

Features of Implementation of Augmented and Virtual Reality Technologies in the Psycho-correctional Process of Development of Emotional Intelligence of High School Students in Terms of Professional Self-determination

Hanna B. Varina¹^a, Kateryna P. Osadcha¹^b, Svetlana V. Shevchenko¹^c and
Olena G. Glazunova²^d

¹*Bogdan Khmelnytsky Melitopol State Pedagogical University, 20 Hetmanska Str., Melitopol, 72300, Ukraine*

²*National University of Life and Environmental Sciences of Ukraine, 15 Heroyiv Oborony Str., Kyiv, 03041, Ukraine*

Keywords: Augmented Reality, Interactive Technologies, Emotional Intelligence, Visualization, Professional Self-identification, Professional Orientation, Empathy, Emotional Awareness, Self-Motivation, Emotional Stability.

Abstract: Trends of modern society development, boom of the computer technologies, globalization and informatization affect all areas of public life, including education. In the conditions of transformational and epidemiological changes the significance, aim and mission of modern education include not just gaining basic knowledge and necessary skills and abilities but also the development of a cultural code, an independent approach to acquiring new knowledge, cultural values, and new forms of the activity. Currently, to solve this problem, innovative methods are used; these methods contribute to more effective acquisition of new knowledge with a high degree of students' involvement in the educational process. These methods also include augmented and virtual reality technologies, i.e. they can be both a learning tool and the research objectives. The paper presents a practice-oriented model of introducing the components of augmented and virtual reality in the process of developing the high school students' emotional intelligence at the stage of their professional self-identification as a key factor of the development of professional self-awareness. An empirical study of high school students' emotional intelligence, based on the elements of augmented and virtual reality, which was carried out before piloting the program showed the following results – the majority of students are dominated by a low level of emotional intelligence. The least pronounced is the ability to manage both their own emotional state and the emotions of other people. In particular, we have to emphasize a tendency of high school students of social type of professional self-identification to recognize the emotions of other people. Participants with a realistic type of professional self-identification have a low level of empathy; those having the entrepreneurial type of professional self-identification have low scores on the scale of emotional management. As a result of approbation of the components of augmented and virtual reality, it was found out that the level of intrapersonal emotional intelligence significantly increased among the respondents with a social orientation of professional self-identification. The priority task of designing a comprehensive program for the introduction of augmented reality in the modern educational space is to increase ergonomics, safety of the use of augmented and virtual reality elements in the process of development of high school students' key life competencies.

1 INTRODUCTION

The need for innovative changes in the modern educational system is determined by the fact that in to-

day's informational society, the main conditions for the well-being of everyone are the knowledge, gained through unhindered access to information, and the ability to work with it. In today's world, advanced technologies, which include information and communication technologies and augmented reality technologies play a key role in the economic development of society, providing new incentives to increase the

^a <https://orcid.org/0000-0002-0087-4264>

^b <https://orcid.org/0000-0003-0653-6423>

^c <https://orcid.org/0000-0002-5140-0018>

^d <https://orcid.org/0000-0002-0136-4936>

competitiveness of the individual. Recently, there has been a rapid development of augmented reality technologies (Kramarenko et al., 2020). According to Zijadic et al. (Zijadic et al., 2020), the market for applications, using elements of augmented and virtual reality, will expand annually, in particular, due to the emergence of new areas of their use, including the sphere of education. Recent studies show that the market for educational software in 2019 was \$ 9.9 billion (Liu, 2020). Forecasts suggest that the education software market will amass worldwide revenues of around 10.4 billion U.S. dollars in 2021. Should this forecast hold, it would represent a year-on-year growth of over 200 million dollars. Estimates suggest that this trend of strong growth will continue for years to come, reaching 11.3 billion dollars by 2024 (Liu, 2020). This indicates the active implementation and use of software in all areas of education. Social changes that take place in society at the level of global processes are more evident than the processes that occur in the mind, psyche, and inner state of the individual.

One of the main tasks of education in secondary school is the development of creative thinking of the individual, who is able to adapt to the conditions of new life and responsible for self-education, self-control and self-improvement (Vlasenko et al., 2020). However, the process of choosing a life and professional path becomes very difficult for today's youth, who are not ready to respond properly to the surrounding conditions, manage their emotions, assess their personal potential, and overcome the difficulties caused by changes in society. Emotional readiness for the professional activity is considered to be a conscious readiness of a specialist to apply the emotional competencies necessary for the constructive solution of professional tasks. In this regard, it is very important to study the impact of emotional intelligence on the professional self-identification, in particular the ability to understand, manage and control your own emotions depending on the situation. At the same time, the issue of identifying ways and methods of diagnosis and development of emotional intelligence as an integrative component of high school students' effective professional self-identification is quite complicated. The main problem is a constant change of the configuration and dominant means of information perception.

Modern teenagers are representatives of a new generation. These teenagers have got into the whirlpool of rapid technological development and social changes. A typical representative of this generation is a child who learns how to use YouTube before he or she learns to read and write. The best leisure

activities for these children are surfing the Internet, social networking and watching videos. At the same time, parents and education in general face a new difficult task – to find something that will motivate, inspire and reveal the talent of each individual. Representatives of new generation will no longer be able to imagine the world without virtual and augmented reality, smartphones, e-books, mobile devices. Accordingly, the methods of influencing and developing personal resources of the younger generation also require global changes, taking into account trends in science, technology and information capabilities of the modern educational environment. Taking into account the high school students' individual and age psychological characteristics, the priority of the research is an introduction of innovative augmented reality technologies into the development of younger generation's emotional intelligence.

2 LITERATURE REVIEW

Modern scientific research is focused on the combination of innovative technologies in science and technology, taking into account the personality's individual typological characteristics. Emotional readiness for professional activity is considered to be a conscious readiness of a specialist to apply emotional competencies necessary for the constructive solution of professional tasks. In this regard, the study of the impact of emotional intelligence on professional self-identification, in particular the ability to understand, manage and control their emotions depending on the situation becomes more and more relevant. Modern scientists consider emotional intelligence to be one of the factors of the ability for professional self-identification. The level of emotional intelligence development will determine to what extent a person is able to adapt to the chosen profession, achieve certain outcomes and realize their own professional and personal potential. Scientists pay considerable attention to the analysis of the relationship between the emotional sphere of an individual and his or her psychological well-being and health, ability to maintain stability and prevent personal and professional burnout (Grover and Furnham, 2021). Scientists have found out that the sufficient level of the emotional intelligence development acts as a buffer in the manifestation of the negative effects of stress. It helps to stabilize the emotional state and prevent mental disorders such as psychopathy. Dave et al. (Dave et al., 2019) in the longitudinal study empirically established the relationship between emotional intelligence and motivation to continue learning af-

ter school, i.e. to get higher education. According to the (Dave et al., 2019), emotional intelligence is, first of all, a complex combination of emotional self-perception and personal trends associated with the perception, understanding, use and management of their own emotions and emotional states of other people.

Scientists assign a significant role to the emotional intelligence as a factor which increases the personality's motivational component. In the empirical study, Lin Tam et al. (Lin Tam et al., 2021) prove a correlation between the level of emotional intelligence development, increased motivation and improved academic performance. Scientists also confirm the interdependence of the level of emotional intelligence development and academic achievements with the behavioral and emotional component of professional development. The results of the empirical research showed that emotional intelligence had a significant direct impact on the behavioral and emotional involvement in the process of learning (Thomas and Allen, 2021). Thus, this empirical and practical research allows us to conclude that functional characteristics of emotional intelligence are represented by a system of emotional attitudes to themselves as the knowers, to the world and other people, and these features are reflected in social interaction. Emotional intelligence should be considered in the context of the category of "activity", because it is developing and is manifested in the activities, in the process of communication and interaction with other people. Therefore, emotional intelligence is an important integrative component of the process of successful career guidance.

Increased interest in the research and development of emotional intelligence has allowed us to expand the idea of traditional tools and take into account trends in the development and implementation of innovative ICT not only in the educational process but also in modern psychological practice. Accordingly, in order to optimize the process of studying the level of emotional intelligence of children, Narimani et al. (Narimani et al., 2019) suggest to use MSCEIT (Mayer Salovey Caruso Emotional Intelligence Test) – one of assessment tools, which uses the approach to the evaluation of the effectiveness of the emotional intelligence realization. To make the evaluation process more exciting and interesting for the children, the researchers gamified the whole process. Researchers have developed and implemented a mini-game, the main task of which is to measure the emotional intelligence of children, focusing on the game participants and facilitation tasks, which are presented in MSCEIT. The emotional component, as an important constant of social interaction, has made it possible

to update research related to the introduction of the emotional component in various artificial intelligence systems. Thus, researchers have found out that the emotional coefficient is still absent in the current generation of interactive chat bots. According to the scientists, it leads to a decrease in the quality of communicative and social interaction, and can also lead to the emotional rigidity of users. Accordingly, the study describes the stages of development of a block of such agents, i.e. the ability to respond with a certain emotion to the input text, which contains a certain emotion and improves the process of understanding the information environment (Shankar et al., 2021). Other studies are devoted to the multimodal recognition of emotions in the process of developing the emotional intelligence of users (Shah et al., 2021). Because of the fact that people express emotions not only in speech, but also by the voice tone and facial expressions, the developers used the functions of three modes – text, audio and video, and tested different fusion techniques to combine models. Shah et al. (Shah et al., 2021) proposed a new architecture specifically designed for dyadic conversation, where each person is modeled using a separate network that shares an emotional context. Researchers also analyze the degree of students' emotional intelligence development depending on the perception of emotions displayed by virtual instructors. Lawson et al. (Lawson et al., 2021) found out that students were able to distinguish positive emotions from negative ones; they considered the teaching of positive instructors to be more effective, more reliable, more human and attractive. In addition, students who saw positive emotional reactions from virtual instructors, indicated that they tried to pay attention to the lesson and enjoyed it more than those who saw negative emotions displayed by virtual instructors.

Having analyzed the priority of using modern ICT in the process of professional self-identification and personality development, we consider the study (Tkachuk et al., 2021), aimed at the identification of the effectiveness of the methods of audience response systems and mobile tools for practical training in the university, to be an innovative one. Researchers have analyzed Ukrainian and foreign research works on the use of mobile ICT in education. The authors have developed methods for applying audience response systems using Plickers and mobile tools for multimedia development based on augmented reality tools. Scientists' comparative assessment of the functionality of audience response systems and mobile tools for the development of multimedia based on augmented reality provides an opportunity to state the effectiveness of the use of appropriate augmented reality tech-

nologies in the process of optimization and individualization of academic learning (Tkachuk et al., 2020). In the context of individualization of the professional and personal development taking into account the individual psychological characteristics of students, it is important to study the implementation of a conceptual model of learning based on the combination of AR and VR technologies with adaptive learning systems. The authors substantiate the use of VR and AR technologies as a special information environment, which is used in accordance with the identified dominant types of thinking and intellectual abilities of students (Osadchyi et al., 2020). In Europe and the USA, the use of AR and VR technologies is actively carried out in psychotherapeutic practice, in psychological counseling and psychocorrection. In particular, in 2008 in Brussels (Belgium) the International Association for Cybertherapy and Rehabilitation was created, which publishes its own journal – *CyberTherapy & Rehabilitation*. Members of this association contribute to the creation, implementation and promotion of new AR and VR technologies in clinical practice. AR and VR methods in psychotherapy are considered as complementary to traditional. Taking into account the increased interest and achievements of scientists and practitioners in the field of use of augmented reality systems and applications for the optimization of cognitive processes, intelligence, emotional and volitional sphere of personality, the issue of analyzing the development of emotional intelligence using modern ICT and design of a comprehensive program of traditional psychotechnologies and augmented reality technologies in the process of developing the high school students' emotional intelligence at the stage of their professional self-identification is becoming a relevant one.

3 RESEARCH METHODS

Interdisciplinary research was conducted as part of the research work carried out at the expense of the general fund of the state budget: "Adaptive system for individualization and personalization of future professionals' training in the conditions of blended learning", state registration number: 0120U101970. A comprehensive interdisciplinary study was conducted in the framework of scientific cooperation between STEAM-laboratory, Laboratory of Psychophysiological Research and Laboratory of Health Psychology of Bogdan Khmelnytsky Melitopol State Pedagogical University. Methods used in the research process are: analysis of theoretical sources, study of advanced psychological and pedagogical experience

of foreign and domestic teachers on the implementation of competence-based and personality-oriented approach in the educational process, development of emotional intelligence of future students at the stage of professional self-identification; methods of generalization and conceptualization to formulate the main provisions of the study; design and modeling of an empirical construct of a combination of traditional and innovative AR/VR technologies in the diagnostics and development of high school students' emotional intelligence; generalization and evaluation of results.

4 RESEARCH RESULTS

Theoretical and empirical study of the development of components of high school students' emotional intelligence at the stage of their professional self-identification based on the elements of augmented reality was conducted on the basis of Bogdan Khmelnytsky Melitopol State Pedagogical University from 2019 to 2020. The piloting study was attended by high school students from Melitopol (educational establishment No 16, secondary school No 7, 14), future university entrants. Participation in the study was voluntary, conducted with the consent of parents or guardians. The sample is representative. The total number of participants was 93 people (girls and boys) aged 15 to 17 years. The study was conducted in several stages:

1. Analysis of the theoretical and methodological foundations of the process of emotional intelligence development in the scientific literature.
2. Construction of a structural-logical model of development of components of high school students' emotional intelligence at the stage of their professional self-identification with the use of augmented reality technologies.
3. Development, planning and implementation of a diagnostic procedure for the identification of the degree of participants' emotional intelligence development using the latest computer system for psychophysiological testing – HC-psychotest (Varina and Shevchenko, 2020). Empirical research was carried out in several stages:
 - Organizational stage: the choice of diagnostic techniques, the formation of a group of experiment participants.
 - Research stage: the first stage of empirical research was aimed at the identification of the role of high school students' emotional intelligence and the level of their professional self-identification.

- Analytical stage: the second stage of empirical research which includes quantitative and qualitative analysis of the obtained data, correlation analysis.
- 4. Development and piloting of a comprehensive program for the high school students' emotional intelligence development.

In the context of the analysis of theoretical models of personality's emotional stability the structural components of this phenomenon have been analyzed. In scientific psychology the first model of emotional intelligence was constructed in 1990 by Mayer et al. (Mayer et al., 2016). Emotional intelligence meant "the ability to follow your own and others people's feelings and emotions, to distinguish them from each other and to use the information obtained to guide your actions and thinking" (Mayer et al., 2016).

Emotional intelligence was viewed as a complex construct that included the abilities of three types: the recognition and expression of feelings, the ability to regulate emotions, the ability to use emotional information in the mental process and life. Final version of the model of emotional intelligence by Mayer et al. (Mayer et al., 2016) is presented as a model of abilities, in which emotional intelligence is the ability to process information contained in emotions; to identify the meaning of emotions, the relationship between each other; to use emotional information for thinking and decision making. In the structure of emotional intelligence within the model of abilities there are four groups of abilities called "branches": identification (perception, recognition) of emotions, the role of emotions in solving problems, understanding and analysis of emotions, conscious emotion management. This model of emotional intelligence laid the foundations for the concept of emotional intelligence developed by Goleman (Goleman, 1998), who supplemented the existing model with personal abilities: enthusiasm, perseverance and social skills (Cherniss et al., 2006).

According to Di Fabio et al. (Di Fabio et al., 2012), emotional intelligence is a set of all non-cognitive abilities, knowledge and competencies that give an individual the opportunity to successfully overcome various life situations. Di Fabio et al. (Di Fabio et al., 2012) identified five areas of competence. These areas are identical to five components of emotional intelligence. Each component contains subcomponents:

1. The process of self-knowledge: awareness of your own emotions, confidence, respect for yourself, wish for independence and self-actualization.
2. Developed interpersonal communicative skills:

empathy, interpersonal relationships, social responsibility.

3. Ability for the adaptation: to solve problems, be flexible and to keep in touch with the real world.
4. Ability to manage a stressful situation: to be resistant to stress, to control impulsivity.
5. Predominant mood: happiness, optimism.

Analysis of the scientific literature allows us to identify the components of emotional intelligence are: self-awareness (awareness of their social status and their vital needs), self-control (awareness and evaluation of the subject of their actions, mental processes and states), empathy (understanding of emotional state, penetration - compassion in the experience of another person), relationship skills (actions that are formed by repetition, which are characterized by a high level of assimilation), motivation (motivations that cause activity of the body and the individual as a whole and determine its direction).

The main aspects of professional self-determination:

1. Professional self-determination is the selective attitude of an individual to the world of professions in general and to a specific chosen profession.
2. The core of professional self-determination is a conscious choice of profession, taking into account its features and capabilities, the requirements of professional activity and socio-economic conditions.
3. Professional self-determination is carried out throughout the professional life: the individual constantly reflects, rethinks his professional life and asserts himself in the profession.
4. Actualization of professional self-determination of the individual is initiated by various events, such as graduation from secondary school, vocational school, advanced training, change of residence, certification, dismissal, etc.
5. Professional self-determination is an important characteristic of the socio-psychological maturity of the individual, his need for self-realization and self-actualization.

Based on the results of theoretical analysis, we have developed a personalized model of emotional intelligence development, taking into account students' individual typological features (figure 1). The model is based on the following principles: principle of theory and practice balance, humanization of education, subjectivity, professional orientation, individualization, choice of individual educational path, situational learning, educational reflection, systematic learning,

fundamentality. The purpose of designing the model is, on the one hand, social order of the society: the need for competitive professionals, on the other hand, future professionals' need for effective personal and professional development.

Criteria for the effectiveness of the developed model is its compliance with the stated goals and objectives, as well as recorded changes that occur with participants in the process, namely the positive dynamics of emotional intelligence and its components in high school students; development of empathy, self-esteem, self-confidence; development and optimization of communication skills, which are reflected in communication and interpersonal skills; development of socio-psychological competence; ability to navigate in social situations, understand other people, choose and implement adequate forms of communication; willingness to understand and accept another person's behavior.

Taking into account the priority prospects for the use of innovative computer technology in psychodiagnostic practice, the analysis of the development the emotional stability components was conducted on the basis of the Laboratory of Psychophysiological Research and STEAM-laboratory. In the Laboratory of Psychophysiological Research, in order to address issues of professional selection and career guidance diagnostics, scientists used the following set of HC-psychotests. "Candidate" is an effective and easy-to-use tool for professional orientation and professional selection, which allows you to assess the level of the manifestation of professionally important psychophysiological qualities and professional competencies, as well as to predict the further development of the specialist and conduct in-depth professional psychodiagnostics. The study was conducted in a group mode, using the program of HC-psychotest. During the study, the same conditions that affect the test results were created: the content of the test material; complexity of questions; time allotted for answers. Indicators for the choice of methods were the following: their compliance with the criteria of reliability and validity, age characteristics of the participants, adequacy (Varina and Shevchenko, 2020). The following methods were used in the empirical study: theory of career choice (Holland, 1974), questionnaire of emotional intelligence "EMIN" (Lioussine, 2003), technique of emotional intelligence (Hall, 2007). To identify the level of relationship between emotional intelligence and professional self-identification, as well as tolerance for uncertainty, we used correlation analysis (Pearson's correlation coefficient), Mann-Whitney's statistical criterion.

Thus, according to table 1, we found out that most

students tend to have a profession of social and artistic types. The social type of professions predominates among the students of the 11th grade. For the 10th grade students the artistic type of professional self-orientation is more characteristic. This indicates the lack of a clear choice of direction of further employment.

Table 1: Indicators of values in the sample according to J. Holland's technique.

Names of the scales	General	10th grade	11th grade
Realistic type	5.3478	5.0938	5.6842
Intellectual type	6.4130	6.5000	5.4737
Social type	8.0000	8.0312	9.1053
Conventional type	6.3478	6.6250	5.9474
Entrepreneurial type	7.8261	7.5938	8.0000
Artistic type	8.1304	8.5625	8.7368

Therefore, according to table 2, we provide a more detailed quantitative and qualitative analysis of the obtained indicators. On the scale of InterU (understanding of your own emotions), we received an average score of 24.12. This is the average rate for this scale (23–26). This score is also within a norm in all groups of respondents. On the scale of InterM (management of other people's emotions), we received an average score of 19.65, which is also an average indicator, within the norm (18–21). According to the scale of IntraU (understanding of your own emotions), we received an average score of 16.49 with the norm (17–21), which is slightly below the norm. Having analyzed this indicator in groups, we found out that in the 11th grade it is low. On the scale of IntraU (management of your own emotions), the average score on the sample is 12.59, which is also below the norm (from 13 to 15), this figure is low in all groups. It can be explained by the fact that high school students do not have the skills to control their emotions because of developmental stage corresponding to their age. According to the IntraE scale (control over expression), we obtained an average score of 10.34, which is within the norm (from 10 to 12), but in the 11th grade it is on the border between low and medium level (low level – 7–9, medium level – 10–12). The obtained data tell us about the low level of control over expression, which may be due to the age range of the respondents.

On the scale of InerEI (interpersonal EI), we obtained an average score on the sample of 43.60, which is a medium level (40–46), this indicator remains medium for all groups participating in the study. According to the scale of IntraEI (intrapersonal EI), we received an average score of 39.82 with a norm (39–47). In the 11th grade, this figure is 36.05, which is

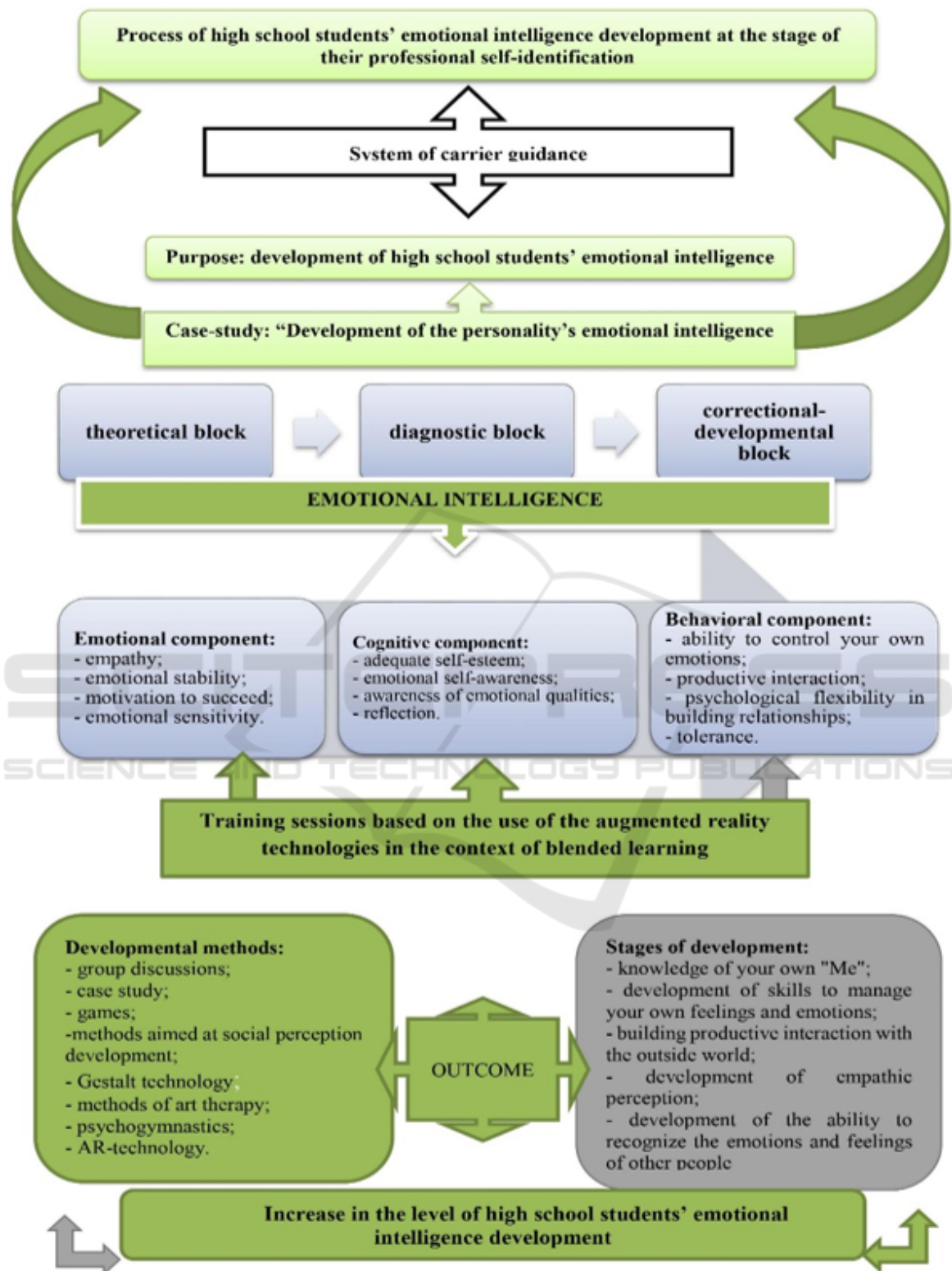


Figure 1: A comprehensive model of high school students' emotional intelligence development at the stage of their professional self-identification.

Table 2: Quantitative indicators according to the “EMIN” technique by D. V. Lusin.

Names of the scales	General	10th grade	11th grade
InterU (understanding of other people's emotions)	24.12	25.19	23.47
InterM (management of other people's emotions)	19.65	20.47	18.79
IntraU (understanding of your own emotions)	16.49	16.31	14.68
IntraM (management of your own emotions)	12.59	12.72	11.21
IntraE (control over expression)	10.34	10.72	9.11
IntraEI (interpersonal emotional intelligence)	43.60	45.50	41.68
IntraEI (interpersonal emotional intelligence)	39.82	40.38	36.05
UE (understanding of emotions)	40.33	41.31	37.63
ME (management of emotions)	43.11	44.56	40.63
General score	83.81	86.38	78.26

also below normal rate. According to the UE scale (understanding of emotions), the average score on the sample was 40.33, which is the medium result with the norm (40–47), in the 11th grade this figure is 37.63. On the scale of ME (management of emotions), the average result is 43.11, which is within the normal rate (40–47). The total general scale is 83.81, which is also within the normal rate (79–92). For a more detailed study of the levels of high school students' emotional intelligence, we used N. Hall's technique of emotional intelligence (table 3).

On the scale of managing your own emotions, the average figure is 0.44. It is low for the entire sample. It can be explained by the age characteristics of high school students. The self-motivation scale is also quite low. The general figure is medium – 6.3 (7 and below is considered to be a low level), it is slightly below the norm for each of the studied groups. On the scale of empathy, the average score is 7.59. It is on the border between medium and low levels. Having analyzed this indicator in detail, we see that in the 10th grade the score on the empathy scale is 9.84 and it is the normal rate. In the 11th grade, the score on the empathy scale is 7.68 and it is on the border between medium and low levels. The average score on the scale of recognition of other people's emotions is also on the border between medium and low levels, it is 7.09 points. In the 11th grade this indicator is low (6.63), but in the 10th – it is medium (8.59).

To prove the hypothesis that the participants with a high level of emotional intelligence will have a more detailed professional self-identification, which in most cases will be aimed at the professions of social type, we used the Pearson correlation coefficient. The calculation was done using the statistical software package SPSS 16.0. According to the obtained data, it was identified that on the scales of the social type of professional self-identification of recognizing other people's emotions the connection was established at the level of 0.01 (0.276). People

with a social type of the profession understand well the emotional state of others because the fact how skillful the employee is depends of the understanding of other people's wishes. For further employment in the social sphere, you need to have a high level of ability to recognize the emotions of other people, and understand when and where they can be displayed. A slight positive shift of 0.05 (0.228) has been established between realistic type scales of professional self-identification and self-management. People of realistic type prefer professions where you need to be able to control your emotions. People with a realistic type of professional self-identification are usually emotionally stable, focused on today, reason rationally. As a result, the negative relationship of 0.01 (-0.278) between the realistic type of professional self-identification and empathy is expected. They do not need to understand other people's emotions. That is, people with a realistic type of professional self-identification rarely have a high level of empathy. Participants of entrepreneurial type of professional self-identification have demonstrated a significant negative relationship with the scale of self-management, it is at the level of 0.01 (-0.333). People of this type of professional self-identification are very active. They do not need to clearly control their emotions. The tendency of people of artistic type of professional self-identification to recognize other people's emotions has been confirmed, positive correlation, found at the level of 0.05 (0.259), indicates that people of artistic type understand the emotions of others very well. Also the respondents of the artistic type of professional-identification have a well developed intuition and imagination. Communicating with others people, they rely on their immediate feelings, which leads to a correlation of 0.05 (0.260) between the artistic type of professional self-identification and emotional awareness. Based on their own feelings, they easily understand the emotions of other people. They also develop empathy, understanding of other

Table 3: Quantitative indicators of the values in the sample according to N. Hall's technique.

Names of the scales	General	10th grade	11th grade
Emotional awareness	7.75	8.34	10
Management of your own emotions	0.44	0.84	-0.31
Self-motivation	6.3	6.78	6.84
Empathy	7.59	9.84	7.68
Recognition of other people's emotions	7.09	8.59	6.63

people's emotional states by facial expressions, gestures, posture, and tone of voice. This is confirmed by statistics, namely a slight correlation of 0.05 (0.273) between the empathy scales and the artistic type of professional self-identification was identified. When using Mann-Whitney statistical criterion in two groups with low and high emotional intelligence, it was found out that groups with a high level of emotional intelligence have a higher tendency to the intellectual type of professional self-identification. People of this type of profession constantly use their intellectual abilities. But talking about the conventional type, on the contrary, in the groups with a high emotional intelligence the tendency to choose the professions of this type is lower than in the groups with a low level of emotional intelligence. This is due to the fact that representatives of the conventional type of professional self-identification feel the lack of need to express emotions. But the entrepreneurial type of emotional intelligence development is almost not affected. Both groups with low and high levels of emotional intelligence can choose this area of professional self-identification. Participants who choose the artistic type of professional self-identification still have a fairly high level of emotional intelligence.

According to the results of the Mann-Whitney U-criterion, a statistical discrepancy was found out only in the social type of professional self-identification (table 4). We also revealed that people with a high level of emotional intelligence have a clearer focus on professional self-identification, while those with a low level of emotional intelligence choose several predominant professions. Accordingly, the dominant psychodiagnostic study established the dominant role of emotional intelligence in the process of conscious choice of future profession.

Based on the established relationships and concept of career guidance in the process of high school students' professional self-identification, on the basis of the Laboratory of Health Psychology and with the support of leading STEAM-laboratory specialists, researchers developed and piloted a comprehensive program "Development of high school students' emotional intelligence". Virtual and augmented reality is designed to provide a person's contact with infor-

mation reality, as close as possible to ordinary reality (Rashevskaya and Soloviev, 2018), which contributes to the simultaneous integration of cognitive processes, motivational and emotional spheres of the individual. As a result of the implementation of augmented and virtual reality technologies, sensory-perceptual, visual, sensory parameters are preserved and even enhanced; the user here deals with superimages: three-dimensional, extremely distinct, which can be influenced, viewed from different angles. In a virtual situation, the developer retains and generates in relief only those properties of objects that are necessary for the implementation of the goals of the software product, in particular, the impact on the emotional component of intelligence.

The corresponding process of integration and impact of augmented and virtual reality technologies is presented in figure 2.

The 40 hour program is designed for blended learning. During September 2020, 4 hours of classroom work and 6 hours of interactive work in the Google Classroom system per week were carried out. Based on the model of emotional intelligence development (figure 1), structural psycho-correctional sessions have been developed, which include traditional psychological technologies and AR/VR technologies. Special technical equipment of STEAM-laboratory was used for realization of virtual and augmented reality constructs. There is a minimum set of equipment required to implement such an integrative approach: the required number of smart phones and VR helmets; tablet; mobile devices; computers; Wi-Fi router, Internet access; remote update system; instructional videos for interactive lectures and software; touch panel. The training program consists of 10 classes of 4 hours each (table 5). The augmented and virtual reality applications used in the presented program have both free and paid content. As part of the formative experiment, based on the implementation of the research project "Adaptive system for individualization and personalization of future professionals' training in the conditions of blended learning", as well as the expanded innovative material and technical base of the STEAM laboratory, a program for the development of emotional intelligence of high

Table 4: Differences in professional self-identification according to Mann-Whitney U-criterion between two groups with high and low levels of emotional intelligence.

	Realistic	Intellectual	Social	Conventional	Entrepreneurial	Artistic
Mann-Whitney U	394.5	369.5	306	369.5	418	398.5
Asymp. Sig. (2-tailed)	0.426	0.247	0.036*	0.243	0.654	0.462

* – connection is significant at the level of 0.05 and lower

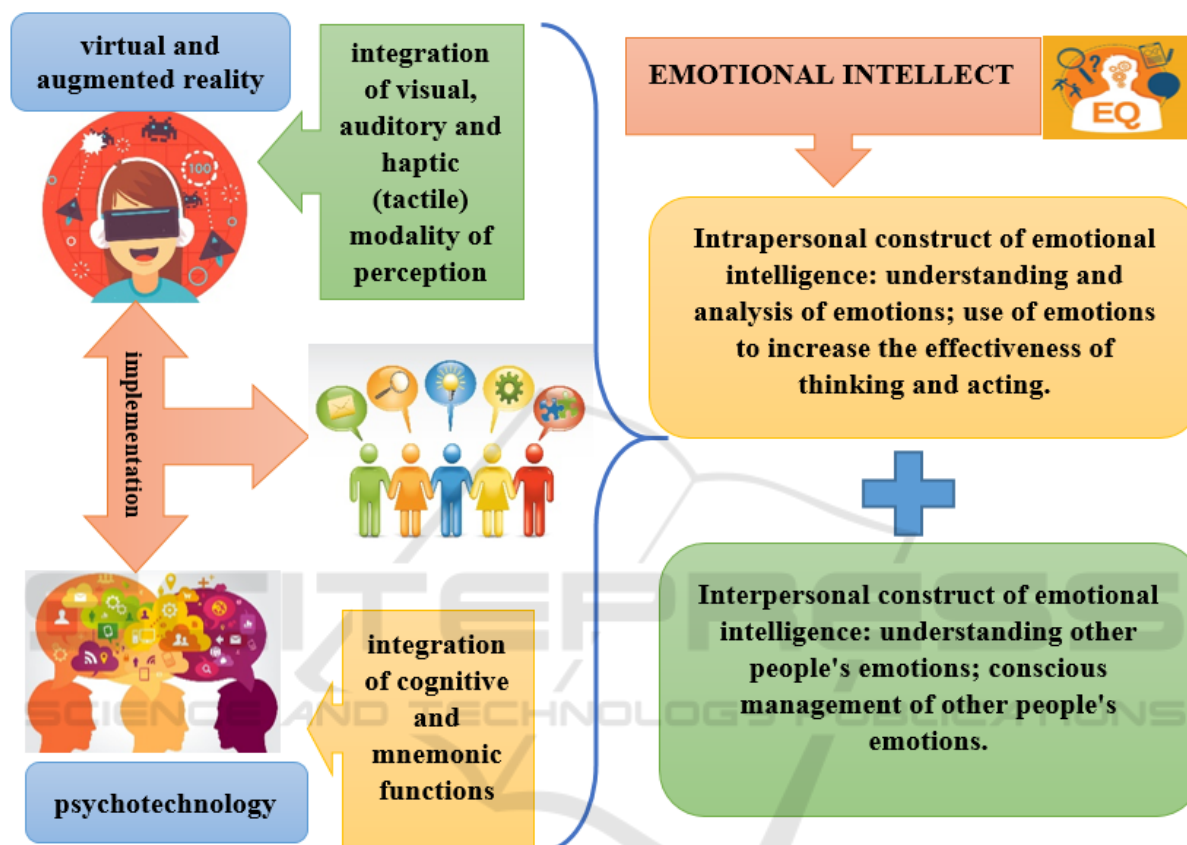


Figure 2: Scheme of implementation of augmented and virtual reality technologies in the context of the development of emotional intelligence of the individual.

school students was implemented in conditions of vocational guidance work. Our task was not so much to trace the complex impact of augmented and virtual reality technologies in conjunction with traditional psychotechnologies on the emotional state of an individual, but to determine whether they have an impact on the emotional component of intelligence. The corresponding comprehensive program was implemented in the experimental group from September to November 2020. 45 high school students took part in the training sessions.

The main mechanism for the implementation of augmented and virtual reality technologies in the psychocorrectional professor of the development of emotional intelligence is based on the mechanisms for reducing a certain emotional state situationally tied to

specific objects and events embedded in individual applications. This approach is traditional and corresponds to European counterparts. This is the use of methods of cognitive and behavioral (behavioral) therapy, which among the majority of practicing psychologists are considered the most effective. The impact on the client's personal experiences was carried out through repeated repetition of emotionally colored situations with an avatar or object. In essence, this program implements systematic desensitization – a phased immersion of the client in a situation that causes a certain emotional state from the simplest to the most exciting image. The images were as close to real ones as possible, the subjects had access to high interactivity and animation. Virtual and augmented reality, created by visualizing three-dimensional ob-

jects using computer graphics, animation and programming methods, is a product of not only information, but also psychological technologies. Modern methods of constructing a time-varying virtual environment also make it possible to register the position of the observer in it, which opens up new research opportunities for experimental and applied psychology and equips it with methods that have a number of advantages over traditional laboratory instruments. The first of these benefits is environmental validity. With the help of augmented and virtual reality systems, it is possible to create not only unreal ("other") worlds, but also an environment "similar to the real world" and at the same time, which is especially important, to control all parameters of the experimental situation. The second is flexibility. The environment of augmented and virtual reality is programmable, which allows you to plastically change the parameters of objects and events occurring with them. It is possible to present a variety of variable stimuli (both stationary and moving) and accurately track the movements of the observer in virtual space. The third is the possibility of polymodal stimulation. Augmented and virtual reality systems allow simulating visual, tactile, auditory images at the same time, which is hardly achievable in traditional psychological research. Simultaneous influence on the sensory-perceptual system actualizes a number of sensations and emotional states. The fourth advantage is the ability to fully record the behavioral reactions of the observer.

According to the implemented BYOD concept ("Bring Your Own Device") when organizing classes using mobile learning technology, respondents can use their own gadgets with the necessary software installed (Feng et al., 2020; Doargajudhur and Dell, 2020). The introduction of elements of AR/VR technologies in the training process provides an opportunity to deeply influence the emotional world of the individual; it stimulates the ability to visualize and reproduce certain emotional states with augmented and virtual reality technologies; provides the possibility of close immersion in students' own emotional world, its active knowledge and emotional development, self-regulation, stress resistance and the ability to understand the emotional world of another person (Vandana et al., 2020). Within the framework of psychological support of professional self-identification, the introduction of augmented and virtual reality technologies provides an opportunity for "real" immersion in a certain type of professional activity, "trying on" the profession in relation to students' own individual capabilities and preferences. Increase of the participants' motivation and interest in individual and group work is also an important feature of the process

of implementing AR/VR technologies in the psycho-correctional process. According to the results of the implementation of the training program using the elements of augmented and virtual reality, certain positive changes in the intrapersonal and interpersonal components of emotional intelligence of high school students were revealed. accordingly, positive changes are reflected in the overall index of emotional intelligence (figure 3 (a, b)).

The reliability of the results obtained on the change in the general level of emotional intelligence was tested using the criterion of signs G . Two hypotheses were formulated. H_0 – the shift towards changes in the level of emotional intelligence after applying a complex program using augmented and virtual reality technologies is accidental. H_1 – the shift towards changes in the level of emotional intelligence after applying a complex program using augmented and virtual reality technologies is not accidental.

Typical shift is positive (18), atypical – 4, $G_{emp} = 4$, $G_{crit} = 6$ (found using the table of critical values of the sign criterion), $G_{emp} < G_{crit}$, which means that the alternative hypothesis H_1 should be accepted, $p < 0.05$.

According to the results of the data presented in figure 3 shows the positive dynamics of the development of components and the overall index of emotional intelligence in high school students.

After the introduction of a comprehensive program with elements of augmented and virtual reality, there is a significant increase in the ability to understand their own and others' emotions and manage them in the respondents of the experimental group.

The ability to understand emotions means that respondents can effectively recognize emotional states, ie establish the very fact of the presence of emotional experience in themselves or in another person; can identify the emotion, or establish what kind of emotion is felt by a high school student or another person, and find a verbal expression for it; understand the reasons that caused this emotion and the consequences to which she will lead.

The ability to manage emotions means that respondents can control the intensity of emotions, especially to suppress excessively strong emotions; can control the external expression of emotions; can, if necessary, arbitrarily evoke one or another emotion.

Both the ability to understand and the ability to control emotions can be directed to both one's own emotions and the emotions of others.

Thus, we can talk about raising the level and dominance of high and medium level intrapersonal and interpersonal components of emotional intelligence. These two options involve the actualization of differ-

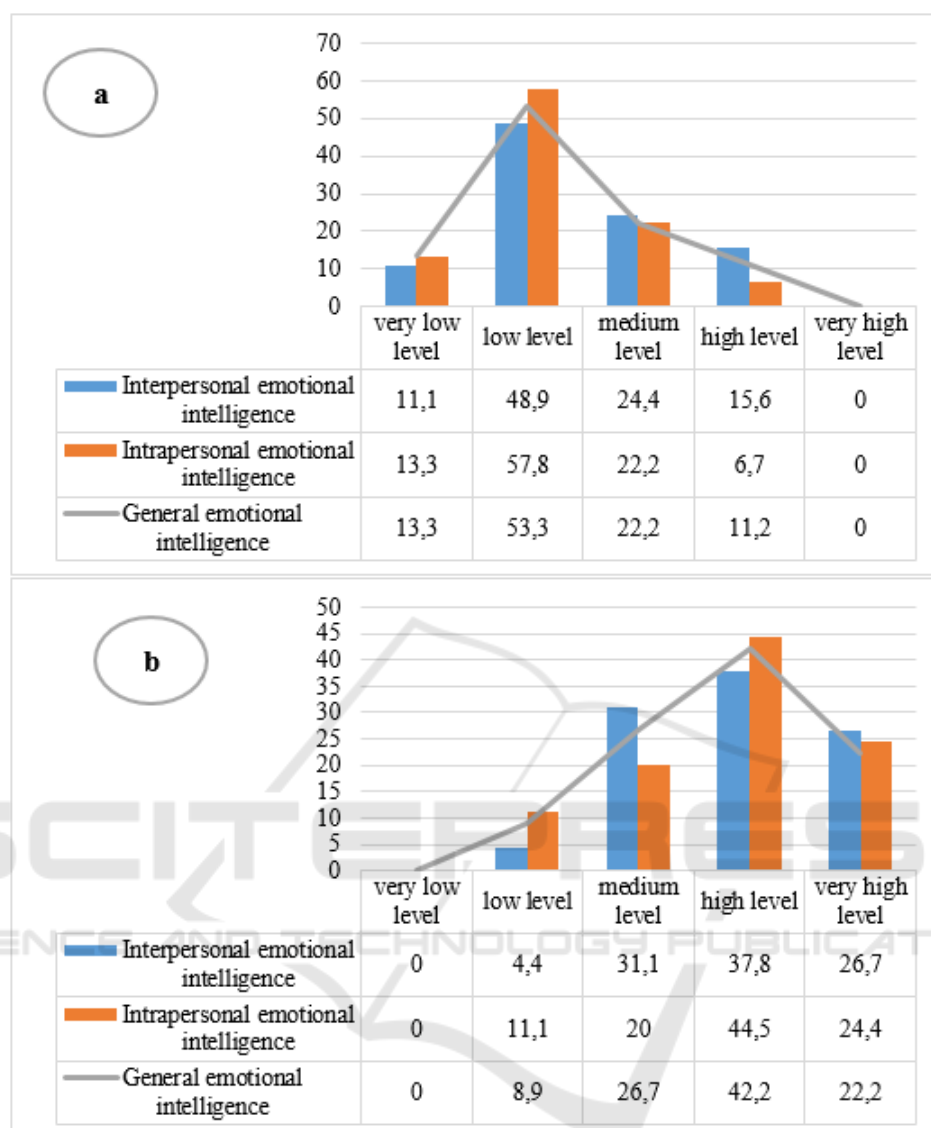


Figure 3: Dynamics of development of emotional intelligence of high school students of the experimental group ($n = 45$): a) the percentage of development of emotional intelligence of high school students to participate in a psycho-correctional program with elements of augmented and virtual reality; b) the percentage of the development of emotional intelligence of high school students after the formative influence.

ent cognitive processes and skills.

There was no significant quantitative difference in the indicators of emotional intelligence in the control group of respondents.

5 CONCLUSIONS

The use of augmented and virtual reality technologies provides high school students with new opportunities and prospects aimed at practice-oriented learning, promotes personal development and improve the

quality of self-education, provides opportunities for the internalization of personal experience. In the context of professional self-determination provides an opportunity to bring high school students closer to real ideas about the future profession, to reduce the impact of social and psychological labels in the process of choosing future professional activities.

The use of reality technologies brings science to life, reproduces real life situations, helps to create fictional spaces for unsolved problems. It creates new opportunities for mastering practical skills, provides research experience, reveals the inner poten-

tial of the individual on the path to self-knowledge and self-development, makes activities a bright process, prevents distractions, increases motivation in decision-making, affects the emotional and cognitive sphere of personality, helps more to understand complex concepts, definitions, properties, which through emotional coloring are formed into a single plane of future professional activity.

Modern digital technologies based on VR/AR form the main criteria for professional selection, such as focus on the practical component of future activities, productivity, competitiveness, stress, increased concentration and attention, information retrieval, motivation, information competence and comprehensive assessment of academic achievement, improving the development of spatial, creative abilities and memory. The influence of augmented and virtual reality technologies on sensory channels promotes the activation of hemispherical interaction of the brain, which directly affects the emotional sphere.

Thus, emotional intelligence is a two-component construct, which consists of intrapersonal (ability to understand and manage your own emotions) and interpersonal (ability to understand and manage the emotions of other people) components. The role of emotional intelligence in professional self-identification is viewed as the ability to identify your own emotions and manage them in order to achieve the goal. According to the results of an empirical study of high school students' emotional intelligence indicators, it was found out that the majority of high school students have a low level of emotional intelligence. Analysis of the results of empirical research has shown that the least pronounced is respondents' ability to manage both their own emotional states and the emotions of other people. According to the results of the study, we found out that the participants with the social orientation of professional self-identification have a high level of interpersonal emotional intelligence. In particular, high school students of social type of professional self-identification are prone to recognize the emotions of other people. We also revealed that participants with a realistic type of professional self-identification have a low empathy level. Respondents with the entrepreneurial type of professional self-identification have low scores on the scale of managing their emotions. Based on the results of a diagnostic study, conducted in groups using the computer complex HC-psychotest, the training "Development of emotional stability" was developed and piloted. An innovative trend in the implementation of training is a comprehensive combination of traditional psycho-correctional and developmental technologies and AR/VR technologies.

The use of training and psychocorrectional programs of programs with components of augmented and virtual reality, specially aimed on personality changes, has a significant impact on the modification of functional personality structures (for example, emotional intelligence). Such programs can be used in the course of continuing education for adults. With their sufficient operationalization, the students themselves are able to reduce anxiety, reduce fears and negative emotions, stimulate positive emotional states by working individually and including self-regulation mechanisms. As a result of feedback from respondents, it turned out that the greatest impact on abilities is exerted, first of all, by didactic programs with elements of augmented and virtual reality, under the influence of which the formation of intellectual abilities is stimulated, as well as cognitive style through the actualization of positive emotional states. The implementation of traditional psychotechnologies and elements of virtual and augmented reality increase the level of reflexivity in cognitive activity and information processing. Correctional programs with components of augmented and virtual reality for the development of emotional intelligence in high school students contribute to a positive change in the conscious assessment of judgments about emotionally colored components of the situation, harmonization of the structure of the relationship between connotative and denotative meanings (meanings and meanings) within individual consciousness. The process of personality action in these programs also changes unconscious attitudes. Prospects for further research are the analysis of the impact of innovative technologies of augmented and virtual reality on the psychological characteristics of man in the educational space.

REFERENCES

- Cherniss, C., Extein, M., Goleman, D., and Weissberg, R. P. (2006). Emotional intelligence: what does the research really indicate? *Educational psychologist*, 41(4):239–245.
- Dave, H. P., Keefer, K. V., Snetsinger, S. W., Holden, R. R., and Parker, J. D. A. (2019). Predicting the pursuit of post-secondary education: role of trait emotional intelligence in a longitudinal study. *Frontiers in psychology*, 10:1182.
- Di Fabio, A., Palazzeschi, L., and Bar-On, R. (2012). The role of personality traits, core self-evaluation, and emotional intelligence in career decision-making difficulties. *Journal of Employment Counseling*, 49(3):118–129.
- Doargajudhur, M. S. and Dell, P. (2020). The effect of bring your own device (byod) adoption on work per-

- formance and motivation. *Journal of Computer Information Systems*, 60(6):518–529.
- Feng, H., Hu, W., and Wu, J. (2020). Bring your own device (BYOD) based flipped classroom in primary school. In *2020 IEEE International Conference on Smart Cloud (SmartCloud)*, pages 154–158.
- Goleman, D. (1998). The emotionally competent leader. *The Healthcare Forum journal*, 41(2):36, 38, 76.
- Grover, S. and Furnham, A. (2021). Does emotional intelligence and resilience moderate the relationship between the dark triad and personal and work burnout? *Personality and Individual Differences*, 169:109979.
- Hall, N. (2007). Emotional intelligence: A primer. <https://positivepsychologynews.com/news/nicholas-hall/20071110481>.
- Holland, J. (1974). Career counseling: Then, now, and what's next? *The Counseling Psychologist*, 4(3):24–26.
- Kramarenko, T. H., Pylypenko, O. S., and Zaselskiy, V. I. (2020). Prospects of using the augmented reality application in STEM-based Mathematics teaching. *CEUR Workshop Proceedings*, 2547:130–144.
- Lawson, A. P., Mayer, R. E., Adamo-Villani, N., Benes, B., Lei, X., and Cheng, J. (2021). Do learners recognize and relate to the emotions displayed by virtual instructors? *International Journal of Artificial Intelligence in Education*, 31(1):134–153.
- lin Tam, H., Kwok, S. Y. C. L., Hui, A. N. N., yin Chan, D. K., Leung, C., Leung, J., Lo, H., and Lai, S. (2021). The significance of emotional intelligence to students' learning motivation and academic achievement: A study in Hong Kong with a Confucian heritage. *Children and Youth Services Review*, 121:105847.
- Lioussine, D. (2003). Components of emotional intelligence and their relations with personality traits and gender. In *Psychology in dialogue with related disciplines. 8th European Congress of Psychology*, page 196, Wien. European Federation of Psychologists' Associations.
- Liu, S. (2020). Size of the education software/application market worldwide from 2019 to 2024. <https://www.statista.com/statistics/643909/worldwide-education-software-market-size/>.
- Mayer, J. D., Caruso, D. R., and Salovey, P. (2016). The ability model of emotional intelligence: Principles and updates. *Emotion Review*, 8(4):290–300.
- Narimani, A., Khaleghi, A., Haedar, H., and Semnani, F. (2019). The use of gamification in evaluating children's emotional intelligence. In *Interactive Mobile Communication, Technologies and Learning*, pages 806–813. https://www.researchgate.net/publication/339166086_The_Use_of_Gamification_in_Evaluating_Children%27s_Emotional_Intelligence.
- Osadchyi, V. V., Chemerys, H. Y., Osadcha, K. P., Kruhlyk, V. S., Koniukhov, S. L., and Kiv, A. E. (2020). Conceptual model of learning based on the combined capabilities of augmented and virtual reality technologies with adaptive learning systems. *CEUR Workshop Proceedings*, 2731:328–340.
- Rashevskaya, N. V. and Soloviev, V. N. (2018). Augmented reality and the prospects for applying its in the training of future engineers. *CEUR Workshop Proceedings*, 2257:192–197.
- Shah, P., Raj, P. P., Suresh, P., and Das, B. (2021). Contextually aware multimodal emotion recognition. In Gunjan, V. K. and Zurada, J. M., editors, *Proceedings of International Conference on Recent Trends in Machine Learning, IoT, Smart Cities and Applications*, pages 745–753, Singapore. Springer Singapore.
- Shankar, S., Sruthi, V., Satyanarayana, V., and Das, B. (2021). Toward artificial social intelligence: A semi-supervised, split decoder approach to eq in a conversational agent. In Chiplunkar, N. N. and Fukao, T., editors, *Advances in Artificial Intelligence and Data Engineering*, pages 251–265, Singapore. Springer Singapore.
- Thomas, C. L. and Allen, K. (2021). Driving engagement: investigating the influence of emotional intelligence and academic buoyancy on student engagement. *Journal of Further and Higher Education*, 45(1):107–119.
- Tkachuk, V., Yechkalo, Y., Semerikov, S., Kislova, M., and Hladyr, Y. (2021). Using Mobile ICT for Online Learning During COVID-19 Lockdown. In Bollin, A., Ermolayev, V., Mayr, H. C., Nikitchenko, M., Spivakovsky, A., Tkachuk, M., Yakovyna, V., and Zholtkevych, G., editors, *Information and Communication Technologies in Education, Research, and Industrial Applications*, pages 46–67, Cham. Springer International Publishing.
- Tkachuk, V., Yechkalo, Y., Semerikov, S., Kislova, M., and Khotskina, V. (2020). Exploring student uses of mobile technologies in university classrooms: Audience response systems and development of multimedia. *CEUR Workshop Proceedings*, 2732:1217–1232.
- Vandana, Purkayastha, B., and Kumar, A. (2020). Issues and challenges in management related to information technology. *International Journal of Computing and Digital Systems*, 9(4):703–713.
- Varina, H. and Shevchenko, S. (2020). The peculiarities of using the computer complex HC-psychotests in the process of psychodiagnosis of the level of development of future specialists' mental capacity. *E3S Web of Conferences*, 166:10025.
- Vlasenko, K., Achkan, V., Chumak, O., Lovianova, I., and Armash, T. (2020). Problem-based approach to develop creative thinking in students majoring in mathematics at teacher training universities. *Universal Journal of Educational Research*, 8(7):2853–2863.
- Zijadic, A., Hilbert, M., Lewis, M., and Nguyen, T. (2020). Augmented reality and virtual reality will transform selling. <https://www.gartner.com/en/documents/3994752-augmented-reality-and-virtual-reality-will-transform-sel>.

APPENDIX

Table 5: Training program “Development of emotional intelligence” based on the use of AR/VR technologies.

Topic of the class	Objectives	Psychological techniques and methods	AR and VR technologies
1. Emotional competence as a vital resource	acquaintance with the training program; ground rules for group interaction; identification of participants' expectations; self-diagnosis of emotional intelligence; informing about the emotional sphere of a person; modeling the image of emotionally competent individual	brainstorming, art therapy, clustering, moderation, facilitation, role play, feedback	Graffiti Paint VR. Art Therapy. NeuroNation Ease: Mindfulness & Meditation
2. The world of feelings and emotions	“acquaintance” with the world of feelings and emotions; development of emotional self-awareness and competencies: observation of the flow of emotions, bodily sensations, thoughts; identification (recognition, naming), analysis of your own emotions, feelings; understanding of the reasons for their occurrence	brainstorming, art therapy, gestalt therapy, interactive mini-lecture, identification technique, case-study, technique of influencing the emotional state through changing body positions - “psycho-sculpture”, meditative exercises, self-training, technique of emotional introspection, music therapy.	VR Maze. VR Mission Leviathan. Moodpath - Depression & Anxiety Test. Wild Symphony. Coastality
3. What can we do with emotions? Emotional self-regulation	responsibility for your own emotional reactions, self-controlled behavior and willingness to manage your own emotions in the steady and emotionally tense life situations; development of emotional self-regulation competencies: adjustment of intensity and evocation of desired emotions, restoration of emotional balance, resistance to immediate desires and emotions; verbalization of emotions and feelings; perception and understanding of nonverbal body language and movements; choice of authentic and adequate to the situation ways of emotional self-expression.	psychogymnastics, art therapy, emotional recharging technique, moderation, technique of metaphorical expression of feelings, technique of “Me-expression”, technique of verbalization of partner's feelings, role play, “aquarium”, technique of restoring emotional balance with the help of images, technique of separating “Me” from emotions, technique of working with emotions “7-P”	VR Thrills: Roller Coaster 360. VR Heights Phobia Horror. VR Relax Travel
4. Psychophysiological self-regulation of emotions	techniques and methods of psychophysiological self-regulation, release of muscle tension (breathing, muscle relaxation, meditation, etc.)	interactive mini-lecture, self-training, relaxation and visualization techniques, psychogymnastics, meditative breathing, physical exercises, technique of freeing unwanted emotions, self-suggestion techniques	Thisissand - Art, Creativity & Relaxation. Relax River VR.
5. Life position. World-view and self-regulation	awareness of life values, beliefs about yourself and others; influence of life position on destiny; uniqueness of each person's picture of the world; development of tolerant attitude towards others	interactive mini-lecture, art therapy, facilitation, brainstorming, transformation game using metaphorical maps	NeuroNation – activities for brain, DEVAR – 4D augmented reality

Continued on next page

Table 5 – continued from previous page

Topic of the class	Objectives	Psychological techniques and methods	AR and VR technologies
6. Positive thinking. Intellectual self-regulation	awareness of the relationship between emotional competence, positive thinking and self-efficacy; formation of motivation for achievement; development of positive thinking competence	art therapy, gestalt therapy, psychodrama, role play, cards with affirmations, technique of positive processing of an unpleasant situation “Magic questions”, interactive exercises, technique “Positive language”, case-study.	CBT Companion: (Cognitive Behavioral Therapy app). ACT iCoach: Acceptance Commitment Therapy App. 3DBear – Visualize your creative thinking.
7. Resources of the past, present, and future. Time management	formation of time management competence; awareness of the importance of a constructive attitude to the past, present, future in order to improve the emotional competence; competence development: being present “here and now”, feeling and objectively perceiving reality, other people; tolerance to failures and uncertainty, ability for reasonable risk	case-study, gestalt therapy, role play, “aquarium”, art therapy, relaxation techniques, “Box of Joy” technique, art therapy.	Diarize. Paint Draw AR Vaytricks. CubeAR: maze 3D & AR. VR Player Best video VR 360 video.
8. Social sensitivity. Non-verbal communication	awareness of emotional processes during interpersonal interaction; mastering skills of social sensitivity; expanding the range of emotions; competence development: identification, analysis, verbalization of the emotions and feelings of the interlocutor, understanding the reasons for their occurrence; emotional support; development of skills of attentive listening	art therapy, role play, brainstorming, transformation game, aquarium, interactive lecture, psychogymnastics, reflection technique, moderation, community emphasis technique, techniques of verbalization of your own and partner's feelings	eQuoo: Emotional Fitness Game. RakugakiAR.
9. The golden mean in communication. Assertiveness of behavior.	development of assertive behavior, adequacy of self-esteem, expanding the range of emotional response; development of competencies: selection of an emotional reaction adequate to the situation; constructive resolution of the emotionally tense situations, protection of your own psychological boundaries, your point of view; resistance towards manipulations; ability to refuse without offending another person	art therapy, role play, case study, interactive mini-lecture, facilitation, assertive refusal techniques, sharing	CBT Thought Diary - Mood Tracker. Timia. Ylands.
10. Career guidance game “Tree of professions”	activation of psychological readiness for professional self-identification; actualization of internal human resources for successful professional self-realization; formation of the ability to make a decision on choosing and obtaining a profession; systematization of ideas about the world of professions, development of skills of search and analysis of information, group work	art therapy, role play, case study, collage technique, transformation game, brainstorming, sharing	Expeditions AR. AR Sandbox. Aircraft - AR No Size Limit. VR - Virtual Work Simulator