INTERPRETIVE INVESTIGATION OF THE USE OF AUGMENTED REALITY IN FAMILY ENVIRONMENT WITHIN CHILDREN'S PLAY THROUGH THE OPTICS OF QUALITATIVE METHODOLOGY

Lilla Korenova, Dusan Kostrub, Peter Ostradicky
Faculty of Education at Comenius University in Bratislava (SLOVAKIA)

Abstract
AR (Augmented Reality) as a current phenomenon has become increasingly recognized and used not only by professionals in the school educational context, but also by parents in the context of family education. Children's leisure time vs. digital technologies in the contours of (family) education is a very actual worldwide issue and in recent years a lot of scientific studies have been devoted to this subject matter in Slovakia. The scientific study presented here focuses on the phenomena of AR and qualitative methodology with the aim to present methodologically applicable principles when investigating AR in education. The principles of a qualitative research and methodology are elaborated and practically applied in a conducted research of AR used in a family environment, detouring its typical use in school educational contexts. In the presented study the authors deal with an investigation of the interpretations of parents of children between 4 and 6 years of age, who shared their views and opinions on the use of AR in their home environment. The methods of indirect observation, focused interview and the constant comparative method were used in the presented research.

Keywords: qualitative methodology, augmented reality, family education, parents, children, play.

1 INTRODUCTION
To deal with two up-to-date topics such as the concept of augmented reality and the concept of children's play in (family) education is highly motivating and inspirational. Incentive and inspiration gain in power because, as added value, there is an exclusivity framework that supports the application of qualitative methodology. In some degree, it comes naturally to those researchers that think in terms of discursive psychology and qualitative methodology to combine augmented reality with (controlled) children's play in (family) education. If the thoughts/ ideas of subjects as well as analysis of their origins and changes are subject of research, quantitative methodology becomes unusable and unsustainable. The methodological framework and educational process presented here relates to children, their parents and researchers. The selection of the framework of a qualitative research was intentional and thorough with regard to the object of the study itself and was in accordance with the principles of qualitative methodology.

1.1 Conceptual framework of investigation
In the process of enculturation of an individual, play has a significant place. Playing is understood as the main formative activity (of childhood). It is a representation of reality, but also a double divergence from reality. It allows the reality to be zoomed and symbolically represented. The learning progress through play allows to move away from reality and then approach it, so that it is represented by the playing subjects as one of the possibilities of reality. These are changes in the form of looking at, thinking about, and acting in reality, but are only partial forms of comprehensive action. Critical change (as proof of learning) requires contrast, plurality of alternatives, change of form of view and position. Then, in play, the basic framework for the essential models of cultural and discursive practices, which people apply to understand and intervene in personal, social, and professional life, is being formed [1]. People's ideas about things are intentional (directed to goals), because they spring from human activities and are also communicable [2]. Man is an entity that is always actively structuring a new concrete situation and assigning it a particular meaning. It is not the situation itself, but its interpretation that decides how a person will behave. There is a dynamic interaction between the different understandings of the particular situation and its psychological nature. If the action does not lead to the expected effect, one analyses the situation in a different way [2]. That is why we are focusing on interpretation and discourse of the mind. This framework suggests that we can focus on at least four interesting areas of research:
a) Understanding others – To which attributes do others assign importance (s) and why? How do others explain the meanings of things, phenomena, etc.?

b) Understanding yourself – To what do I assign meaning and why? How do I explain the meanings of things, phenomena, etc.?

c) Understanding the importance of regulatory mechanisms through conversation and rules - How do others influence me and how do I influence them?

d) Understanding the processes that occur at the interface of the social (they) and the personal (me).

The unifying idea in this study is to recognize and identify conversational realities, that is, how subjects together and mutually construct life, the world, reality through speech, under the influence of augmented reality.

1.2 Concept Augmented reality and the concept controlled / participatory children's play in family education

Play is an essential educational tool that is in some way the language of children and adults, allowing the development of thought and speech in interaction. A child in play, playing gets a natural space for (self) presentation, and a parent has the space to teach the child what it needs to learn. Play, playing eliminates superiority in knowledge, because knowledge is shared and constructed between the playing subjects. Within play the intelligence of acting and influencing subjects is being provoked in terms of its further development. What is more, the intelligence is provoked by individual (and socially conditioned) experience (as cultural content situated in the minds of the subjects) in terms of its further restructuring. From the moment of provoking intelligence and provoking personal experience, the personality of the child is being constructed - its identity, autonomy, competence, etc. [1].

In relation with the term “controlled /participatory play” we would like to emphasize that educators (parents) should opt for optimized management of the play, so that it is educationally effective - as well as the process of education/learning - should be planned, adequately implemented, controlled and evaluated. Optimal play management/control allows the child/children to decide, choose, agree on the play, partners - teammates, play material, all in connection with the formation of their arguments relating to the subject of the play, as well as the context [1]. A goal-driven play always has a precisely determined educational content and contains an appropriate motivation that the adult thinks in advance and prepares. The most important essence of a controlled play is the individual's approach to the child. The crucial essence of a controlled child’s play (in an educational play) is the possibility to express one's own activity, intent, will, etc., which at the same time makes it possible to realize educational goals - play as a means of achieving certain educational goals [3]. Optimal play control is an indirect (didactic) educational intervention into the playing of children, in which the parent is a teammate presenting the play model, but leaves space for independent, autonomous action of the child. Autonomous, independent action of children, which is indirectly but deliberately supported by parents, enables the development of the child's self-regulatory mechanisms, using cultural and discursive practices to adapt to the sociocultural systems of society.

1.3 The potential use of augmented reality in (family) education

The use of mobile AR technology applications is a method with which the work of parents (educators) can be enhanced if used well and can enable children (pupils/students) to become more actively involved in the educational process. It is hoped that AR can make learning/playing both in class and outside class become more attractive and experiential. Augmented Reality, introduced by Tom Caudell in 1990, represents the integration of virtual images into the real world. In other words, the reality is augmented by virtual elements. Integration of such images is a result of the use of information and communication technologies (ICT), through a mobile device with a camera (computer, tablet, mobile phone with android or iOS operating systems), which allow access to available content with an augmented reality. In addition, the development of such content fosters higher autonomy in learning together with cooperation, innovation and creativity of the learner (s) [4]. One of the characteristics typical of AR applications is integration and interaction between real and virtual, allowing for great versatility and creativity in applications and hence in learning [5]. It is to be expected that within a few years, a significant proportion of children will have a device, such as a smartphone, which is able to run AR applications, thus in the school context, it may be an effective tool for reaching students who have been raised with extensive access to visually stimulating entertainment. The visual
impact of AR is important because with little children, motivation is a crucial factor. For example, when colored images appear in space and start to move \textit{(Quiver 3D Augmented Reality coloring apps)}, then we can prompt kindergarteners to color some more, thus develop their manual skills, etc.

Implementing augmented reality in learning/teaching/educating through play (within the family) is understood by us not as enrichment (not a complement to) the learning/teaching/educating process, but it is its conceptual nature, which means that the augmented reality encompasses the entire learning/teaching/educating process (within family education).

2 METHODOLOGICALLY APPLICABLE PRINCIPLES IN RESEARCH OF AUGMENTED REALITY INSPIRED BY QUALITATIVE METHODOLOGY

Based on years of experience and professional preferences, we prefer qualitative methodology in order to better understand human events and human activities. Qualitative methodology uses principles of uniqueness, unrepeatability, contextuality, processiveness and dynamics. Based on this, we use the reflexive nature of any pedagogical and psychological research. We apply qualitative research tools, methods, techniques and strategies to describe, analyze and interpret the non-quantified and non-quantifiable characteristics of pedagogical and psychological and social phenomena of our internal and external reality. Qualitative methodology is a self-sufficient methodology, which means that it does not need the concepts of quantitative methodology to be and to remain functional, integrated and with its own identity. One of the key elements of a qualitative methodology is (re)conceptualization and, thanks to this element, it is distinct from quantitative methodology. Qualitative methodology deals with words, meanings, subjective meanings of messages, narratives, metaphors, or hyperbola. Quantitative and qualitative methodologies represent the exploration of different and incompatible entities, and elements. Both see the world and its interpretations differently and in an incompatible manner. Quantitative methods seek proof, while qualitative methods show the world from the perspective of those who live in it. One is sterile, untouched, distant, objective, while the other is interfered by and interconnected with its subjects, and therefore, subjective. Thus, explaining the same phenomenon from the point of view of quantitative methodology is and must be different from its explanation from the aspect of the principles of qualitative methodology, by corresponding terminology. Both methodologies are different, but if both are equally well conducted by two different groups of researchers, they can provide a richer picture of the reality studied. When applying a qualitative methodology we ask questions: Why?; How?; How come? etc., which means the search for the quality of meaning (s) and the determination of quality from the point of view of the subjects concerned. Qualitative methodology is always applied in research when the problem under consideration is an integral part of research subjects.

Qualitative methodology enables the researcher to discover what is behind the research problem from the aspect of the research subjects. For the success of detection, it is necessary to determine the extent of understanding of the research problem by the subjects, directly or subsequently concerned, because the problem arises from the subjects and the researcher strives to understand it at the outset so that it can be interpreted relevantly by the researcher. When examining the learning / teaching (in this case family education) process through qualitative research, we can identify:

- Factors or influences that are in the background of specific attitudes, beliefs, and beliefs of the subjects.
- The factors and barriers that support or suppress specific decisions, actions and / or inactivity of subjects.
- Sources, suggestions for the beginning or occurrence of specific events, personal or group experience present in educating and / or having an impact on the process.
- Educational contexts in which certain educational phenomena occur, relationships, contexts of a particular system.

A researcher investigating AR from the perspective of qualitative methodology should divide the design of the research process into three units.

1 Before the event
   - Which social representations had / have an impact on the creation of constructs related to augmented reality?
What was the location of subjects (parents and children) in a discourse about augmented reality before the event?

How do they consider using augmented reality for the benefit of learning and teaching / educating?

2 The event

What are the children / parents exposed to in the conversation?

What cultural practices are being practiced with augmented reality by children / parents, what attributes do they assign to the proceedings and the conversation and why?

What context of educating (through play) with the use augmented reality is maintained by parents and children? What is its content?

3 After the event

What relevant meanings and labels were created and / or highlighted in a relevant discursive context? What did the children / parents pay attention to?

What is the location of subjects in post-event discourse? What constructs are the result of the event - interpersonal discourse? How did they use augmented reality for the benefit of educating and what do they think about it?

2.1 Expectations and purpose of research

The studied augmented reality is a novelty in terms of the educational context out of schools, in family education in the Slovak Republic. The historically initial introduction of augmented reality into teaching / learning / educating through children’s play (in family education) represents a number of possibilities, which we hope to be manifested by the justifications, explanations, interpretations of the subjects. Changed conditions of today’s family education call for different views linked to how subjects are confronted with a new educational reality that includes augmented reality, and how they control and manage it. It is an understanding of the relationship formed by the subjects in the process. The focus of interest is on those areas of discourse, together with the adaptation to discursive contexts, which have changed interpersonally.

The aim of the presented research was to gain interpretations of the subjects of the research (parents) on the use of augmented reality in educating through children’s play and thus to understand their educational discourse. Via using the qualitative methodology itinerary, we also wanted to answer the following research questions:

• How does the discourse develop/change in the context of family education, under the influence of the use of AR systems in children’s play?

• What was the location of subjects (parents and children) in a discourse before using AR systems in children’s play?

• To what phenomena (topics) within the discourse (under the influence of AR) do research subjects attach importance or vice versa, and why?

• How do the topics of the discourse, influenced by AR, affect decision-making of research subjects?

• Where do the subjects of research seek the potentials or limits of the use of augmented reality in children’s play?

2.2 The applied methods and implementation of research

The conducted researched which took place between 2018 and 2019 in Slovakia wanted to find out about the opinions and experience and interpretations of parents who were using AR systems and applications in educating their children through play in their home environment. The research was sequenced into two stages. In the first stage of the research, we used non-participatory observation, via sensing and imaging technology to create an audiovisual record and obtain research material that could be repeatedly analyzed. We in this way assured that non-participatory, systematic observation as a method of collecting visual data was applied, where the objective of the observation was to find out, recognize, detect, and to extract entities, elements and factors of observed phenomenon / phenomena. The observation was focused on gaining aspects that are relevant to research questions, and was repeated until phenomena observed in the research material were saturated. For this
purpose, we used the Constant Comparative Method (CCM) in accordance with [6]. In such case the researcher searches for the presence of the phenomenon - its occurrence, its distribution (in which passages it appears), the representation (what it represents) and its repeatability - when (under what conditions) and in what contexts it is repeated. The researcher is interested in the subjective importance that the subject of research personally attaches/assigns to the phenomenon, as well as in why the subject does so. The researcher also searches for contextuality, meaning in which context the phenomenon is suited and what context can be represented by the phenomenon. Identified relationship frameworks of the phenomenon are important. They provide the researcher with the possibility of creative mental abstraction. By associating the individual identifiers in the research material, the researcher gains a prediction of the research object. The authors of the presented scientific study emphasize the concept of searching, which means finding the identifiers (as if evidence) that are decisive.

Since the main method used in this stage was a selective observation, it allowed central categories to be acquired, which were later subject to further analysis. The primary collection of data was carried out in the framework of a controlled/participatory educational play of children ageing from 4 to 6 in their home environment. Subjects (parents) agreed on using AR applications as a play tool, in our case it was (Quiver 3D Augmented Reality coloring apps).

In the second stage of the research we used the method of a focused interview via which we aimed to obtain statements about a particular phenomenon and the interpretation of participating subjects. The main objective was to describe and analyze the experience of a particular subject with a given phenomenon and search for intersubjective significance in the interpretations of subjects. The interview was also repeated to generate personal interpretations in order to verify approximations of research interpretations. The central theme were the discourse practices of the subjects in educational/participatory play, which aimed at gaining the views and interpretations of the subjects of research on what we saw (in observation) and what we shared (in interview) with the subjects of research.

In the conducted qualitative research, such methods of validation (validity) and reliability were applied according to [7]:

- Triangulation - Combined application of different research tools, methods, groups of research subjects, local and temporal spaces, and various theoretical perspectives aimed at gaining the phenomenon.
- Constant comparative method - application of systematic comparison of codifications and classifications.
- Degree of generalization - creation of a construction coming from the ground (terrain/field).
- Presentation of the process - imaginary transfer of the audience to the research field.
- Process evaluation and quality control – was realized through reliability and credibility.
- Presentation of the results of the research - the conception of the research findings (questions raised) and the discussions (questions referring to the essence of the text, what to do further in terms of the support of (family) education by the augmented reality and its development at the level of the relevant educational principles) based on consensus design in discourse (intersubjectivity).

2.3 The research sample

As far as the character of the research sample in the presented study is concerned, it is a sample of homogeneous cases because the research subjects possess a certain type of experience related to the thematic core of the object of the research, as the researcher examines the reality from the centre of the problem/the phenomenon. At the same time, it is also a sample of a logical case in which it is about joining and handling all the samples that combine some predetermined criterion (in our case, reflective parents) of importance. It is the handling of information that has come to the knowledge of a wide range of people to look for possibilities of change or satisfaction. The basis lays in the critical thinking of the subjects and its consequences [7]. It should be noted that in the case of the research sample, it is composed of parents with whom we have been cooperating for a long time via research, seminars and workshops. These are parents of preschool and elementary school children who critically reflect on the need for innovation and optimization of (family) education in Slovakia. Specifically, it was 5 families who cooperated with us in the research presented here, namely 5
mothers with their child. The criterion as age gender or occupation of the parents, or others, was not set in advance in the selection of subjects. The crucially important criterion was the ability of subjects to think critically about the constructs of education and the participatory (controlled) play of the child.

3 RESULTS

Research aimed at investigating the interpretations of parents of pre-school children and children at primary school about the impact of AR systems and applications on controlled / participatory play of children in their leisure time (in their home environment) has shown that via a thorough, critical and reflective thinking about the opportunities and implications that AR applications and systems provide, the parent and child find themselves in three fundamental roles. These three roles identified by the research subjects are interpreted by them as a consequence of the AR phenomenon together with their ability to critically reflect on family education, namely the play / controlled participatory play of a child. The roles identified by these subjects were the basis for the interpretation of research results.

A parent in the role of a teammate in a controlled / participative educational play of the child influenced by AR

Interpretations of the participants indicate that the subjects have identified themselves as teammates, which they justify by the fact that when playing with a child (influenced by AR) and in cultural discursive practices, they provide feedback, answer children’s questions, comment, evaluate the activity / activities of the child, thereby pursue the intention to initiate reflection of the child in order to foster his / her ability to justify his / her actions and intentions with the play material. They further interpret their position as a teammate and under the influence of AR, specifically highlighting its characteristics as being dynamic, rich in stimuli and authentic, they are themselves motivated, stimulated to create and transform the play scenario in collaboration with children. Subjects in their interpretations emphasize the need to give the child the opportunity to discover (manipulate, try, make mistakes) not only in the creation of the scenario of play, but also in familiarizing themselves with the play material. They consider the child's manipulation with the mobile application to be educational worthy; given the fact that the current generation's daily contact with ICT is becoming more natural. In this case they consider themselves to be less proficient users, and they observe the nature of how their children handle their mobile and application with fascination. They also see their role as a teammate and participant in the need to provide adequate cognitive stimuli, animate the child's play / playing, propose possible solutions strategies, etc., and thus optimize the educational potential of such play. The subjects realize the importance of guaranteeing a positive climate that the parent provides by insuring freedom when respecting the child’s play / playing sequences and strategies applied in establishing / reconstructing their own product. This aspect of designing one's own product is unanimously appreciated by the parents and considered to be the added value of the quiver application, which was the primary play material used in our research. The Parent "teammate", influenced by AR, is an active listener and participant observer of how, why, and what the child is saying, doing, etc. A Reflecting parent (critically thinking and acting) on optimal family education, is under the influence of AR, an initiator, and at the same time, a guarantor of dialogue, discourse, which aims to understand the child and enable the child to be understood.

Parent in the role of an observer / diagnostician in educational play influenced by augmented reality

Participants have also identified the added value of AR play material in that the quiver application allows them to better and more comprehensively diagnose the child's level of development. According to their interpretations this was enabled by deliberately observing not only the manipulation of a child with objects (paper / marker, pencil, mobile, and application) the creation of his product, but also by exploring the mental processes of the child by entering into and participating on the child's discourse. Subjects have stated that by applying the quiver application in the child’s play the so-called passive product of the child (painted drawing) was transformed into a dynamic and authentic representation of reality, which enriched the parent's ability to target cultural and discursive practices to the intention to recognize current needs, interests and, in particular, the child's interpretations of socially constituted reality.

Child in the role of an interested, active creator of a representation of reality influenced by augmented reality

The interpretations of the subjects also show that the advantage of using play materials enriched by AR lies in the fact that they are the direct opposite of traditional static materials, and that the child finds
itself involved and active in play - representing the socially constructed reality. Children's involvement has been identified by the subjects as a result of their complete fascination with the moment when the painting in front of them 'came to life'. From that moment on, children were motivated to create new and new products and to drive discourses with parents about why and what is happening to their product. Parents appreciated that the child started spontaneously asking questions and telling how it understands what it sees in the dynamic projection of its product and why, and what is the child doing with it itself. Thus, the child spontaneously "invites" the parent to cooperate within a play/playing, which is undoubtedly beneficial for optimizing education, under the condition that this challenge is recognized by parents and optimized in discourse. The AR-enriched play provides the child the ability to create and produce an individual version of a reality representation, recognize its surroundings and its position, become an independent and distinctive personality, learn to communicate, listen and be listened to in cultural and discursive practices. Last but not least, the subjects also positively evaluated the situations when their children spontaneously and independently handled their mobile / application, directed the play scenario where they practiced their ability to solve problems, discover and design solutions and procedures.

Table 1. List of the main identified categories and concepts found in individual protocols for the key concept: Interpretive investigation of the use of augmented reality in family environment within children's play through the optics of qualitative methodology. L. Korenova, D. Kostrub, P. Ostradicky (2019)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Concepts</th>
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<tr>
<td><strong>A parent in the role of a teammate in a controlled / participative educational play of the child influenced by AR</strong></td>
<td>The parent &quot;teammate&quot;, influenced by AR, is an active listener and participant observer of how, why, and what the child is saying, doing, etc. Provides adequate cognitive stimuli, animates the child's play / playing, proposes possible solutions strategies, etc. The parent as an initiator, and at the same time, a guarantor of dialogue, discourse, aimed at understanding the child and enabling it to be understood.</td>
</tr>
<tr>
<td><strong>A parent in the role of an observer / diagnostician in an educational play influenced by AR</strong></td>
<td>AR enables the parent to proceed a more optimal and comprehensive diagnostics of the achieved level of child development. AR develops the parent's ability to target cultural and discursive practices in order to recognize current needs, interests and, in particular, the child's interpretation of a socially constituted reality. The child spontaneously &quot;invites&quot; the parent to cooperate in a play / playing. The child has the opportunity to create and produce an individual version of reality representation. It recognizes its surroundings and its position. Becomes an independent and distinctive personality. Learns to communicate, listen and be listened to in cultural and discursive practices.</td>
</tr>
<tr>
<td><strong>Child in the role of an interested, active creator of a representation of reality influenced by AR</strong></td>
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3.1 Limitations of research

Despite the significant findings on the impact of AR systems and the applications within their use in a controlled / participative child’s play, we are as researchers aware of the characteristics of the research sample. By this we mean the fact that the sample consisted of subjects who were critically and thoroughly reflecting on the phenomenon of family education, parents with whom we have been cooperating for a long time in other research, seminars and workshops and therefore we cannot generalize our findings to the common population of parents in Slovakia. However, we still consider these findings to be of research value because they show us that the close cooperation of parents with pedagogical professionals and their interest in tracking and applying trends, such as the use of AR, undoubtedly has the potential to improve not only the family education of the 21st century children.
4 CONCLUSIONS

Research on learning / teaching/ educating supported by augmented reality offers more opportunities to have the subject matter apportioned in the different areas studied. We have given preference to interesting areas and themes that call for further exploration. Examination / research as such (perceived in part but also in its entirety) represents didactic and methodological inspiration. We identify with the results of research, among which the autonomous and collaborating subject, cooperates actively with other subjects, actively discovers and processes the curriculum through the use of augmented reality. In this type of research are, as the determined results the effects, consequences of the influence of the educational discourse, conducted between the parent and the children. Conceived conceptions of the subject / subjects (grounded in consensual opinions) that are consistent or in contradiction with alternative conceptions, produced by discourse in teaching /learning/educating supported by augmented reality, are also consequential. We consider the conceived conceptions, which find anchoring in socially acceptable explanations of the consequences of using augmented reality in learning processes (deliberately in teaching/ learning), in the sense of preferred discourse as a consistency. Due to the fact that the realization of teaching / learning / educating with the support of augmented reality in our conditions is unmatched, it is necessary to talk about the emerging discourse in this field. How this discourse will develop depends on specific experience which enable mental abstraction of the contents of speech acts and create a conjunction into interactions with the minds of other subjects.

REFERENCES

