershey PA: IGI Global, 2018. 387 p.

28. Voloshynov S., Kostyuchenko O., Osipova N. Realization of visual technique didactic approach in algorithmic training of students through information and communication technologies of educational environment. *Інформаційні технології в освіті.* 2016. № 4 (29). P. 63-74. DOI: 10.14308/ite000611.

29. Zhou S. Engineering Ingenium: Improving engagement and accuracy with the visualization of Latin for language learning. Harvard College, 2015. 204 p.

Information about the author:
Balalaieva Olena Yuriivna,
Candidate of Pedagogical Sciences,
Associate Professor at the Department of Philosophy
and International Communication
National University of Life and Environmental Sciences of Ukraine
15, Heroiv Oborony str., Kyiv, 03041, Ukraine