Perspectives on the use of augmented reality within the linguistic and literary field of primary education

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Abstract. The article analyzes the scientific sources on the problem of augmented reality in the educational field. There is a fragmentary rationale for new technology in primary school, to a greater extent the experience of scientists and practitioners relate to the integrated course "I am exploring the world". The peculiarities of Ukrainian and foreign writers' works with AR applications, which are appropriate to use during the classes of literary reading, are analyzed. The authors substantiated the prospect of augmented reality technology for mastering the artistic image of the world of literary work, the relevance of use of AR to modern educational challenges, and also demonstrated the possibility of immersion into the space of artistic creation and activation of students' imagination with the help of AR applications. The article demonstrates the possibilities of use AR-technology for the development of emotional intelligence and creative thinking, solving educational tasks by setting up an active dialogue with literary heroes. The basic stages of the application of AR technologies in the literary reading lessons in accordance with the opportunities of the electronic resource are described: involvement; interaction; listening, reading and audition; research; creative work; evaluation. It is confirmed that in the process of using augmented reality technology during the reading lessons, the qualitative changes in the process of formation of the reader's culture of the students of experimental classes appears, as well as the increase of motivation, development of emotional intelligence and creative thinking.

Keywords: Augmented Reality technology, 3D-visualisation, creative thinking, emotional intelligence, creative imagination.

1   Introduction

1.1   Problem statement

Virtual and augmented reality technologies are gaining more are more popularity in the world. At North Carolina State University, students use virtual reality tools while studying science [17]. In the process of virtual field research, they find, observe and study organisms in their natural habitat [7]. At Penn State University in Pennsylvania, students in all disciplines attend practical classes in virtual reality technology

classrooms. In such a way, they learn from situations designed for the future life [1; 27]. VR and AR are widely used in schools of America and Europe. Augmented reality technology has become particularly popular, as a regular smartphone is enough to work with it [16]. Students from near and far abroad with interest are moving in classes with phones in their hands, exploring the human body in virtual microcapsules, going on a journey [25], participating in historical events [9], watching physical phenomena [24], etc.

The modern development of ICT makes it possible to modernize the educational process in primary school as much as possible, in accordance with the challenges of time and the requirements of reformed education [12; 19; 26; 29]. The linguistic and literary sector is, at first glance, somewhat remote from ICT. However, the specifics of fiction, its imagery, its organic integration into the multimedia space, suggest that it is necessary to partially revitalize fiction with the help of augmented reality technology in the process of literacy and reading [8]. This hypothesis may also be confirmed with the examples of imaginative approaches to the virtual world, such as in the Lewis Carroll novel "Alice's Adventures in Wonderland", or augmented reality, such as interactive pictures of Hogwarts in the Joanne K. Rowling series of "Harry Potter".

While developing lifelong learning skills in primary school students, it is important to build interest in books, to learn how to feel beautiful in the artistic word. Depth of perception of a work depends not only on the development of critical thinking and aesthetic sense associated with the sense of beauty, understanding of values that are accumulated in the artistic image, but also on emotional intelligence. Therefore, the development of a dialogic interaction with works of art will be greatly facilitated by the use of augmented reality technology, which causes its visualization to be primarily emotional resonance and promotes creative imagination.

1.2   Literature review

We analyzed the current state of research on the use of AR applications in education [3]; studied the experience of combination of AR with learning based on games in primary school [21], the impact of integrating game approaches with augmented reality on learning [23], improvement of learning efficiency and students' motivation through the use of AR applications on smartphones [4].

Possibilities of application of AR technologies in different fields of education were considered by Svitlana I. Pochtoviuk, Tetiana A. Vakaliuk and Andrey V. Pikilnyak [22]. The authors noted the great impact of presentation of educational material by augmented reality on the development of facial expressions, attention, stimulating thinking and increasing the level of understanding of information. Among the benefits, scientists point to realism, clarity, completeness, information and interactivity. The didactic potential of virtual information learning environment is determined by Olga V. Bondarenko, Olena V. Pakhomova and Włodzimierz Lewoniewski [2]. Scientists emphasize such features of VR and AR as immersion, dynamism, sense of presence, continuity, causality, intensification of the process of cognition, saving time for processing the material. While acknowledging the effectiveness of learning with the help of VR and AR, the authors also point out the disadvantages, including low

computerization, low number and low quality of software products [2], difficulties in applying these technologies, such as: small experience in using this technology, lack of methodological literature, lack of developed methods of AR implementation [6]. Lacunae of augmented reality educational products are filled by practitioners who create mobile applications to visualize educational material, including the chemical structure of water and display video data from laboratory experiments to study subjects of the natural cycle [18] in the primary school. According to the authors of the LiCo.STEM application (can be downloaded from a publicly available GooglePlay Market resource), its contributes to the development of cognitive motivation of primary school students and educational energy, their imagination, creative initiative and research activity [14].

Joseph Walsh, David McMahon, Padraic Moriarty, Marie O'Connell, Betty Stack, Conor Kearney, Mary Brosnan, Cliona Fitzmaurice, Clare McInerney and Daniel Riordan offer the development and implementation of educational tools using virtual and augmented reality for language learning in primary school [28]. Vladimir D. Sekerin, Anna E. Gorokhova, Anatoliy A. Scherbakov, Evgeniy V. Yurkevich outlined the prospects for the implementation of the latest educational technologies that allow to increase the effectiveness of teaching. Thus, in the course of the study, they found that 20% of students are ready to receive educational information from conventional sources, and 80% of students need interactive perception of information based on augmented reality. Carrying out lessons with the help of virtual reality tools, according to scientists, contributes to the full involvement of students in the educational process and, accordingly, successes in the acquisition of knowledge [24]. For primary school students in Ukraine, a textbook and universal didactic material from AR for the integrated course "I am exploring the world", aimed at developing research skills [13], has already been created.

Thus, most of the publications on the identified problem testify to the possibility of using VR and AR technologies in the educational field for the purpose of visual modeling of educational material; supplementing its visualization; developing students' spatial ideas; research and experimentation skills; three-dimensional design, which saves time for learning information, accelerates learning and makes the process fun and engaging.

1.3   The aim of the research

Therefore, augmented reality is increasingly used in various fields of social activity and in particular in education. Special educational applications in physical, mathematical, natural, historical and other subjects have been developed, and AR textbooks have been created for primary school students in the "I am exploring the world" course. However, the methodology and effectiveness of its application in literacy and reading lessons remains poorly understood.

Recommendation of the European Parliament and of the Council on Key Competences for Lifelong Learning refer to the formation of basic competences that help a person to successfully socialize in the society. As the main competencies one can mention such reference frameworks as critical thinking, creativity, initiative, ability

to constructively manage emotions, etc. [5]. We believe that such qualities of a personality are formed during the reader's activity, which will be activated by augmented reality.

The purpose of this article is to substantiate the prospects of using augmented reality technologies in the linguistic and literary field of primary education, to organize and test the effectiveness of younger students' literacy with the help of AR.

We used the following research methods: analysis of scientific sources, analysis of school programs and fiction with AR applications, synthesis of the obtained information – to determine the state of development of the problem and ways to solve it; problem-searching and pedagogical modeling – to create a methodical model of studying a work of art by means of augmented reality. Methods of observation, surveys, questionnaires of teachers and students were also used to determine the problems of application of augmented reality in the language and literature domain of primary school. Comparative methods, quantitative and qualitative analysis of learning outcomes were used to examine the effectiveness of augmented reality in the reading activities of primary school students.

2   Discussion and results

Augmented Reality (AR) technologies provide the introduction into the real world of a three-dimensional field of human perception of virtual information that can be assimilated as elements of real life. Augmented reality projects digital information (images, videos, text, graphics) beyond the screens of devices and combines virtual objects with the real world. Nowadays, thematic visualized content is being used by modern electronic devices to target audiences in a variety of fields, such as science, manufacturing, technology, marketing, design, entertainment, medicine, education, etc. [10; 11]

The importance of augmented reality in the initial process is determined by the immersiveness that is also inherent in Virtual Reality (VR) technologies. Quality augmented and virtual reality content balances the boundaries between an artificially created world and reality. With the help of gadgets, as if through a window, the student watches an amazing image of the world (scientific, technical, artistic, etc.), investigates, learns its laws, practices to change it for the better. Therefore, the use of these technologies results in the maximum expression of students, and, most importantly, allows them to actively interact with different objects of study in three-dimensional space. In this way, augmented and virtual reality technologies allow students to better learn the subjects in the entertainment form of the game, to gain useful experiences that are usually restricted to access. Scientists note the major benefits of these immersive technologies: clarity that allows one to seamlessly examine any process or object; focus that allows one to not be distracted by external stimuli and focus on the lesson material; maximum involvement of students in the educational process; the effectiveness of understanding and memorizing important educational information, etc. [1; 20].

In the linguistic and literary field of primary education, there is also the opportunity to use augmented reality technologies. Such products include interactive alphabets and

fiction books by Ukrainian and foreign writers. Thus, "Kobzar Alphabet" (Kyiv, 2019) contains works of Taras Shevchenko for every letter of the alphabet, illustrations of which come to life, move and talk with the free FastAR Kids app on smartphones or tablets (iOS, Android, iPhone). This publication was produced with the support of the Ukrainian Cultural Foundation. "Kobzar Alphabet" is a successful attempt to introduce Ukrainian children to a prominent Ukrainian writer, to visualize the artistic world of his works. The interactive pages of the book show the beauty of Ukrainian landscapes, while audio playback of poetic lines broadcasts the spiritual values of Kobzar, nurtures a love for the mother tongue, the people and their traditions. Based on the works of the talented Ukrainian writer Taras Shevchenko, preschoolers and younger students have the opportunity to learn or deepen their knowledge of the native language alphabet, to feel its sweetness and beauty. In this way, the classic of Ukrainian literature, the energy and the spirituality of its artistic word becomes modern, clear and instructive for the students.

FastAR Kids provides a visualization of another "Living Alphabet" book. The online edition features a game platform with special labels on the pages of the edition that activate the augmented reality in 3D with plots of poems with amazing stories and animated characters. Students have the opportunity to explore living objects from different directions, expand the 360-degree image to help imagine a holistic vision, interact with characters, listen to verses, and memorize letters.

In primary school, it is appropriate to organize interactive reading lessons using augmented reality books. A series of books "Read and Play" by Ukrainian publishing house Art Nation Publishing have appeared in the book markets, including Lewis Carroll's fairy tales "Alice's Adventures in Wonderland" (2017) and "Alice Through the Looking-glass" (2018), Ernst Theodor Amadeus Hoffmann's "The Nutcracker and the Mouse King" (2018), Hans Christian Andersen's fairy tales "Wild Swans" (2019) and "The Snow Queen" (2019), Charles Perrault's "The Sleeping Beauty" (2019) and "Puss in Boots" (2020). The high quality of each book in this series is confirmed by the coordinated work of talented translators, artists, animators. For example, the fairy tales "Alice's Adventures in Wonderland", "Alice Through the Looking-glass", "The Nutcracker and the Mouse King" and "The Snow Queen" were illustrated by famous Ukrainian artist E. Gapchinska, others by O. Drachkovska, M. Koshulinska, and I. Kravets. With the free WowBox AR app on illustrated pages with special designation, the artwork scenes come to life, and the real images are combined with the virtual ones, which is demonstrated in fig. 1.

Wow-animations in augmented reality become interactive: carefully following the prompts, readers actively interact with the characters; take photos or shoot videos with your favorite characters; listen to a fairy tale by selecting Audiobook from the menu. Publishers accompany the augmented reality editions with interactive bracelets, coloring books, stickers that activate readers' activity in the virtual art world.

We consider this approach justified, since it is becoming increasingly difficult to educate the interest of younger students in literary reading in the current conditions of informatization of society. From preschool, children are accustomed to a variety of gadgets that are gradually becoming one of the leading ways of knowing the world. At the same time, one cannot ignore in shaping the personal image of the world the

undeniable benefits of fiction. The art of the word is one of the most important carriers of culture, which opens up the world of new knowledge, has a powerful educational potential, develops memory, critical thinking and emotional intelligence, promotes awareness of national identity and socialization of personality, gives unforgettable impressions and aesthetic pleasure. Therefore, it is necessary to attract the attention of younger students to fiction, to form readers' interests, to demonstrate the uniqueness of literary reading. This goal can be achieved by conducting interesting interactive literary reading lessons. The emotional perception of literary works is enhanced not only by the Wow-effect of augmented reality, but also by the involvement of the reader in interaction with the characters, which contributes to a deeper assimilation of the system of values accumulated in artistic texts.

Fig. 1. Combination of the realistic images with virtual ones, using the WowBow AR application.

A qualitative example of the digitization of contemporary Ukrainian literature for children is a small story for children by Kateryna Babkina called "The Pumpkin's Year", published by the Old Lion Publishing House in 2015. The Pumpkin's Year app available in AppStore or GooglePlay for iOS and Android platforms, respectively, helps to revitalize the Pumpkin's Year print edition. To activate the interactive pages of an animation book, one have to download it on the smartphone or tablet and place a gadget on the cover or one of Julia Pylypchatina's nine illustrations. A specially designed application attaches a virtual AR object to the tag and activates it on the screen. The augmented reality of the Pumpkin's Year story should be used in primary school reading lessons, as Kateryna Babkina's works have been recommended by the Ministry of Education and Science of Ukraine.

By creating a model for the use of augmented reality in primary school reading lessons, we analyze the state requirements for mandatory student learning outcomes. In assessing the linguistic and literary knowledge of the students of the New Ukrainian School, the emphasis is placed on learning activities in expressing their own attitude to works of art and reading, identifying readership interests, the ability to translate their

ideas into artistic images and create artistic images by various means [15]. Thus, the New Ukrainian School fosters a personality capable of emotionally perceiving, thinking creatively, projecting, modeling, changing the world for the better. On the basis of such considerations, a methodological model of augmented reality application in reading lessons was developed. This model consists of the following stages: attraction; interaction; listening, reading and audition; research; creative work; evaluation.

Attraction. Thus, modern teachers are challenged to involve the "digital generation" in the reading activity, to form the need for students to learn the world through fiction in primary school students. The use of augmented reality technology in the process of reading works primarily visualizes the artistic world and provides a Wow-effect from the revitalization of illustrations to works of art.

Interaction. The next step is watching the literary heroes through the animation. AR technologies allow one to create gaming tasks that enable the sharing of impressions via mobile devices. Interactive applications are designed in such a way that readers can interact with the characters. For example, following the plot of the Hoffmann's fairy tale "The Nutcracker and the Mouse King", it might a good idea to ask students to release Nutcracker from mice, help characters find hidden objects in the virtual room, turn on music for the main characters' dance, etc. The activated AR applications by the students are shown in fig. 2 and fig. 3.

Fig. 2. First demonstration of augmented reality by Hoffmann's fairy tale "The Nutcracker and the Mouse King".

In the augmented reality of K. Babkina's story "The Pumpkin's Year", readers can click on the subject to make it move or make sounds. Thus, in particular, the students clearly visualize the personification of artistic images such as Bicycle, Pumpkin, Rook, perceived by different sensory organs. Therefore, the augmented reality in literary publications contributes to the development of students' creative imagination and the formation of their creative thinking.

To organize verbal interaction between students in a group, one may set the task of coloring the characters of a work of art from augmented reality fairy tales, drawing a smartphone or tablet with pre-installed augmented reality augmentations and activating

images. Such observations give students the opportunity to tell a group about a literary hero, characterize him, create a text description.

Fig. 3. Second demonstration of augmented reality by Hoffmann's fairy tale "The Nutcracker and the Mouse King".

Listening, reading and audition. Most augmented reality books have audio. After listening to an excerpt of the piece, students are encouraged to go for a QR code to pass the Content Comprehension Test. Engaging younger students in the art world through augmented reality and engaging with a hero is a motivation to read a fairy tale to learn about the work's intersection. The students are tasked with playing the story, schematically reproducing the sequence of events by reading different parts of the work and recounting them in a group.

Research. With augmented reality applications, younger students have the opportunity to immerse themselves in the virtual world of a work of art, to explore it in detail. This approach allows students to visually imagine the reality portrayed by the writer, to get closer to understanding of the images, to learn more about the value accents while being in the virtual plane of the artistic world. This stage involves the analysis of a work of art, including explaining to students the content of what they have read, seen and heard through augmented reality.

Creative work. At this point, the teacher asks questions for reflection or fantasies. This stage involves the students expressing their own attitude towards the read, for example, what the artwork teaches. Pupils learn to think, write simple texts about their thoughts, impressions, observations. Also, based on the artwork, students are encouraged to fantasize about changing the end of the artwork or inventing a new story with the artwork hero.

It is appropriate at this stage to conduct games and theatricalization. In this case, one should invite the students to choose an interactive bracelet with any character of the work and in pairs to build a dialogue or in groups to play a part of the work.

Evaluation. The results of reading activities of younger students in the lesson using augmented reality are analyzed by the following criteria: motivational, emotional, activity, valuable. According to these criteria, the indicators are outlined in table 1.

Table 1. Criteria and indicators of results of reading activity of younger students using augmented reality.

| Criteria for evaluating the performance of reading activities of younger students	Indicators
Motivational	Expressing interest in learning and being active during literary reading lessons. Motivation for thoughtful reading of a work of art. Focused reading. A desire to express opinions about what has been read and learned through augmented reality technology.
Emotionally reflexive	Enough sensual range for perception of a work of art. Adjusting to the appropriate level of emotional reflection in the process of reading, exploring augmented reality. Understanding the emotional state of literary heroes, the ability to reproduce a variety of emotions while reading, using voice, pantomime, facial expressions and more.
Activity-creative	The student understands the read text, explains the content of the read, heard and seen from the AR applications. Able to ask questions and engage in dialogue about what interests him/her or what remains unclear. Expresses his/her own attitude to the read, characterizes artistic images. Creates plain text as a continuation of a story or a variant of its ending.
Valuable	Formation of value system through aesthetic perception of works of fiction and products of augmented reality.

Analyzing the key competences identified by the European Parliament, we drew attention to such reference frameworks as critical thinking, creativity, initiative and the ability to constructively manage emotions. A survey among primary school teachers confirmed the effectiveness of the development of these qualities through the literary reading. However, research of the school library forms of students indicates a low level of interest in fiction. During the process of survey conducted on teachers, the factors that influence the activation of the reading activity of the younger students were identified. Among the received answers one can identify the following: meeting with the writer – 84%, interesting book-trailer – 82%, successful advertisement of the book – 75%, library lesson – 73%, high quality of the illustrated edition – 71%, the augmented reality book – 34%. The analysis of the respondents' answers showed the fact that the younger students were involved in the reading activity through visualization of the artwork (review of the book-trailer) and communication with the writers, and at the same time low level of knowledge of literary publications accompanied by AR applications.

The formative stage of the experiment took place in the Kyiv Gymnasium of Oriental Languages. Experimental learning involved 68 students from experimental classes (EC) and 67 students from control classes (CC). During its implementation, the author introduced a model of the study of artwork with activation of AR applications for students of 3rd-4th grades, methodical recommendations for teachers on the use of augmented reality in the language and literary field of primary education.

Taking into account the state requirements for the results of the reading activity of the younger students during the experimental training (formative stage), the attention

was directed to the formation of stable motivation of students to literary reading by means of "animation" of the artistic image of the world by means of augmented reality. The objectives of the proposed model required the use of smartphones and tablets for the effective perception of artistic text. Visualization of the artistic image of the world provoked a casual expression of empathy by the younger students and facilitated the students' perception of literary work in the virtual world. Therefore, the proposed tasks have intensified the research and creative activity of younger students.

Presentation of augmented reality opportunities in literacy and reading lessons, approbation of methodical model of application of books with AR applications in reading lessons confirmed the increase of interest of younger students to the fiction by means of visualization of the figurative world of literature and, as a consequence, the teachers (91% of respondents), who noted positive impact of the augmented reality on the learning outcomes. The results of the survey conducted on the teachers are shown in fig. 4.
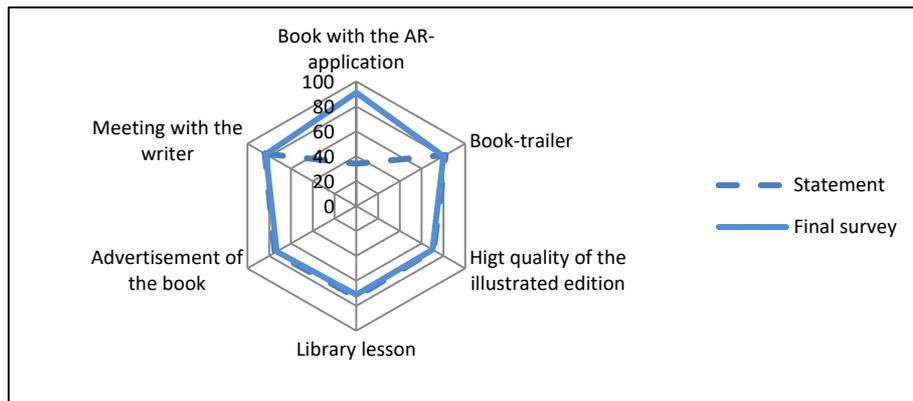
Fig. 4. Factors that influence the activation of the reading activity. The results of the survey.

According to the results of the educational achievements of the students of the experimental classes, the quality of their education was improved. To confirm this, the results of the final testing of the control phase of the experiment are presented, which demonstrate the qualitative positive dynamics. Therefore, according to the results of a comparative analysis of the experimental study, it can be stated that the emotional-reflexive (high and sufficient) level of reading activity in younger primary school students using augmented reality is higher than in the CC by 30.1%, which is illustrated in fig. 5.

The activity-creative level of reading activity of younger students with the use of augmented reality in EC (high and sufficient) is higher than in the CC by 15.3% (fig. 6.).

The value level of reading activity of younger students with the use of augmented reality in the EC is higher than in the CC by 10.9% (fig. 7.).

Thus, according to the results of experimental education in EC students significantly increased the overall level of reading activity, augmented reality contributed to the

expansion of the sensory range of perception of the work of art, activating the need for reading and the development of critical thinking.
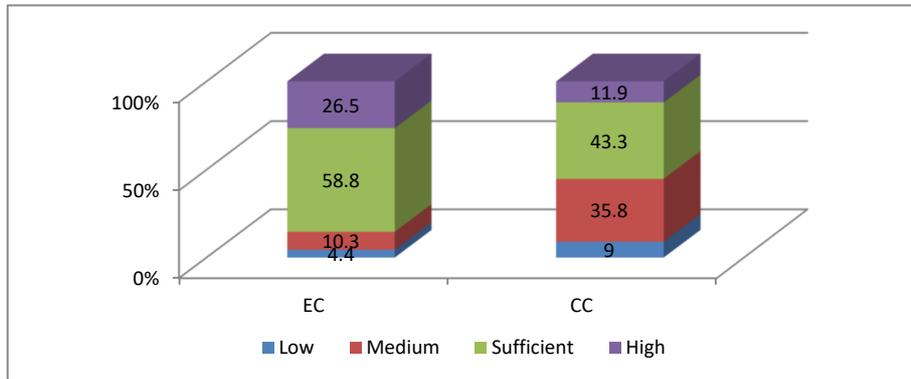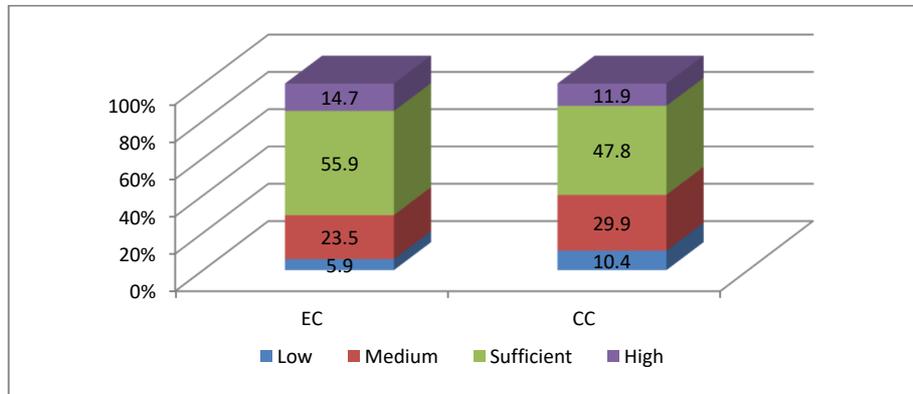

Fig. 5. Dynamics of emotional-reflexive level of reading activity with the use of AR applications.
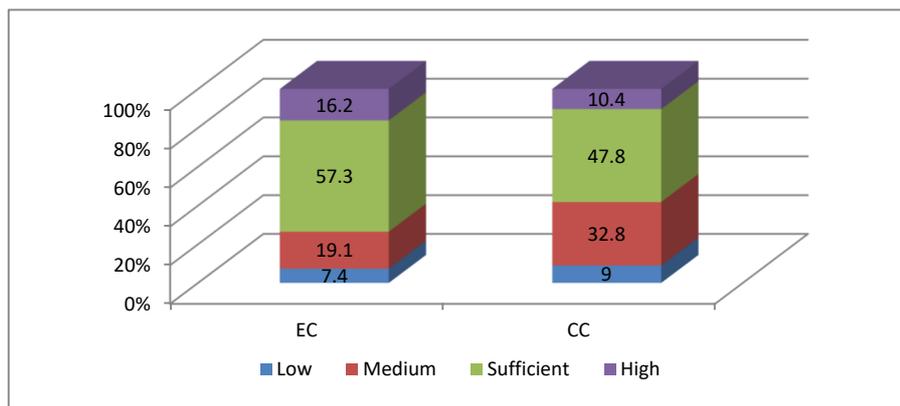
Fig. 6. Dynamics of activity-creative level of reading activity with the use of AR applications.

3 Conclusions and prospects for further research

The analysis of scientific sources on the problem of research indicates the creation of a new generation of education system, while the experience of using augmented reality applications in primary classes is described fragmentarily. Educational institutions are gradually changing their learning aids, textbooks that contain augmented reality elements, QR codes. Books of Ukrainian and foreign writers with AR applications are gradually appearing in the book markets, which should be used in literary reading lessons.

Fig. 7. Dynamics of the value level of reading activity with the use of AR applications.

The presented study confirmed the importance and relevance of the use of AR applications in the practice of literary education of primary school students. Augmented reality technologies are promising for the development of the artistic image of the world, reflected in the literature, meet contemporary educational challenges, provide an opportunity to immerse themselves in the space of artistic work and activate the creative imagination of students, and therefore their empathy. The article demonstrates the possibilities of using AR applications for the development of emotional intelligence and creative thinking, solving educational tasks by setting up an active dialogue with literary characters. The basic stages of the application of AR technologies in the literary reading lessons in accordance with the opportunities of the electronic resource are described: involvement; interaction; listening, reading and audition; research; creative work; evaluation.

It is confirmed that in the process of using augmented reality technology in the reading lessons of students of experimental classes, the qualitative changes in the process of formation of the reader's culture appear, as well as the increase of motivation, development of emotional intelligence and creative thinking. The results of the study, surveys conducted on primary school teachers and students proved the effectiveness of using AR applications, their advantages for activating the reading activity of students.

In our opinion, visualization of artistic image during the reading and writing lessons in primary school by means of augmented reality contributes to the effectiveness of learning in different directions, in particular:

— creates a Wow-effect, it is amazing how it deepens emotional resonance from reading a work of art;
— becomes a powerful motivation for the reader's activity;
— compensates for the lack of development of the creative imagination of younger students;
— provides perception of artistic image by different sensory organs;
— activates students' interest in reading fiction;

─ demonstrates to students the benefit of gadgets for learning and personal development.

The expediency of further scientific research on a certain problem is seen in the direction of systematization, generalization and verification of the effectiveness of the experience of preparing future primary school teachers to apply augmented reality during the lessons of literacy and reading.

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