

## Methodological aspects of using augmented reality for improvement of the health preserving competence of a Physical Education teacher

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**Abstract.** The article deals with the results of the research aimed at the improvement of methodology of use of augmented reality for the development of health preserving competence of a Physical Education teacher under conditions of post-graduate education. From the point of Umwelt phenomenology, augmented reality is characterized by correspondence to nature, its cognitive, metaphoric, diverse, interactive, anthropomorphic nature. The article analyzes the vectors of using augmented reality in the professional activity of a Physical Education teacher, particularly the one that is aimed at health preservation. The software that may be used with this purpose has been described. The attitude of Physical Education teachers to the use of the augmented reality for preserving their students' health and development of their motion skills, intellect and creativity was determined in the research. The results of the survey show that the majority of teachers positively react to the idea of using augmented reality in their professional activity. However, in some cases, not a fully formed understanding of this issue was observed. The ways of solving the stated problem could be the inclusion of augmented technologies' techniques into the process of post-graduate education, taking into consideration the anthropological, ethical, cultural contexts as well as teacher involvement in the stated process.

**Keywords:** health preserving competence, a Physical Education teacher, post-graduate education, augmented reality, Umwelt, pedagogy of health, methodology, digital technologies.

## 1 Introduction

The need to use augmented reality in education [29; 31; 34; 41; 43; 49; 57; 62; 63] and, first and foremost, in practices and technologies of Physical Education is caused by its “congruence” to the “human reality”, particularly its correspondence to the peculiarities of a pupil’s motor activity and the multi-dimensional, adaptable and diverse spectrum of tools that can be used within it. The use of augmented reality in the educational process correlated with the disclosure of the value of human existence and the anthropological-value reflection of Lebenswelt [17] of a person may form synergic, developing and intellectual effects, which are the manifestation of digital transformation of education and its shift to a new quality level. At the same time, the issue of using augmented reality in the professional work of a Physical Education teacher, namely, for health preservation, is an actively developed topic. We view the problem of development of a methodology for using augmented reality for the development of a health preserving competence of a Physical Education teacher in conditions of post-graduate education and on the basis of anthropological [3; 12; 23; 30], ontological and value paradigms, which includes the need to consider the phenomenology of a person, his/her multidimensionality and the peculiarities of this field of education (of physical culture and sport), creativity and potential of a personality.

Considering the introduction of the augmented reality in an educational process, the necessity of use of ontology-oriented comprehension of a person and his/her motion activity is actualized. In the semantic framework of ontological understanding of a person, he/she is represented as a multidimensional and polyontological creature. Experimental data received by N. Nosov and then used by him as the foundation for the development of the virtual psychology, prove the polyontological nature of a person, view the person as place for integration of many realities [44; 45]. Therefore, it is necessary to examine the augmented reality not only traditionally from the “instrumental and technological” point of view but also from ontological positions. In such a case, the augmented reality is considered as a relevant component of person’s ontology.

Accordingly, the methodological perception of the possibilities of using augmented reality is carried out with the application of relevant from the point of biosemiotics Umwelt (“the surrounding world”) concept [28; 56; 59]. This concept provides a holistically oriented reflection of a special world or a specific reality of a living organism. The stated reality (Germ. Umwelt), according to Jakob von Uexküll (his work “Umwelt und Innenwelt der Tiere” [59], 1909) is manifested through integration of the world of perception (Germ. Merkwelt) and the world of action (Germ. Wirkwelt) [59]. Thus, in the course of its existence, the body forms a “relevant zone”, which is that very fragment of reality, which seems to be vitally significant for its perception and activity.

The application of Umwelt conception for the improvement of the use of the augmented reality is a methodologically determined way of ontologization of Homo Educandus (A Person who studies) and humanization of an educational process. Accordingly, the use of an Umwelt idea can extend methodological and technological

possibilities of application of the augmented reality by the selection of the special “transitional reality” between a person’s reality and the world. Therefore, we suggest to perfect the methodology of use of the augmented reality in professional activity of a Physical Education teacher in the ontology oriented direction, which considerably extends and anthropologizes traditional methodologies and technologies in particular.

In addition, in order to broaden the possibilities of implementation of the existing potentials of the motor and mental fields of a person, an integrated “external” reality is needed. In this respect, there occurs a need to integrate “corporal”, “motor” and “intellectual” realities and “ontologies” (in the sense of reality) of health through the use of an external integrating factor (a “special” reality), which a priori must itself be intelligent. Such an “external reality” within the framework of methodological comprehension presents itself as Umwelt and as the augmented reality.

Accordingly, such an “external” reality must form an intellectualized, dialogic, activity based and intentional (in the sense of targeted) anthro-technical medium, capable of self-development. A natural pre-condition of the indicated “corporal and intellectual” integration is the phenomenon of Umwelt, and an artificial one is the augmented reality. Nowadays, such a “new” and “integrating” reality may be formed using digital technologies [25; 26; 42; 48], namely, in the form of augmented reality. The example of the indicated “corporal and intellectual” integration is the use of the augmented reality for the development of emotional intellect of children with disorders of autism spectrum [7]. In the work of C.-H. Chen, I.-J. Lee, L.-Y. Lin, the augmented reality was used to teach to recognize mimic patterns [7]. Accordingly, in the indicated cases [7], while forming mimic characters there will be present integration of corporal, emotional, intellectual components and an “external” component as the augmented reality.

Thus, we determine the need to use augmented reality in the course of training a Physical Education teacher, particularly, for improving his health preserving competence [12], as a nature-corresponding way of a person’s development, which correlates with a person’s transcendent and polyontological essence. Augmented reality is a way of integrating the realities already existing in a person (mental, corporal, motor) as well as a way of their improvement. Thus, the application of augmented reality is an end-to-end anthropological project [1; 51], which corresponds to human nature and his/her motor being, and not a “local improvement”. Accordingly, in this aspect, the concept of Umwelt can be applied.

Despite a considerable number of studies dedicated to the use of digital technologies and, first of all, of augmented reality in the educational physical culture practices and technologies, the problem of using augmented reality for the development of the health preserving competence of a Physical Education teacher in conditions of post-graduate education has not been sufficiently studied yet. Particularly, the methodological, pedagogical, anthropological, prognostic and psychological aspects of the stated problem haven’t been thoroughly studied. In the methodology of use of the augmented reality, the presence of a “transitional zone” between a person and the world (Umwelt) is not sufficiently taken into account.

Taking into consideration the digital trend of education development and perceiving the practical demand for raising the effectiveness of pupils’ health preservation during

motor activity, as well as actualizing the issue of education professionalization, pedagogization, digitalization and technologization, the stated research is defined as relevant.

*Purpose of the research:* improving the methodology of use of the augmented reality for the development of a health preserving competence of a Physical Education teacher under conditions of post-graduate education.

## 2 Related works

As of today, augmented reality has become an effective digital learning technology based on the achievements in the field of artificial intelligence [15; 36; 52; 53; 58]; a way of “broadening” the living world (Germ. Lebenswelt, by Edmund Husserl – the world of everyday life, which is the basis of cognition) [17] of a person; a way of reflection and effective innovative methodology of actualizing emotional intelligence [7], intellect, storytelling activities [1], creativity [47; 61], 21st-century skills [50], interaction of parents with children [22] and potential of a personality.

The issue of using augmented reality in physical culture and sports has been studied by many researchers [2; 6; 11; 16; 21; 33; 35; 39; 46]. A. Casey and B. Jones used digital video technologies to raise the level of interest and motivation to motor activity in pupils of general secondary schools of Australia [6]. The authors note the efficiency of this technology in terms of improving coordination skills of the pupils and raising their learning interest [6].

P. Legrain, N. Gillet, C. Gernigon, M.-A. Lafreniere used ICT at Physical Education lessons in combination with the increase of the autonomy and independence of pupils proportionally to the decrease of the teacher’s active interference [35]. Such approach increased the efficiency of forming motor and cognitive skills, raised independence and motivation to doing sports activities as well as actualized progress [35].

K.-F. Hsiao in Taiwan used augmented reality (AR) integrated with the educational process [16]. This included the use of the developed AR-Fitness system. At the same time, he actualized the development of knowledge in such fields as “cardiac-lung stamina”, “muscle conditioning”, “explosiveness”, “flexibility” [16].

M. M. H. Alhamdi, S. B. Salih and M. A. A. Abd used digital technologies to increase the efficiency of forming motor skills in the deaf and dumb children [2]. The authors note the efficiency of the development of motor skills while using the stated approach included computer movement analysis [2]. Computer movement models can be represented as components of augmented reality.

In order to increase the efficiency of forming motor skills in pre-school children, E. E. Lauer, S. B. Martin and R. A. Zakrajsek created a virtual interactive study environment with the help of ASUS Xtion PRO [33]. According to the data given by researchers, the stated methodology is effective.

Using digital video for teaching 9-10-year-old children, J. O’Loughlin, D. Chróinín and D. O’Grady raised the motivation and self-esteem with regard to Physical Educational lessons as well as showed better results in mastering motor skills [46].

B. Melton, H. Bland, B. Harris, D. Kelly and K. Chandler successfully used mixed technologies to increase the efficiency of dance teaching as well as to raise the motivation and self-sufficiency [39].

Such authors as E. Enright, J. Robinson, A. Hogan, M. Stylianou, J. Hay, F. Smith and A. Ball analyze the need to use digital technologies in physical culture on the basis of democratic values and innovative, critical and praxeological methodological orientations [11].

While studying the use of augmented reality, we develop the methodological constructs based on the idea of unconditional value of intellect development, creativity and motor activity, which are being implemented due to physical culture. It is based on the fact that it helps the pupil to unveil his/her corporality as well as the mental sphere in the form of a special motor being, as well as through actualization of vitality, life-creativity and sense-creation. Thus, physical culture is a particular motor reality, which corresponds with human nature. Movement and motor being are interrelated with health, which is viewed as an authentic and anthropologically specific way of human existence.

Corporal and motion reality are also the basis of the psychic and mental fields of a person. According to L. S. Vygotski (the cultural-historical psychic concept), consciousness is the result of interiorization (in the sense of shifting to the center, into the psychic reality) of the “history” of a person’s interaction with the environment [24; 60]. Motor activity occupies the central role in this interaction. At the same time, motor activity lies at the basis of the intellect, both during its formation in ontogenesis (individual development) and during a person’s mental activity, as it is in fact a specific motor reality and existence of a human being.

From methodological positions, following the ontological approach, accordingly, we present health, motion and corporeality of a person as special realities. Therefore, they can be purposefully perfected by cooperation with the augmented reality. Meaningful in this aspect is sense-forming and intellectual dimensions of such cooperation. The use of the augmented reality in health preserving practices of physical culture is the way of opening of motion activity in the formats of intellectual existence.

For the anthropological-value perception of the phenomenon of an intellect as an anthropologically specific reality and ontology (being) it is important to understand that its beginnings and currently relative components lie in the body, corporality and motor activity. This is described by G. Lakoff in his classical work “Metaphors We Live By” [28]. In his embodied cognitive science, G. Lakoff [28] points out that the notion and metaphors, as system-organizing “elements” of the intellect are primarily formed as corporal phenomena. Currently, embodied cognitive science is developed on the basis of the idea about a close and interdependent connection between the mind, the body and the environment [56].

Schematically, the stated above ideas can be depicted as a sequence of a mutually determined and mutually dependent phenomena, namely: “body, motor activity and interaction with the environment – intellect – adaptation, creativity, development”. Thus, a person may be viewed as a human being that consists of various ontologies (beings) and realities [44; 45]. And the “way” they are organized into a unity makes the very phenomenon of a person. The stated unity is first and foremost carried out “from

within” as this is determined by human nature. According to C. Jung, such unity is perceived by a person as Self, which predominantly is perceived by a personality as the highest harmony of the “internal” God [7]. The idea of a polyontological character of a person is the basis of virtual psychology worked out by N. Nosov [44; 45]. Relevant in this aspect is the conception of Umwelt [28; 56; 59]. Umwelt is a special “perception and activity reality” of a living organism.

Thus, the reality is being “fragmented” and “channeled” into a countless number of “parallel” Umwelts “in” which certain biological species live and which they “carry around” with them. This means that the existing reality is multi-dimensional and multi-aspect due to the formation of specific individualized “perception-activity” worlds – Umwelts.

Thus, every biological species generates, masters, sees and somehow understands and interprets the specific and significant for him/her personally spectrum of phenomena, which together form Umwelts. According to E. Husserl, we comprehend being through perception of relevant phenomena [17], which together reflect the reality in one’s consciousness. That’s why, in the context relevant to our problematics, we may speak about the peculiarities of the living world (Germ. Lebenswelt) [17], which is formed through a person’s unveiling, perceiving and using the significant for him/her phenomena. In comparison we should note that apart from Human, other biological species have quite a limited number of phenomena that form their worlds and are presented and “narrowly” specific. These are the worlds of perception, action, being, which primarily define the mode of existence. Quite strictly determined combinations of specific phenomena form the Umwelts of biological species. Thus, all the biological species except for humans are maximally adapted to “their” Umwelts.

Limitation in space and time of animals’ Umwelt is pointed out by M. Stella and K. Kleisner [28, p. 69; 56, p. 39]. At the same time, when an animal is transferred to a different environment the stated adaptation possibilities drastically decrease and it is not always possible to for “new” Umwelts, even when resources are available. In essence, living organisms form, support and “carry around” a certain fragment of the reality, which is desired and to a considerable extent set for them. Thanks to the use of the Umwelt concept, subjectivity and personalized differences are actualized alongside with the significance of species peculiarities [28, pp. 68–70]. Every or person has their own Umwelt.

Analyzing the Umwelt concept, O. Knyazeva singles out some aspects that are significant for our methodology: active influence on the environment; feedback between the environment and the creature; selectivity of perception and action; sense making; existence of a dynamic boundary between a creature and the environment; interactive unity of the environment and the organism [28, p. 69].

### **3 Selection of methods and diagnostics**

In the course of the research, the following system of methods and approaches was used: analysis, synthesis, statistical, empirical (survey, questionnaire); competence, health preserving [12], ontological, hermeneutical, axiological, phenomenological [17],

epistemological, transdisciplinary, systemic, holistic, biosemiotic [40], semiotic, humanistic, psychological [20; 24; 44; 60], anthropological [3; 12; 23; 30], cultural, innovative, futuristic, problematic, targeted.

We used the concepts of anthropologization [3; 12; 23; 30]; knowledge transfer; sustainable development, anthropological practices and “technologies of self” (M. Foucault) [13]; Umwelt (J. von Uexküll) [28; 56; 59]; living world (Germ. Lebenswelt) of E. Husserl [17]; of contact boundary developed in gestalt psychology; of sense making (C. Lorenz) [28]; autopoiesis (U. Maturana, F. Varela) [37]; of embodied mind (J. Lakoff) [32]; of cultural-historical theory of psychic development (L. S. Vygotski) [24; 60]; of C. Jung’s Self (Germ. Selbst) [20]. We also used visions and methodological approaches developed in the system of embodied cognitive science [55], enactivism [27] and virtual psychology and virtual science [44; 45].

For the methodological perception, the following Ancient Greek concepts were used: “human nature” (Ancient Greek *φύσις του ανθρώπου*) [19, p. 15; 24; 32; 33; 55]; “harmony” or “mixing” (Ancient Greek *κρασις*) [19, p. 15]; “self-perception” (the Delphian principle “Perceive yourself” – *gnothi sautou*) and “care of self” (*epimelēsthai sautou*) described by M. Foucault [13].

Proceeding from the methodological understanding of peculiarities of the augmented reality as well as Umwelt, we can point out that they are the phenomena that contribute to the formation of meanings, semantic contexts, values, patterns of action, images of health, and semantic images. Therefore, for the expansion of the education-oriented understanding of the augmented reality, we determine the attitude of teachers to the necessity of using the augmented reality for preserving health, development of creativity, intelligence, etc.

In order to determine the attitude of Physical Education teachers towards the idea of using augmented reality in the educational process with the purpose of preserving pupils’ health and development of their motor skills, intellect and creativity, we developed a questionnaire that consisted of 6 questions. The respondents were asked to choose one of the three possible answers – “Yes”, “No”, “Cannot decide”. The survey contained 6 questions:

1. Does the use of augmented reality facilitate the development of critical thinking and forecasting (anticipation) skills in pupils aimed at trauma prevention during lessons? (“Yes”, “No”, “Cannot decide”)
2. Can the use of augmented reality facilitate the development of corporality, aesthetic and ethic orientation of a pupil as well as of the competence of self-health preservation? (“Yes”, “No”, “Cannot decide”)
3. Can the use of augmented reality facilitate the formation of ergonomic lessons and the creation of a comfortable, safe and health preserving environment? (“Yes”, “No”, “Cannot decide”)
4. Can the use of augmented reality facilitate the development of harmonious relations with the environment, eco-consciousness, implementation of the sustainable development concept and health preservation? (“Yes”, “No”, “Cannot decide”)
5. Can the use of augmented reality facilitate the development of motor skills, creativity, existence and reflection in pupils? (“Yes”, “No”, “Cannot decide”)

6. Can the use of augmented reality facilitate the development of digital and learning competences and intellect (motor intellect, in particular) in pupils? (“Yes”, “No”, “Cannot decide”)

#### 4 Results and discussion

The methodological search was carried out based on the ideas and intentions of integrity, anthropologization [3; 12; 23; 30] and humanization. Thus, the peculiarities of using augmented reality with the aim of improving and implementing the health preserving competence of the Physical Education teacher in conditions of post-graduate education were studied using the anthropological and biosemiotics approaches [40].

Within the framework of the indicated approaches, as well as following the idea of integrity of an organism and the environment and their dynamic cooperation we actualize the question of the use of the conception of Umwelt [28; 56; 59] for the improvement of the methodology of use of the augmented reality for the development of health preserving competence of a physical culture teacher.

Clarifying the importance of the formative specificity of the Umwelt [28, p. 69] as a manifestation of life that is related to the semantic potential of augmented reality. Umwelt as well as augmented reality can thus be regarded as environments (or worlds) of forming meanings and ways of using them.

Concerning Umwelt, this is analyzed by the ethologist Conrad Lorenz [28, p. 69]. That is, through the mind-body, the living organism acquires meaning (living is sense making) [28, p. 69], which can be modified and enhanced or weakened by the use of augmented reality. The semantic sphere of man, in turn, is connected with life, existence, images and symbolic and symbolic reality. Therefore, the Umwelt is the living condition or “transient” fragment of reality that contextually integrates or correlates (according to the concept of autopoiesis by V. Maturana and F. Varela) [27; 37] life is represented as existence, as a given and semiotic-symbolic systems. On the other hand, semiotic systems are formed and exist precisely because of the specific formation of the Umwelt, which is a transition zone or a contact boundary between man and environment. These effects can to some extent be achieved through the use of augmented reality, which we consider as a component of the mind of the modern man or as a way to compensate for disturbed natural connections with the environment and by forming new ones. Similar understandings of the significance of boundary phenomena exist in Gestalt psychology in a system that is considered by the psyche as the contact line between a person and a significant problem. Therefore, one can say, metaphorically, “Whoever controls the Umwelt shapes meaning and influences life.” To a large extent, such an impact can be realized through the use of augmented reality.

Human Umwelts are qualitatively different from other living beings. Man, in the course of its development has created a special environment that at this stage of its existence and development becomes cognitive and cognitive-semantic. The Umwelt created by man actively interacts with it, forming communicative-semantic and cognitive contexts and essentially “communicates” with it. No wonder some creative people point out that the environment “speaks” to them and they take ideas and forces



from it. As a specific feature of a person, we distinguish his ability to form “cognitively oriented” Umwelts. In this context it can be stated that by means of professionally made advertising it is possible to form a “digistic Umwelt” through which it is possible to “easily” gain 10 kg of body weight. Accordingly, through the use of physical culture and augmented reality, which will form the “Umwelt of movement”, this process can be reversed.

Let us present the methodologically and technologically significant characteristics of the human mind: historicism; cognitive, that is, it is an environment in which data is partially processed and information and knowledge are contained; aesthetism (even the presence of anti-aesthetic tendencies is the antithesis of illuminating aesthetism); ethics (or anti-ethics); value character (in animals we can mostly talk about the hierarchy of needs and importance); dynamism; anthropomorphism; ergonomics; comfort; interpretability; speech characteristic; antitrust (predictive) nature and predictability; ecology (nowadays); promoting sustainable development (at this stage of humanity’s existence); harmony; educational; semiotic; digital (currently); health-saving; humorous (only human inherent humor); existential – as open, independent and self-sufficient being; multidimensionality; developmental and creative character; polyontological character; psychologically significant; technological and technical; characterization of relative autonomy. Our understanding of the human mind is close to the concept of the world of life (Germ. Lebenswelt) by E. Husserl [17]. That is, we do not reduce a person’s mind to a perceptual-activity phenomenon, but understand it a little more broadly – based on the allocation of relatively autonomous other components or spheres. For example, training, technology, creativity and more. This understanding of the human mind is also based on an understanding of the as yet undiscovered potential of using augmented reality and digital technologies in general. Based on a methodologically and technologically oriented understanding of the phenomenology of the human mind, we interpret it as a significant multidimensional cognitive and meaningful human reality that has a degree of autonomy and significant contextual impact on humans. Based on the selected characteristics of the human mind, a questionnaire was developed for physical education teachers.

We consider it expedient to use purposefully or at least take into account the phenomenology of human mind when designing and implementing augmented reality technologies. That is, the construction of augmented reality can be carried out not only on the basis of effective target, needy, technological methodological installations, but also taking into account the “transition zone” between man and the world – mind. Digital technologies and approaches that take into account the phenomenology of Umwelt, we call Umwelt oriented. Accordingly, augmented reality can be shaped as mind-oriented. The peculiarity of such technologies will be primarily the use of non-direct influences, cognitive, metaphorical, contextual, spatial, temporal, variability, interactivity, anthropomorphism, individual orientation and other characteristics that reflect the specificity of a person and his mind. This approach is contextually existent and is still being implemented mostly intuitively. In order to maintain health and improve motor activity, the importance of this Umwelt oriented approach is relevant because movement and health are, in so far as they are, contextual values. Movement

and health are completely shifted to the actual area of consciousness when a person has certain problems, risks and threats.

Augmented reality allows you to “delicately” create “mental health”, “mental movement”, “mental health and comfort” and more.

Thanks to the use of the augmented reality, we can create “tactfully” the “Umwelt of health”, “Umwelt of motion”, “Umwelt of safety and comfort”, etc.

The indicated Umwelts are a special-purpose transformation or one of possible variants of a person’s Umwelt. The purposeful Umwelt formation with desired qualities is a human specific that, first of all, can be exposed due to the use of the augmented reality.

Considering the “multichannel” of human perception, it can be noted that the actual component of “human Umwelts” that can be formed on the basis of augmented reality is their “ability” to synthesize different sensory modalities, namely, sound, visual, tactile, motor. We represent this as a “cognitive-environment synthesis” that facilitates the discovery of humans as beings of “cognitive-motor”, intellectual, creative and polypotent. Similar synthesis occurs in associative areas of the cerebral cortex. Artists dreamed of such a synthesis, namely of union, music, light, visual images, movement, movements, odors, touches [14; 22, pp. 269–362]. This is partly embodied in contemporary art. Thus, augmented reality opens up new and special possibilities for a “new cognitive synthesis.” For physical culture, the use of augmented reality, considered in relation to the preservation of health, opens up innovative perspectives, which are first and foremost related to the intellectualization of motor activity and to the ergonomic and natural disclosure of the potentials of man, in particular motor, physical, cognitive, creative.

The actual contemporary direction that gives the opportunity to consider augmented reality and Umwelt as an “active” “cognitive-activity” reality is the concept of autopoiesis by V. Maturana and F. Varela [28, pp. 70–72; 37]. Within the semantic sense of this concept, the phenomenon of life, including the interaction of the organism with the environment, is presented as an active autopoiesis and cognitive process. Also significant is the trend of enactivism [27], in which the mind-body problem [27; 28, p. 70]. The body and consciousness in this system of ideas are understood in a holistic way. Defining in this aspect are also the ideas of Embodied Cognitive Science [55]. In the system of this direction, cognitive is represented as a phenomenon that is formed by the interaction of consciousness, body and environment. The notion of cognition as a physical and environmental phenomenon is significant for the professional activity of a physical education teacher, because it works primarily with interdependent phenomena – movement, body, health, which exist in a particular reality and form it. The above ideas about Umwelt and the concepts of autopoiesis, enactivism and embodied cognitivism are considered as aspects that contribute to the introduction of augmented reality, defining the latest understanding of physical culture and sports as “body-cognitive-environmental” and “health-protective” only as a traditional development of strength, endurance, or other qualities. The key in these cognitively oriented interpretations of motor activity is the phenomenon of augmented reality as one of the “paths” of the autopoiesis of a person. Similar notions of bodily, motor, and mental perfection existed in the system of the Hellenistic tradition of the *paidae* (Greek

Παιδεία) [18; 19] and were realized through “taking care of themselves” [13] and “self-knowledge” [13]. Thus, through the use of augmented reality, we actualize the development of physical culture as a “body-cognitive” and health-saving anthropopractic and promote intellectual activity of motor activity.

Here are some avenues of using augmented reality for the purpose of developing health-saving and professional competences for physical education teachers:

1. To watch sports on video or visit the stadium. For example, overlaying content with real-time commentary or recording of a given sport or team player, in particular using face recognition technology and more (see fig. 1).



**Fig. 1.** Organizing specialized online training using SGM SPORTS [54].

2. View matches and training while recording. Here, it is possible to overlay video comments, discussions, graphics, graphic analysis on video; such as displaying trajectories, etc.
3. For training and sports, rehabilitation, inclusion. For example, analysis of data on individual stages of training, displaying the strengths and weaknesses of students in this process, overlay training videos, graphics, comments, realistic 3D simulations, organizing discussions in real time, evaluation of the training session, etc. (see fig. 2).
4. Development of training videos using augmented reality: commenting on individual stages of training, monitoring the functioning of individual body systems during appropriate physical activities, graphical analysis, discussions, displaying trajectories, etc.
5. Educational marketing. For example, advertising an educational institution, developing links to your own training courses and training sessions, site pages, programs, and links to other pages of academics, coaches, athletes, clubs, and more.
6. Techno sport. The combination of augmented reality and the physical movement of a player, such as competing with a virtual sport tool (this use is less traumatic than real competition).



**Fig. 2.** Organization of individual training using SGM SPORTS [4].

7. Simulation of sports competitions: conducting competitions and trainings, graphical analysis, discussions, help, comments, etc.

The use of augmented reality increases the motivation of physical culture teachers to master the complex of professional knowledge, promotes the humanization of the educational process, develops intellectual, emotional and volitional spheres, improves critical thinking, promotes professional reflection of practical experience. It is also aimed at the development of professional subjectivity, the discovery of sports talents, the improvement of sports equipment, the regulation of the volume and intensity of physical activity according to the state of health, etc. Considering all the advantages of this technology, it should be noted that it cannot completely replace the traditional technologies of organization of the educational process and will be the most effective in combination with them.

Consider software that implements augmented reality technologies that can be used in physical education. That software contributes to the formation of “human Umwelt”. The specificity of “human Umwelt” is the preservation of health, in particular, through physical activity. Opportunities for augmented reality make it possible to build a trajectory of learning according to individual requirements and needs, and immersion in the audiovisual space makes the theoretical learning experience interesting, engaging and motivating students.

SGM SPORTS by SGM Solutions & Global Media GmbH is designed to organize specialized online training [54] (see fig. 1, 2). The basic idea behind this product is learning to generate sports strategies through augmented reality experiences. One of the company’s products is a prototype ARVolley volleyball strategy that can be downloaded for free and used on Android and iOS platforms. The program demonstrates and explains the attack numbering system. With it, you can place a virtual interactive playground on the table. These tools are implemented using virtual and augmented environments .experience from brainshuttle™.experience [4]. Immersing students in the augmented reality environment of brainshuttle™.experience with realistic simulations, activates them in the learning process, exploring their own opportunities at an individual pace. Depending on the actions, students’ situations and outcomes change dynamically, supporting the student to actively engage and achieve

learning outcomes. With realistic simulation, the student perceives and performs the task at any level. Playing situations of realistic simulations can teach students some maneuvers, understanding of complex games, which can also help prevent injury.

brainshuttle™.experience augmented reality environments are created using 3D video, 360 degree video, Combined 3D and 360 degree video, 3D animation, Virtual environments, Game environments, Augmented environments (3D video, 360 degree video, Combined 3D and 360 Degree Video, 3D Animation, Virtual Environments, Game Environments, Enhanced Environments) [4].

DribbleUp offers software based on Augmented Reality Basketball (Smart Basketball), Soccer (Smart Soccer Ball), Health Gymnastics with a Ball (Smart Medicine Ball) [8; 9; 10; 38] (see fig. 3, 4, 5): DribbleUp add-ons are designed for both phone and tablet. DribbleUp products provide the ability to work with a virtual trainer, track the accuracy of the exercises performed, train muscle memory, track workouts over time. DribbleUp Smart Ball allows you to combine different cardio-strength exercises.



**Fig. 3.** DribbleUp: Smart Basketball [8].

For techno sports (a new HADO sport format that combines augmented reality with players' physical movement) from Japanese company Meleap Inc. developed hardware and software based on augmented reality [4] (see fig. 6.). To play the game, players must also wear a motion sensor and specially designed HMD to track virtual balls and other players. This integration of augmented reality into sports adds magical effects in a normal game, is health-friendly and prevents injury.

In order to determine the attitude of physical culture teachers to the use of augmented reality in the educational process, a survey was conducted by 36 Physical Education teachers. The research was conducted in 2017-2018 at Drohobych Ivan Franko Pedagogical University, Sumy Institute of Postgraduate Pedagogical Education,

Mykolayiv Institute of Postgraduate Pedagogical Education. The results obtained are presented in fig. 7 and fig. 8.



**Fig. 4.** DribbleUp: Smart Soccer Ball [10].

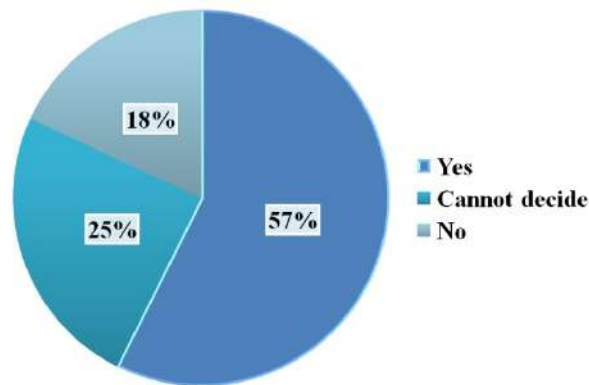


**Fig. 5.** DribbleUp: Smart Medicine Ball [9].

Having analyzed the results of the survey we can note that the majority of teachers (57%) have a positive attitude towards this issue, 18% of the teachers demonstrate negative perception of the idea and 25% were not able to provide a definite answer. Such response distribution within the survey may be caused by the fact that the teachers are not sufficiently informed about the potential possibilities, opened by the use of augmented reality in the educational process.



**Fig. 6.** HADO Game Using Means by Meleap Inc. [38].



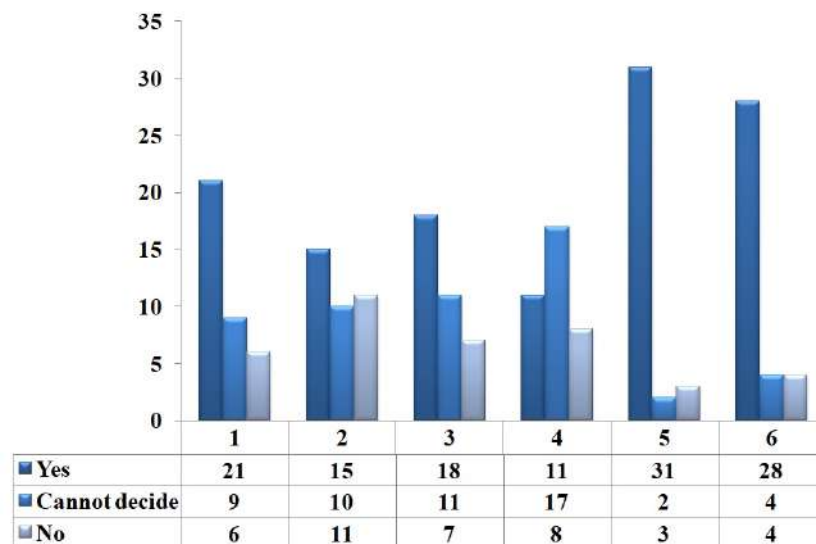
**Fig. 7.** Percentage distribution of responses of physical education teachers by the criterion of their attitude to the use of augmented reality in the educational process to preserve the health of students and develop their motor skills, intelligence and creativity.

The analysis of the structure of the answers, provided by Physical Education teachers in the questionnaires shows that so far, the teachers do not fully understand the possibilities of augmented reality in forming ethical attitudes of the health preserving environment, eco-consciousness, comfort. This means that Physical Education teachers do not fully understand the sense-forming, contextual and environmental influences of augmented reality.

The ways of solving the stated problem may include the inclusion of augmented reality technologies into the process of post-graduate education taking into consideration the anthropological, ethical, cultural contexts and using the competence based and personally-oriented paradigms; the involvement of Physical Education teachers to the development of educational software applications using augmented reality technologies in the role of consultants, coaches, experts etc.; improving the



knowledge and skills of Physical Education teachers on concrete issues and phenomena related to health preservation; involvement of Physical Education teachers into the project work on introduction of the software that includes augmented reality.



**Fig. 8.** Visualization of the structure of physical education teachers' responses to the questionnaire aimed at determining attitudes toward the use of augmented reality in the educational process to preserve students' health and develop their motor skills, intelligence and creativity (see questionnaire in "Selection of methods and diagnostics").

## 5 Conclusions

The use of augmented reality is an effective innovative technology of development of a health preserving competence of a Physical Education teacher under conditions of post-graduate education. Improving the methodology of use of the augmented reality for the development of health preserving competence of a Physical Education teacher under conditions of post-graduate education was carried out on the basis of the anthropological paradigm and the concept of Umwelt. Umwelt represents a "perceptive-acting" world of a person. A person's Umwelt has a sense-forming potential. Such features as correspondence to nature, indirect and contextual influences, cognitive, metaphoric, diverse, interactive, anthropomorphic, image-based and personalized nature as well as other characteristics, which take into consideration the anthropological and personalized peculiarities should be characteristic of Umwelt oriented technologies of augmented reality.

The relevant forms of augmented reality representation with the purpose of improving the health preserving competence of a Physical Education teacher include the combination of the content with real time or recorded comments, graphic images,



graphic analysis; realistic 3-D simulations, assessment of the training session, etc. the important vectors of using augmented reality with this purpose is the development of study videos, techno sport, simulation and watching sports competitions and workout sessions, educational marketing etc. As for a Physical Education teacher the application of augmented reality in the educational process facilitates professionalization, technologization, axiologization and humanization of his/her professional activity, including its health preserving component, technologies into the educational process in order to conduct Physical Education lessons, workout sessions, sports competitions, rehabilitation activities etc.

Based on the analysis of the currently available areas of use of the augmented reality, as well as through its methodological understanding, we point to the significant innovative, educational potential of this digital technology. From a methodological point of view, the use of the augmented reality correlates with the application of the concept of Umwelt, contributes to the formation of meanings, semantic contexts, values, patterns of action, images, semantic images, motor images, and images of health. This determines possibilities for extended and innovative use of the augmented reality for the development of a health-preserving competence of a Physical Education teacher in particular.

A survey was conducted to reveal the understanding of a value potential of the augmented reality. The attitude of Physical Education teachers to the use of the augmented reality in an educational process to preserve their students' health and develop their motion skills, intellect and creativity was determined. Analysis of the results of the questionnaire was performed, the aim of which was to determine the attitude of Physical Education teachers to the use of the augmented reality in an educational process for preserving their students' health and development of their motion skills, intellect and creativity. It is determined that most teachers (57%) treat positively this problem, 18 % – negatively and 25% were not sure about this question. We can explain such a division of answers by not sufficient awareness of Physical Education teachers of an educational potential of the augmented reality.

The ways of effective introduction of augmented reality in health preserving activity of a Physical Education teacher are more active bringing specialists to the development of software additions of the augmented reality as well as its introduction into an educational process. Important in this aspect is the use of the anthropology oriented approaches that assist humanization of an educational process and technological adaptation of the augmented reality to the nature of a person.

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