

Methodological Aspects of Utilization of Immersive Technologies in Japanese Language Learning for Future Language Teachers

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Abstract: The article is dedicated to methodological aspects of utilization of immersive technologies in Japanese language learning for future language teachers. We analyzed the use of virtual and augmented reality for supporting and organizing Japanese language learning for future language teachers and identification of the main approaches to the usage of augmented reality in language learning. It is concluded that immersive technologies provide a new paradigm of teaching materials, which has a positive impact on the formation of basic and professional competencies of future Japanese language teachers; it can be effective when used in blended learning that combines distance, online, traditional and self-directed learning of Oriental languages. Prospect for further research is the creation of guidelines for the use of immersive technologies for teaching Oriental languages at different levels of the training of future language teachers.

1 INTRODUCTION

The development of information and communication technologies and their active use in various fields of human activity require young people to adapt to new ways of working, living, and interacting.

Current technologies, used for various professional activities, are of great importance for implementation in the educational process, in particular general education institutions, and are necessary for the competitiveness of young people in the global labor market.

In this regard, immersive technologies are becoming increasingly popular in education (3, 2020). Immersive Technologies (ITs) are influencing many areas of human life in the 21st century: trade, tourism, the interaction and perception of digital information and media, science and education. Immersive technologies are technologies that extend reality or create a new reality by leveraging the 360° space. Makransky and Petersen (Makransky and Petersen, 2021) note that the use of these technologies can improve real-world visualization through virtual objects, graphics, and object recognition technologies.


ITs include Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR), which are now

used in many and varied fields – ranging from games and entertainment; theater and live events; museums and cultural heritage; marketing, advertising and tourism; architecture, product development and design; to simulation and health care (Buttussi and Chittaro, 2018).

The ITs are mostly used in education for science classes for covering human anatomy (Anatomy AR-VR, AR Human Anatomy, The Brain AR App, etc.), the universe (Planets AR, EARTH AR Poster, etc.), chemical reactions (MoleculAR, Chemistry Augmented Reality Education Arloon, etc.) and plant anatomy contents (Froggipeadia, Arloon Plants AR, etc.). However, this paper deals with ITs place in foreign language education, in particular Japanese language learning. Since a very limited number of applications and ITs content are available for language education, we will describe all possible uses ITs (VR and AR) for Japanese language learning and the experience of students.

2 THEORETICAL BACKGROUNDS

The multifunctionality of ITs and unfamiliarity of “virtual reality” became the impetus for the actualiza-

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tion of the concept of “virtual”, the rapid expansion of its scope; the impetus for the conceptual design of the idea of virtual reality in various fields of human activity.

AR has great potential in the field of language education (Amelina et al., 2022), as it performs such functions as contextual visualization (that is presentation of virtual information in an extended context) and interactivity of learning (that is the embodiment of interaction with virtual content). VR is a virtual 3D world that allows users to get visual simulations and feel immersed in a time and space-free environment.

The popularization of the phrase “virtual reality” belongs to Jaron Lanier in the late 1980’s (Firth, 2013).

At the present stage of information and communication technologies (ICT) development Immersive technologies based on VR can be represented as (figure 1):

- VR with full immersion, which provides realistic simulation of the virtual world with a high degree of detail (for example, the game zone Virtual Shooter);
- Partial immersion VR, consisting of VR and real-world attributes, is performed by embodying computer graphics objects in a reality scene (for example, a flight simulator) (de Oliveira et al., 2020);
- VR without immersion, related to the virtual experience with a computer, when you can control individual characters or their actions in the software, while the environment does not interact directly with the user (for example, World of Warcraft, ReHабgame);
- VR with group work, which represents a three-dimensional virtual world with elements of a social network (for example, Minecraft already has a version of virtual reality, which is supported by Oculus Rift and Gear VR helmets) (Monahan et al., 2008);
- CAVE (Cave Automatic Virtual Environment), which was developed by students of University of Illinois in 1995, and is a three-dimensional stage with wall projections (de Oliveira et al., 2020; Chang et al., 2012).

The term “Augmented Reality” was created by aircraft engineers Caudell and Mizell (Caudell and Mizell, 1992) in 1990. They developed the head-mounted displays as equipment for electricians to be used during assembling complicated wiring harnesses (Arth et al., 2015).

Nelson (Nelson, 2012) singles out augmented reality as important element of “Bring your own device” (BYOD) approach, which stands for usage of

mobile devices by teachers and students in classroom for learning purposes.

Calo et al. (Calo et al., 2015) define Augmented Reality as “... a mobile or embedded technology that senses, processes, and outputs data in real-time, recognizes and tracks real-world objects, and provides contextual information by supplementing or replacing human senses”.

AR is a technology that incorporates digital information such as images, video, and audio into real-world spaces, giving the possibility to blend virtual environment with reality (Kiv et al., 2019). Users of this technology have a chance to learn in immersive, computer-generated environments through realistic sensory experiences.

The mobile AR applications can be grouped into three categories depending on their purpose, place of use, and usability, such as marker-based, creation-based, and marker-less AR (figure 2).

It should also be noted that some apps in these categories may have both creation-based and marker-less features. However, if an app is a marker-based one, it can’t have a marker-less AR feature because it could only work with flashcards.

We can distinguish the following types of mobile AR (Soroko, 2021):

- marker-based, that uses a camera and a special visual marker, such as a QR code (quick response code);
- creation-based, that uses the browser-based platform allows users to upload 3D files and edit them with comments, detailed instructions and animations via a drag-and-drop interface;
- marker-less, that uses Global Positioning System (GPS); the most common uses are to mark destinations, search for the right number, such as a café or office, or in location-oriented apps.

Researchers identify the following positive effects of AR on students’ foreign language learning: improving the effectiveness of their language skills in professional translation, increasing motivation to learn, and involving students in cooperation with each other, as well as with native speakers of the foreign language studied (Cheng et al., 2010; Chik, 2014; Kiv et al., 2019; Frazier et al., 2018; Makransky and Petersen, 2021; Geng and Yamada, 2020a,b; Monahan et al., 2008; Nelson, 2012; Popova, 2017). AR has great potential in the field of language education, as it performs such functions as contextual visualization (i.e. presentation of virtual information in an extended context) and interactivity of learning (i.e. the embodiment of interaction with virtual content).

Review of the literature by Viberg and Grönlund

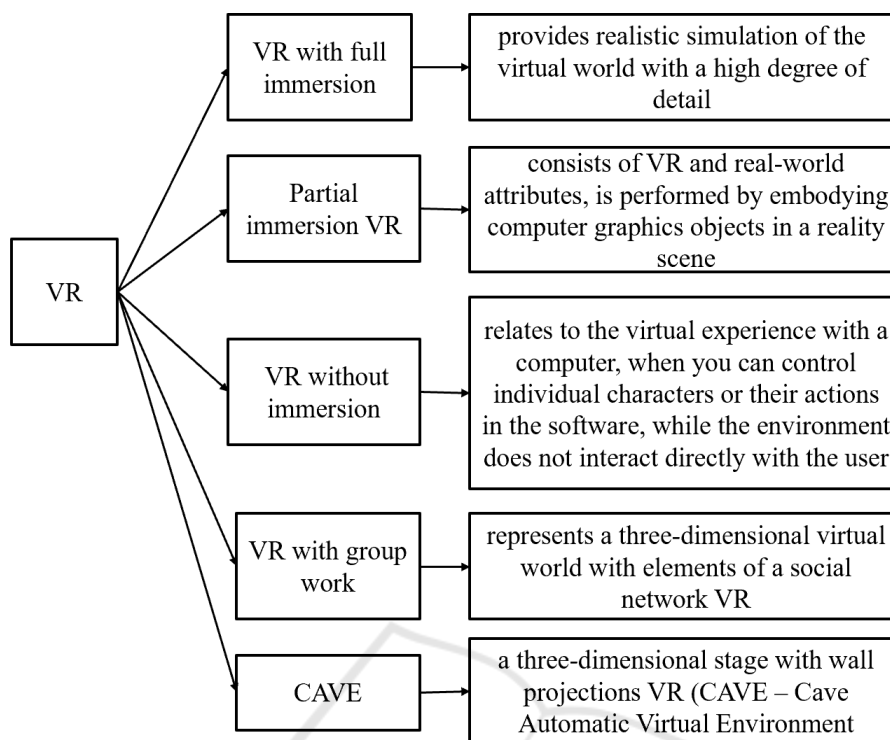


Figure 1: The five categories of VR.

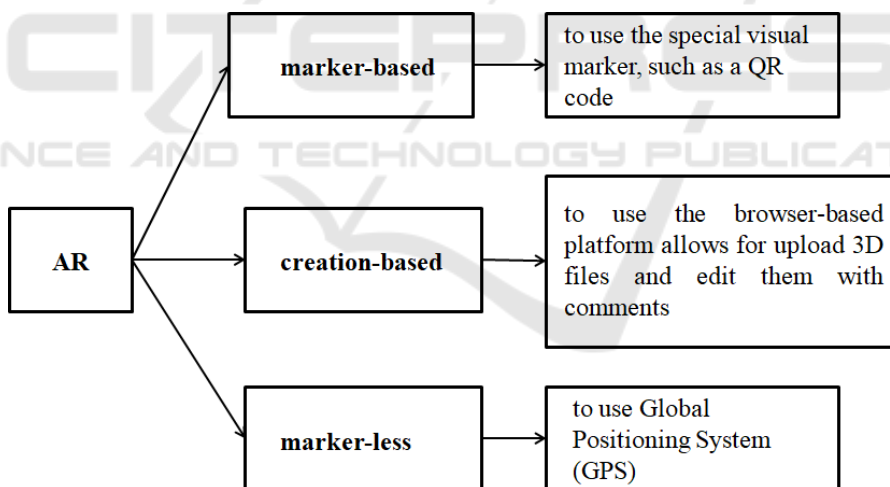


Figure 2: The three categories of mobile AR.

(Viberg and Grönlund, 2013) states that Mobile Assisted Language Learning (MALL), as the mobile technology which can be adapted to support language learning, is applied in a number of ways but generally focuses on vocabulary acquisition, listening and speaking skills and language acquisition while grammar learning, pronunciation and writing skills were underrepresented in the application of MALL.

Hein et al. (Hein et al., 2021) analyzed 2507 sources and selected 54 articles for the period from

2001 to 2020, relating to the immersive technology’s role in students’ foreign language learning.

They found that most of these studies concerned the comparative analysis of traditional blended learning methods, which included the use of VR and AR. The main characteristics of these technologies, that support the foreign language learning, are to promote the vocabulary learning, to development of speaking skills and intercultural competence, students’ motivation to foreign language learning, to overcome anxiety

and discomfort when communicating in a foreign language. The advantage of learning with AR over traditional teaching methods is in a fact that the student is given the opportunity to feel, rather than imagine, the subject, situation, scenario, which cannot be demonstrated or described in traditional teaching methods.

The purpose of the article is to analyze the use of immersive technologies for supporting and organizing the Japanese language learning for future language teachers, and identification of the main approaches to the use of immersive technologies in Japanese language learning.

3 RESEARCH METHODS

To achieve the purpose of our study and also to clarify the problem of utilizing the immersive technologies for future Japanese language teachers we used the following methods: systematic and comparative analysis of pedagogical, psychological, philosophical, sociological works, methodological and specialized literature; analysis of the pedagogical experience of usage of immersive technologies at the Institute of Philology of Taras Shevchenko National University of Kyiv at lecturers and seminars of study of “Japanese characters”; synthesis and generalization to formulate the main points of the study; interpretation of the research results by student survey and comparative analysis of exam results in Japanese lexicology of students who will study language using ICT and immersive technologies with exam results of students who will study language using ICT but not using immersive technologies. The research hypothesis is based on the assumption that the training of future Japanese language teachers will be effective if the following pedagogical conditions are implemented: activating the motivation of future foreign language teachers to carry out project activities in the use of immersive technologies as didactic tools for learning Japanese; improving the content of training future foreign language teachers in order to form their knowledge about the use of information and communication technologies and immersive technologies for learning Japanese.

4 RESULTS AND DISCUSSION

Scientists attach special importance to the use of augmented reality in the study of Oriental languages by students, in particular future teachers of Japanese language.

They note that the preparation of future teachers of Oriental languages (including languages with

character-based writing, such as Japanese, Chinese) for professional activities is a complex process, as it differs significantly from the study and teaching of any other foreign language (for instance, English, French, German, Italian, Spanish, Turkish languages that are also included into educational planning of Institute of Philology of Taras Shevchenko National University of Kyiv).

Researchers recognize the use of ITs as solving the problems of fast, active, correct, and convenient students’ Oriental languages learning (Cheng et al., 2010; Kiv et al., 2019; Frazier et al., 2018; Makransky and Petersen, 2021; Geng and Yamada, 2020a; Nelson, 2012). They note that the use of these technologies can improve real-world visualization with virtual objects, graphics, and object recognition technologies.

Frazier et al. (Frazier et al., 2018) singles out application Google Earth VR and AR for foreign language learning, including Japanese language that allowed users to visit different locations throughout the world; in meanwhile supports their own learning of various studies i.e. history, political studies, international relations, etc.

Google Earth AR includes various numerous instruments, like Mindshow for creation of different new exciting places and using them for role playing (Nelson, 2012). This tool is marker-less, that uses GPS. Scientists focus their attention on the issue that these instruments are useful for distant language learning, thought should be supervised by teacher.

We should pay attention to the possibility of foreign language learning, in particular Japanese, with the help of this service and others that focus on various fields of science in Japanese.

We want to pay attention to augmented reality services that support the teaching of various disciplines. Special emphasis should be placed on training in the fields of STEM training, which involves integration between the disciplines of natural sciences, technological sciences, engineering and mathematics (Soroko, 2021; Lukychova et al., 2022; Mintii, 2023). For example, many augmented reality applications offer materials in Japanese (BioDigital Human 3D anatomy, 3D Anatomy Learning – Atlas, GeoGebraAR, Planets AR, etc.). It is clear that the vocabulary of these applications is designed for students who have language skills at the level of B1 and above.

Geng and Yamada (Geng and Yamada, 2020a,b) offer their experience of usage of AR generators to create markers based on Kanji characters as QR codes. They made an AR compound verb learning system to support learning of Japanese verbs. Under this system, students can scan a card with the Kanji

characters of a particular verb, and thus watch an animation that displays the corresponding action with the card through the smartphone screen in the application. “In this system, the meanings of verbs, including both single verbs and compound verbs, were represented by 3D animations created using Maya, according to the image schemas of the verbs. Maya is a 3D computer graphics software, and it is used to create interactive 3D animations and visual effects”. The application was developed by scientists using Unity 3D and Vuforia. In addition, the combination function was proposed based on a combination of two cards with the corresponding Kanji characters (V1 + V2) to facilitate the effective study of complex verbs by students. Researchers have proven that approach involving AR in Oriental languages learning is the most effective for students compared to the traditional method.

Platte et al. (Platte et al., 2020) suggests using ARTranslate (<https://github.com/benpla/ARTranslate>) to foreign language learning using augmented reality. ARTranslate is software that recognizes up to 1,000 objects in a user’s environment using the Convolutional Neural Networks (CNN) method and names them accordingly. Objects are superimposed on 3D information in different languages, using AR. The user can open the surrounding everyday objects in any language by switching languages in the ARTranslate application settings. The software runs on iOS version 12.

We surveyed students (31 students took part in this survey) about their attitudes toward the use of ITs to improve the quality of Japanese language learning. We proposed the following statements, that students should be designated as “Strong disagree”, “Disagree”, “Neither agree”, “Agree”, “Strongly agree”: “I have a clear understanding of what ITs are and how I can it integrated it into my own education process”, “I have heard about ITs in foreign language learning”, “I have discussed with my friends about ITs for foreign language learning”, “I have experience when teachers use approaches with ITs for Japanese language learning”.

According to the questionnaire analysis of the attitudes and understanding of ITs in Japanese language learning process, it was found out that students understand what augmented reality is, but have not used these tools to learn Japanese: “I have a clear understanding of what ITs are and how they can be integrated into my own education process”: Strongly disagree – 8% students; Disagree – 17% students; Neither agree nor disagree – 32% students; Agree – 39% students; Strongly agree – 4% students; “I have heard about ITs in foreign language learning”: Strongly disagree – 3%; Disagree – 16%; Neither agree nor dis-

agree – 28%; Agree – 49%; Strongly agree – 4%.

We showed students the options for using such IM for different levels of Japanese language learning (Japanese language learning levels are available at <https://www.jlpt.jp/>) as:

- ITs for not language learning such, as BioDigital Human 3D anatomy, 3D Anatomy Learning – Atlas, GeoGebraAR, Planets AR, Google Earth AR and VR;
- ITs for language learning such, as Easy Japanese news, Triplens, ARTranslate;
- Platforms for creating web projects with AR elements such, as BlippAR and Google ARCore, and with VR such, as CoSpaces, that for students to create their own examples of language learning.

This tools were proposed to use by 3rd year students of Bachelor program in study “Japanese Kanji characters”, 4th year students of Bachelor program in study “Linguistic Tradition of Japan”, 4th year students of Bachelor program in study “Japanese Language Etiquette”, 2nd year students of Bachelor program in study “Japanese language: Practical Course for Translators”, 1-2 courses year students of Bachelor program in study “Oriental Language (Japanese language)” of the Department of Languages and Literatures of the Far East and Southeast Asia of the Institute of Philology of Taras Shevchenko National University of Kyiv.

After classes and self-study of students with the help of ITs, a survey was conducted as experts (27 students) on the choice of approaches to the study of Japanese characters. They were asked to use the Likert Scale method to rank approaches to language learning according to their importance – from ineffective (1 point) to very effective (5 points).

Approaches to the study of Japanese Kanji characters were determined according to traditional methods (direct method, grammar-translation method, audio-linguistic method, cognitive method) and considering the use of information and communication technologies, in particular immersive technologies.

Our students were offered the following approaches to Japanese Kanji (漢字) learning for the assessment:

- use of electronic dictionaries;
- search and use of Internet resources;
- usage of online educational literature;
- creation and application of their own associations (offline);
- handwriting Kanji characters (offline);
- use of AR and VR applications;

Table 1: The results of students' survey on their understanding of ITs in Japanese language learning process (2020-2021).

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I have a clear understanding of what ITs are and how they can be integrated into my own education process	8%	17%	32%	39%	4%
I have heard about ITs in foreign language learning	3%	16%	28%	49%	4%
I have discussed with my friends about ITs for foreign language learning	18%	35%	14%	33%	0
I have experience when teachers use approaches with ITs for Japanese language learning	8%	43.6%	35.5%	12.7%	0
Total (<i>N</i> = 31)					

- creation of their own educational materials on the basis of ITs.

The results of this questionnaire are presented in table 2 “Results of students’ questionnaires on their opinion on the choice of approaches to the Japanese Kanji characters learning”.

Thus, the results of students’ questionnaires about their opinion on the choice of methods for studying Japanese Kanji characters showed that the most necessary for them was an approach based on the creation of students’ own learning materials based on augmented reality (5). According to interviews with students who wished to comment on their answers, this was motivated by the creation of an augmented reality Kanji characters that would be of interest to other students and reflect the most difficult cases in Oriental language translation practice. It is also important to use electronic dictionaries (4.8), in particular, most AR applications are focused on the assimilation of foreign language vocabulary by users (for example, Triplens, ARTranslate, etc.).

To achieve our goal, we created organized and implemented educational content (training course) “Information Support of Philological Research in Japanese Studies” for philologists-bachelors of Oriental languages, based on the use of immersive technologies. It consists of the following modules: Module 1 “Theoretical foundations of the use of ICT in the study of foreign languages”, covering topics such as “Basic concepts”, “Methods of using ICT in the study of foreign languages”, etc.; Module 2 “Electronic educational resources for learning a foreign language (Japanese)”, which covers topics such as “Electronic dictionaries and their practical use in translation and teaching”, “Online tests in foreign languages: the use of international test systems and the creation of personal tests using web services”; Module 3 “Immersive technologies of learning a foreign language (Japanese)”, which covers such topics as “Model of learning a foreign language using virtual reality”, “Model of learning a foreign language using

augmented reality”; Module 4 “Research activities on the establishment of Electronic Educational Resources for the translation and teaching of Japanese”.

Students were divided into groups according to their desire to learn language using ICT, including immersive technologies, which are present in separate modules of the course “Information Support of Philological Research in Japanese Studies”, which is part of a series of linguistic disciplines that form the philological basis of the bachelor’s program at the Institute of Philology of Taras Shevchenko National University of Kyiv at different lecturers and seminars.

To the question “Do you want to learn a language using immersive technologies?” 21 students answered, 8 students did not take an active part in the survey and training due to extreme conditions (military action in Ukraine). As a result of the survey, two groups were created: 11 students who will study language using ICT and immersive technologies, and 10 students who will study language using ICT but not using immersive technologies. A group of students studying “Japanese language and literature” course using ICT and immersive technologies passed the exam with an average of 95 points, a group of students that studied language using ICT, but did not use immersive technology, passed the exam with an average of 85 points only.

5 CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

Thus, ITs provide a new paradigm of presentation of educational materials, which has a positive impact on the formation of basic and professional competencies of the future teachers Japanese language. We can indicate the following benefits of using ITs to train future teachers with the Japanese language:

- the usage of ITs makes the learning process more

Table 2: Results of students' questionnaires on their opinion on the choice of approaches to the Japanese Kanji characters learning.

The approaches to Japanese Kanji (漢字) learning	Mean values
use of electronic dictionaries	4.8
search and use of Internet resources	4.4
usage of online educational literature	3.2
creation and application of their own associations (offline)	2.9
handwriting Kanji characters (offline)	4.7
use of AR applications	3.8
use of VR applications	3.7
creation of their own educational materials on the basis of augmented reality	5

visual and mobile;

- the usage of ITs increases the interest and motivation of students to learn the language;
- ITs improve the learning process, which uses innovative forms of work with students;
- ITs use the conditions for the formation and development of creative abilities of students;
- these technologies and approaches contribute to the support of the linguistic and cultural aspect in student learning.

The following approaches to the use of ITs for the study of Japanese by students should be distinguished: 1) the use of specialized applications for language learning; 2) the use of applications for the study of other disciplines (anatomy, biology, computer science, astronomy, etc.), using a foreign language learning by students; 3) creation of personal examples by students for learning a foreign language with the help of special Web platforms.

ITs can be effective if they are used in blended learning that combines distance, online, traditional and self-directed learning of Oriental languages.

Author is planning to continue the longitudinal research, analyzing the statistical data of students' academic performance, expanding the research to several other subjects (taught by Taras Shevchenko National University of Kyiv) during the academic year of 2022-2023.

Prospects for further research are the creation of guidelines and manuals on the use of immersive technologies for the study of prefabricated languages at different levels of training of future teachers of Japanese language.

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