PALACKY UNIVERSITY IN OLOMOUC
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DEPARTMENT OF SOCIOLOGY, ANDRAGOGY AND CULTURAL ANTHROPOLOGY

EVALUATION OF EDUCATIONAL PROJECT OUTCOMES:
IMMERSIVE TEACHING TOOLS

Master's Diploma Thesis

Study Program: Sociology – Andragogy

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Olomouc 2020

I declare that I am the sole author of this master's thesis on Educational Activities in Virtual and Traditional Environments, listing all the literature and other resources that I have used.

In Olomouc …….……………   Signature …………………….

Annotation

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Title of Thesis	Evaluation of Educational Project Outcomes: Immersive Teaching Tools
Annotation	The diploma thesis focuses on evaluation of two educational courses, where one of them implements immersive virtual technologies as a teaching tool and the other one implements traditional teaching tools to teach clinical empathy. The thesis analyses the outcomes of both educational courses through Kirkpatricks model of evaluation. It analyses both qualitative and quantitative data in Level 1: Reaction and quantitative data with
Keywords	Teaching tools, Immersive Technologies, Immersive Environment Virtual Reality, Clinical Empathy
Attachments	
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Content

Abbreviations

AR   Augmented Reality

CE   Clinical Empathy

IT   Immersive Technologies

MR   Mixed Reality

TMU   Taipei Medical University

VR   Virtual Reality

Introduction

In recent years, virtual (immersive) technologies have been tested and implemented into many educational programs, in a form of a teaching tool at school institutions or by organizations for training and employee education. Since the development of the first VR platform by Krueger in 1976, virtual technologies went through major improvements, such as integration of VR into military training, cockpit simulators for astronauts in 1990, entertainment in form of growing VR headset production, and many more. Educational programs have adapted virtual technologies as well, as they were found to have a high potential in educational activities and were proved to have positive impact on students' motivation and commitment (Martín-Gutiérrez, Mora, Añorbe-Díaz, González-Marrero, 2017).

Virtual technologies enable the user to act in simulated environment. If we consider virtual technologies from the perspective of education and training, it is understandable that regular research has usually focused on their implementation in those study fields which require training of specific skills and gaining practical experience. Such fields are for instance medicine [unlike the traditional teaching environment, virtual teaching environment reduces the training costs, reduces the anatomical specimens in laboratory practices, and enables the participants to experience more interactive educational activities (de Farias Paiva, Machado, Valença, 2013)]. Other fields of research focusing on virtual technologies and education are military *["simulating operational situations that the participants cannot meet in reality for training exercises because they might be too dangerous or inaccessible" (Querrec, Buche, Maffre, Chevaillier, 2004)],* art education - digital arts, an example according to Han and Li can be the users' opportunity for 3D modeling in Second Life (Han, 2011; Lu, 2010), architecture (better spatial understanding), and many more. These fields have common characteristics, and that is the

requirement of practical skills, to name a few: surgery in medicine, interior design in architecture, or terrain training in military. In contrast to traditional learning environment, the virtual technology provides alternative environment in which those skills can be trained. As a teaching tool, the virtual reality has been studied from many perspectives, such as financial costs of training, educational transfer, effectiveness in terms of the outcomes of educational activity, and many more.

Whilst much is debated about the implementation of virtual technologies into educational activities requiring skills training in real or simulated environment, little is known about applying these technologies in soft skill training. Soft skills are usually understood as a knowledge/skill that is taught in traditional environment. Considering the potential of virtual reality for teaching mainly psychomotor skills and abilities, the questions that may rise is, firstly, whether there is a potential in applying virtual technologies into courses that focus on affective skills and abilities, and secondly, what are the differences of teaching the same skill in virtual and traditional environments in terms of learning outcomes and overall course evaluation.

Therefore, the main purpose of the research is to evaluate and compare the outcomes of clinical empathy projects which applied either immersive or non-immersive teaching tools.[1]

The virtual technologies have been a subject of numerous studies in medical environment, however, the research on soft skills training in andragogy field is not as usual, especially when considering the differences between traditional and immersive environments as a didactical method or tool. In the present research, the specific soft skill that is studied is clinical empathy, as it is an important competency of every health professional. As training that uses virtual technologies provides different features than the training in traditional

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[1] In the present research, immersive teaching tools are understood as tools which belong to immersive virtual reality technologies. Further details are provided in chapter??

environment, the main focus is on learning outcomes in both environments, and their comparison. Therefore, the goal of the present study is to compare the outcomes of two educational programs where one of them implements immersive virtual technologies as a teaching tool. Both qualitative and quantitative approaches were applied in this study with an evaluative multiple-case study research design. The study is divided into four sections. The first section provides the reader with an overview of educational project and its aspects including the explanation of traditional and immersive teaching tools and their differences. The second chapter describes the evaluation methods in education. The focus of the third section is on clinical empathy which represents the educational objective of both courses. The forth section evaluates the clinical empathy courses in traditional and virtual environment at Taipei Medical University.

1 Educational Project

Given the research goal, the aim of this chapter is to provide the reader with a general overview and description of selected learning strategies and educational project. Educational project in overall and all its parts will be mentioned with main focus on the educational tools which will be described into details to enable the reader to, firstly, understand the differences between immersive and non-immersive educational projects, and secondly, to understand the specific characteristics of cases in chapter 5. Considering the aim of the thesis, the present chapter does not require detailed explanation of other educational project parts.

Although specific details of immersive and virtual technologies are described in chapter 3, some of the terms related to these technologies will be used in the present chapter due to the fact that application of these technologies will make the difference between the two educational cases.

1.1 Experiential Learning

Given the fact that clinical empathy, which is the educational objective of later described courses, is usually developed experientially, and both studied courses are based on the principles of participant engagement in the educational process, the present chapter explains the principles of selected constructivist theories: active learning and experiential learning.

Constructivism, which can be associated with "learning by doing" (Buche, Querrec, De Loor, & Chevaillier, 2003), is a paradigm for teaching characterized by active experience and interaction with real objects and events (Lefrancois, 2012, p. 221) and is based on what the student already knows, usage of manipulative materials, dialogue between the teachers and the students, and encouragement to use multiple modes of representation (video, audio text, etc.) (Bada, & Olusegun, 2015). In this paradigm, learning starts

from the learner's own experience[2], and according to Glasersfeld, *"knowledge does not reflect an objective ontological reality, but exclusively our ordering and organization of the world constituted by our experience"* (Glasersfeld, 1981 in Aiello, D'Ellia, Di Tore, & Sibilio, 2012), simply put, learners create their own learning (Schunk, 2004, p. 286). Such an approach of learning through a certain experience is a core approach of both case studies of the present research. The research will then compare the learning outcomes and participant experience with immersive and non-immersive teaching tools, considering the differences of both environments. As mentioned earlier in the introduction part, authors emphasise that virtual (immersive) environment enables the participants to experience more interactive educational activities (de Farias Paiva, Machado, Valença, 2013), and enhances sensorimotor interaction with the environment for effective knowledge construction (Aiello, D'Elia, Di Tore, & Sibilio, 2012). Such argument indicates that virtual (immersive) technologies might provide greater interactive learning experience. This research is not aimed at proving the argument, however, since the learner's experience is related to interactivity and both teaching tools provide them differently, the argument should be considered.

As mentioned earlier, 2 constructivist theories were selected for further description. These theories and their principles can be then understood as a framework in which both later described case studies will take place. Although the learning theories chapter might not seem relevant in the first part of the research, the principles of further described theories are crucial for understanding the interpretation of analysed data described in chapter 5.

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[2] The terms experience and knowledge have several meanings depending on the specific type of constructivism (social, psychological, radical, cognitive, and other types) (Phillips, 2000, p. 6-15), however, considering the research goal, the present research does not distinguish between them. In this study, experience is understood as *participant's experience of something, rather than simply experiencing*. The participants are actively involved in the learning which *"provides them with experiences that challenge their thinking"* (Schunk, 2004, p. 291).

Aforementioned, clinical empathy is usually developed experientially, thus a proper explanation of theories described in the present chapter was identified as appropriate. Consequently, the evaluation of educational project will reflect the experiential learning later in this chapter.

Experiential learning *"is constructing knowledge and meaning from real-life experience"* (Yardley, Teunissen, & Dornan, 2012), and it begins with two prerequisites: providing an experience for the learner and facilitating the reflection on that experience (Warren, Mitten, & Loeffler, 2008, p. 16, 22). Experiential learning is not operative without the reflection which allows individuals to review experiences and become aware of cultural and psychological assumptions that influenced their understanding. (Smith, 2016; Warren, Mitten, & Loeffler, 2008). Besides that, participants should feel involvement which results from engaging in an activity as it *"affects attitude change and growth as well as skill development" (Walter, & Marks, 1981, p. 3).* Referring to undermentioned chosen characteristics of teaching tools, the level of immersion in educational courses might influence participants' involvement in learning. Therefore, consideration of this fact is important for the interpretation of participants' experience in chapter 5.

As one of the most influential models of experiential learning is often mentioned Kolb's Experiential Learning Theory (Cycle) (Warren, Mitten, & Loeffler, 2008, p. 224):
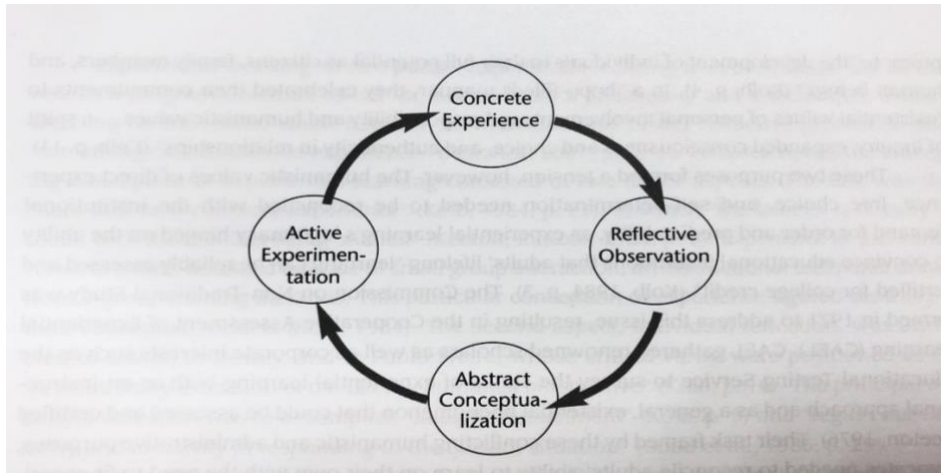
Figure 1: Kolb's (1984) experiential learning cycle (Warren, Mitten, & Loeffler, 2008, p. 225).

The Experiential Learning Theory *"is the process whereby knowledge is created through the transformation of experience"* and *"through assimilating lessons and feelings stem from experience"* (Kolb, 1984 in Chiu, & Lee, 2019). As Chu and Lee further explain, Kolb's learning cycle consists of 4 stages:

1. concrete experience: when students engage in the experience to learn

2. reflective observation: when students review from their experience; according to Kelly, in this stage we *"ask questions about the experience in terms of previous experiences"* (Kelly, 1997).

3. abstract conceptualization: when students apply the knowledge to explain what they have just experienced; Kelly notes that in this stage, in contrast to the previous one, *"we try to find the answers"* Kelly, 1997).

4. active experimentation: when *"students use what they have acquired from the experience into future applications"* (Chiu, & Lee, 2019).

Theorist have suggested adding a dialogue into experiential learning cycle as it *"invited people to open up to each other with the objective of really trying to understand the meaning behind what is being said. This type of communication involves uncovering assumptions and may help people better understand how meaning is influenced by each person's unique history"* (Boud, Cohen, & Walker, 1993; Bohm, 1996; Greene, 1993 in Warren, Mitten, & Loeffler, 2008). Adding

a dialogue into learning can therefore allow the participants to acquire diverse perspectives and enhance learning.

Following on from the previous section which emphasized the importance of experience for learning, the categories of experience inspired by Edgar Dale will be further described. As the authors explained, the Cone illustrates the importance of direct experience for effective learning (Lee, & Reeves, 2017).
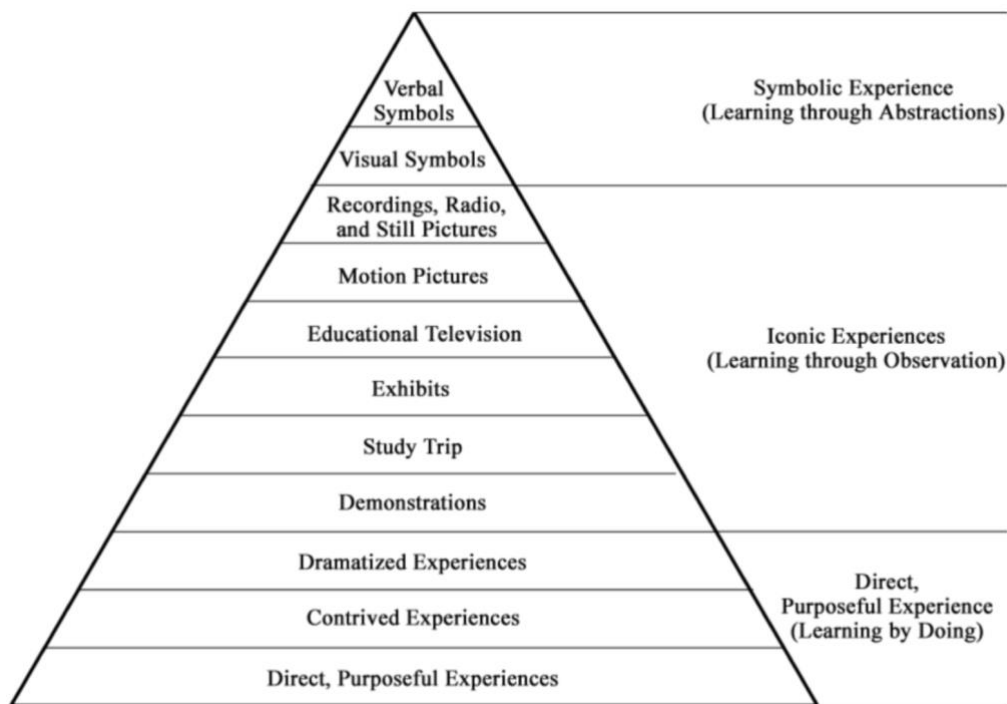
Figure 2: Cone of Experience (Lee, & Reeves, 2017).

The Cone of Experience *"shows the progression of experience from the most concrete (at the bottom of the cone) to the most abstract (at the top of the cone)"* (Molenda, 2003) and the further is the progress on the cone, the greater is the learning (Davis, & Summers, 2015). As shown in the Figure 2, the base of the cone consists of 3 modes (Lee, & Reeves, 2017):

1. enactive: direct, purposeful experience (learning by doing)
2. iconic experiences (learning through observation)
3. symbolic experience (learning through abstraction)

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According to the aforementioned theory, the lower the learner is in the cone, the more he/she learns. Based on the research goal of this study, this statement has a significant importance since the study compares educational tools which both belong to different levels in the Cone of Experience, and consequently might have impact on the outcomes of both educational projects. Furthermore, the contrast of both educational tools is demonstrated on Multimedia Cone of Abstraction (Figure 3), which displays the level of learning abstraction in terms of multimedia usage in a learning context (Baukal, Ausburn, &Ausburn, 2013). Since the immersion level of the educational tools in this study will be provided by regular and virtual reality videos, the Multimedia Cone of Abstraction was found to be essential.
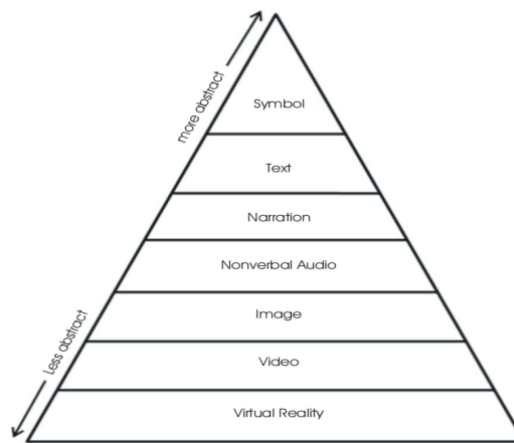
Figure 3: Proposed Multimedia Cone of Abstraction (Baukal, Ausburn, &Ausburn, 2013).

In this subchapter, selected constructivist theories were described since the awareness of specific activities which improve learning were found to be important, we well as the awareness of how experiential learning works (experience-reflection). These theories are related to the following chapters which explain the essentials of clinical empathy teaching, and the differences between immersive and non-immersive educational tools, which will be set in the context of experiential learning.

1.2 Educational Project as a Term

First of all, it is important to clarify the terms that are used for similar definitions. Referring to reviewed literature, there are several terms with a similar definition as the one that explains the term educational project, such as *educational program, educational event, training project,* or *didactical process*. It is a matter of context and the author's preference to choose the most suitable one amongst those terms. To provide the reader with a brief terminological overview, those terms will be introduced, followed by the explanation of choosing specifically the term *educational project*.

According to Zormanova, *educational project* is a description of an educational course and it has a strict structure that determines its goals, content, target participants, organizational form, methods, didactical technologies, educators, the form of event's evaluation, financial aspects and pedagogical documents (2018, p. 100-101). Noticeably, the author, as well as other authors such as Bartonkova (2010, p. 112) uses both terms: *educational project* and *educational event* in the same context.

Muzik (2004, 2005) and Zormanova (2018), use the term *didactical process*. Both authors focus specifically on didactics of adult learners, therefore the term has been modified for the purposes of explaining education of adults from didactical perspective.

Other term that is commonly similar to educational project is the term *educational program* (Miller, Nemejc, 2014; Plaminek, 2014). However, Zormanova describes this term as a set of courses and educational events/projects used for specific professions (Zormanova, 2018, p. 101).

Last but not least, Nickols (2012) prefers the term *training* which is, according to Wills*"the transfer of defined and measurable knowledge or skills"* (Wills, 1994 in Masadeh, 2012). Masadeh supports the thought that it is a practical process: *"It is best supplemented with practical, hands-on experience."* Learners should be

actively involved in the learning experience (Hughey & Mussnus, 1997 in Masadeh, 2012).

As the educational courses analysed in chapter 4 are designed both as a hand-on experience and classroom lecture, the term training was not found to be the most appropriate one in this study.

With no concern, each of the terms mentioned above is suitable for the topic of educational activities, therefore, while deciding for the right term, the explanations mentioned above were considered thoroughly, and the term *educational project* was selected to be defined according to Kasova as a complex of actions that meet the educational needs (Kasova, 1995).

1.3 Aspects of Educational Project

The aspects of educational project are not always the same as it depends on authors' preference, however, it is possible to think of general design that explains all the important aspects. It is up to the organization which aspects to choose according to its specific objective of the educational project. Authors describe variety of possible models in this regard. For instance, Jedlickova explains that the aspects usually are: a recipient, setting of objectives, number of participants, length of the program, organizational form, learning environment, educational content and structure, educators, propagation and financial plan (Jedlickova, 2014). Other authors emphasize the didactical aspects, such as Muzik who describes the model of aspects as follows: educational needs, setting of objectives, educational content and structure, educational form, methodology, and educator (Muzik, 2005, p. 42). Finally, Knowles, Holton III, and Swanson (2012, p. 114), authors from andragogical field, understand the aspects as: preparing learners, climate, planning, diagnosis of needs, setting of objectives, designing learning plans, learning activities, and evaluation.

Given the three descriptions, a simple synthesis of educational aspects combining the ones mentioned above was created:

1) Adult learner
2) Diagnosis of needs
3) Setting of Objectives
4) Content and form
5) Educational methods and tools
6) Evaluation

Each of the selected aspects will be briefly described, as they all contribute to the project outcomes. The educational methods and tools, however, are approached in a separated chapter since these aspects need complex description considering that their specifics are directly related to the impacts on educational outcomes which are the objective of the present research.

Adult Learner

The characteristics of target participants must be taken into an account when designing an educational course. The educational projects of the present study are for medical students and health professionals who can be described as adult learners. According to Lindeman's adult learning theory, adult participants have educational needs and interests that learning will satisfy, the richest resource for their learning is an experience (which was delineated in subchapter 1.1), they need to be self-directing, and the educator should be engaging the process of mutual inquiry with the learners (Knowles, 1980, Knowles, Holton & Swanson, 2012, p. 39). Regardless of whether their learning is work-related, personal or social/community-related, adults are motivated by wanting to improve their life situation (Merriam & Bierema, 2014, p. 12) and their learning process is reflective rather than mechanical (Veteska, 2016, p. 89).

Prior to completing the course, the adult learner is described as the participant who becomes an absolvent after the completion. Together with needs analysis

and competency analysis, the profile of participant and profile of absolvent determine the content of the program.

Diagnosis of Needs

In professional education, the educational need is characterized as a disproportion between knowledge, skills and abilities, and the expectations of the institution. Bartonkova describes it as a difference between "what exists now" and "what is required" (2010, p. 18), where the "what is required" determines the goal of an educational project. According to Bartonkova, the educational need can be identified either by a research which is based on rules of sociological research, or by analysis of competencies which is based on analysis of document and literature to understand what kind of skills, knowledge or abilities is required for a specific position (2010, p. 24-25).

Key Competencies and Educational Objectives

Competencies can be understood as a qualification (competence) which is related to work or a set of character qualities or skills (competency) which is related to behavior and its direct effect on performance (Armstrong, 2006, p. 151; Woodruffe, 2000). In other words, competence represents what should be reached, and competency explain how it should be reached (Whiddett & Hollyforde, 2003). In the educational or organizational context, most of the authors usually describe competencies as motives, abilities, skills, knowledge and attitudes (Bartoňková, 2010, p. 26; Mikusova, Copikova, 2015, p. 114; & Vazirani, 2010). Besides the mentioned categorization, there is also a perspective which emphasizes the type of work position, and which is perhaps the most relevant in this study. This perspective includes: managerial competencies (such as conflict management, strategical thinking, coaching, and many more), interpersonal competencies (such as empathy, negotiation, presentation skills, and many more) and technical competencies that are

directly related to certain work position (Mikusova & Copikova, 2015; Vodak & Kucharcikova, 2011).

Once the term competency is defined, the competency model can be explained: it is an organizing framework that lists the competencies required for effective performance in a specific job or organization (Hoge, Tondora, & Marrelli, in press In Marrelli, Tondora & Hoge, 2005; Hronik, 2007).

Since this study focuses on a specific competency, clinical empathy, the abovementioned interpersonal competencies of the participants are in the center of focus. Therefore, it is not necessary to describe the whole competency model and its elements that includes all categories.

Focusing on the interpersonal competencies of health professionals, the Institute of Medicine defines five core competencies: 1. Patient-centered care, 2. Teamwork and collaboration, 3. Evidence-based practice, 4. Quality improvement, 5. Informatics (Bormann, 2016, Greiner, Knebel, 2003).

The empathy skill belongs to the category Patient-centered care and will be considered as the main subject of the educational programs that are studied in the empirical part of this research, and it will be reflected in the research methods. The other 4 core competencies are not being considered in this study thus, these are not reflected for the data analysis.

The objectives (goals) of the educational program are based on the diagnosis of educational needs and required competencies and they determine the abilities/skills/knowledge of the participant after the completion of the program (Vodak, Kucharcikova, 2011, Muzik, 2010).

Following the types of competencies (skills, abilities, knowledge and attitudes), authors structure the educational goals according to different learning dimensions (Palán, 2002 in Bartonkova, 2008, Zormanova, 2017).:

1. cognitive goals (educational dimension, knowledge)

Cognitive educational goals are associated with gaining knowledge and intellectual abilities (Zormanova, 2017). Most frequently used taxonomy of

cognitive goals formulation and evaluation is Bloom's taxonomy (Anderson, 2005; Miller, & Němejc, 2014; Sadler-Smith, 2006). The original taxonomy included: memorizing, comprehension, application, analysis, synthesis, and evaluation (Krathwohl, 2002, p. 2013).

2. <u>affective goals (emotional and moral attitudes)</u>

Affective goals are associated with emotional skills therefore, it includes adoption of attitudes, formation of opinion, activation of emotional aspect of personality and values determination (Zormanova, 2017).

3. <u>psychomotor goals (practical abilities, training)</u>

Psychomotor goals are related to psychomotor skills, mutual coordination of perceptions and movements and physical abilities (Bartoňková, 2010, Zormanová, 2017).

The educational goals should be objective and concrete (Bartak, 2008). As Skalkova notes, the concretization is related to cognitive, affective and psychomotor aspect of the learner (Skalkova, 2007). The goals should be measurable and clearly state the required outcomes and results of the educational project (Bartonkova, 2010, Zormanova, 2017).

There are other available criteria of structuring the educational goals, such as criteria based on the level of expertise, criteria based on the concretization of educational program, and many more. Considering that these categories are not in the main concern of the present study, they are not described in more details. The key parameters are the division of the educational goals based on the learning dimensions.

Educational Content

According to Vodak and Kucharcikova, the educational content is the program of the educational project, and is includes the schedule of the project, its form, its content (themes), methods and didactical tools. It has impact on the whole

learning process and the organization of the educational project (Vodak & Kucharcikova, 2011, p. 100; Bartonkova, 2010, p. 144). For its design, a profile of participant and a profile of absolvent need to be set (Bartonkova, 2010).

Educational Form

The aspects that belong to organizational forms, methods, and didactical tools are categorized in many ways depending on the author and the approach (didactical, pedagogical, andragogical), therefore, the number of possible schemes and divisions of categories is potentially infinite. It is not in the scope of this thesis to provide their comprehensive overview. Instead, certain models were selected for each of these aspects (forms, methods, and tools) and briefly described. The basic forms that Zormanova calls organizational forms in school adult education, are consensually introduced as basic forms by most authors: full-time learning, distant learning, part-time learning, and self – learning (Zormanova, 2017, p. 119-122; Muzik, 2010, p. 84, Bartonkova, 2010, 149; 2013, Bartak, 2008, 89-96).

These basic forms are more or less the same (except the last point – self learning, which is not noted by all authors).

For other divisions of educational forms, the theoretical concepts differ by each author, concretely in identifying whether the concept belongs to the category of forms or category of methods. Once the literature was reviewed, those concepts were identified and divided into categories based on the summary of authors' conceptions.

The first subcategory which might be identified as either subcategory of forms (Bartak, 2008; Zormanova, 2017) or methods (Muzik, 2010; Bartonkova, 2010, 2013), is, according to Zormanova, the universal form of adult education, and in this study, it is understood as a list of educational forms rather than methods. The subcategory includes the following form types: lecture (monologue of the lector, passive role of the participants, focus on knowledge), seminar (participants are active, focus on participants' improvement of critical

thinking, cooperation, and communication), tutorial (completes the lecture, focuses on practical activities, applying the theoretical knowledge), course (consist of several lectures, seminars and tutorials), interest program (voluntary, practical approach), field trip, workshop (group problem solving), conference, internship, and consultation (Zormanova, 2017, Bartak, 2008).

One more category which does not clearly belong to either forms of methods can be listed – depending on an author, its classification depends on a specific case. This category divides the educational forms into dialogue, monologue, or group discussion. This category can be understood as a form as it correlated with the category mentioned above (e.g.: monologue as an educational form can be interpreted as a lecture as well). However, it is mostly described as an educational method rather than an educational form, and such interpretation was also adapted in this study.

1.4 Educational Methods

According to Skalkova, educational methods can be understood as the planned structure of educational activities that are implemented for the purpose of reaching educational objectives (Skalkova, 2017). When deciding for the appropriate method, these are the factors that need to be considered: the specifics of the taught course, mutual collaboration of the teacher and students, tools that are available for the class, and teacher's experience.

Educational methods can be categorized into different groups, and their division (as well as division of forms) is up to each author. After reviewing the literature, the structure of the classifications was inspired by Bartonkova (2010) and summarized in the following table.

Method	Description/Division		
General Approach Skalkova (2017)	Didactical	**Verbal**	Based on the learners' ability to perceive and understand what is being taught. According to Muzik, these methods can be either a monologue (narration, explanation, school lecture), a dialogue (exchange of thoughts between the teacher and the students, or between the students only; interview, dialogue, discussion, brainstorming) (Muzik, 2010), or books, textbooks, written materials (Skalkova, 2017).
		Illustrative	Observation of objects and phenomenon, demonstration of objects, activities, experiments, static and dynamical projection (Skalkova, 2017).
		Practical	The main focus in on the participants' activity, direct contact with the objects and manipulation with these objects; such methods can be for instance a didactical installation work, laboratory work, or practical activity based on the field of study (administrative, technical, and more) (Skalkova, 2017).
	Psychological	Psychological aspects of educational methods include communication methods, individual work of the learner, and research. (Skalkova, 2017).	
	Interactive	The category of interactive aspects include discussion methods, situational methods, dramatization, didactical games, and specific methods such as workshop or coaching (Muzik, 2010).	
Adult Education Approach	Approach introduced by Bartak (Bartak, 2003 in Bartonkova, 2010). This approach is not further described as it does not relate with the goal of this study.		
Relation of learner	Approach introduced by Buckley and Caple (Buckley & Caple, 2004 in Bartonkova, 2010). This approach is not further described as it does not relate with the goal of this study.		

Table 1: Classification of Educational Methods, inspired by Bartonkova (2010).

Theoretical approach	This approach includes methods that can be completely theoretical, theoretical-practical, or completely practical (Muzik, 1998 in Bartonkova, 2010).	
Level of learners' participation	The classification starts with the most passive and progresses to the most active level of learner's participation: lecture, model behavior, videoconference and multimedia, case studies, games and simulations, role playing, group discussion, action learning, and workplace training (Belcourt, Wright, 1998 in Bartonkova, 2010).	
Type of lecture	Approach introduced by Manak and Svec ((Manak, Svec, 2003 in Bartonkova, 2010). This approach is not further described as it does not relate with the goal of this study.	
Educational Transfer	Approach introduced by Bartak (2008). This approach is not further described as it does not relate with the goal of this study.	
Intensity of Innovation	Approach introduced by Bartak (2008). This approach is not further described as it does not relate with the goal of this study.	
Place of Educational Project	Approach introduced by Koubek (Koubek, 1995 in Bartonkova, 2010). This approach is not further described as it does not relate with the goal of this study.	
Educational Activity	Training	the participant is trained by a teacher
	Coaching	participant is learning how to learn while he has the support of a coach
	Lecture	participant is informed by a coach
	Consulting	participant is instructed by an advisor
Phases and Types of the Educational Process	Approach introduced by number of authors (Bartak, 2008, Malach, 2003 in Bartonkova 2010). This approach is not further described as it does not relate with the goal of this study.	

The main focus of this study is on educational teaching tools, however, as described in chapter 1.5, teaching tools are usually described in terms of physical objects, and to some extent, the selection of tools for specific educational program is usually determined by certain educational method/form or vice versa. Considering the studied cases in chapter 5, educational methods and tools are closely connected, therefore, the methods applied in this research (highlighted in Table 1) are further discussed to enable the reader to understand the differences between these methods and their effects on learning. The methods relevant for this study are mainly didactical and interactive methods which belong to the general approach, and methods based on participation and theoretical approach from table 1.

Didactical methods are listed as the first category of methods in Table 1. Referring to Cone of Experience in chapter 1.1.2, *verbal methods* would most likely belong to the symbolic experience – the top of the cone which does not enable the participant to learn as much as in the other 2 levels. The *verbal methods* start with lecture, which provides the most passive level of *learners' participation* (if not combined with other methods) and according to Sawyer, only *"superficial learning occurs when learners passively take in information transmitted from a teacher, a computer, or a book"* (Sawyer, 2006, p. 318). For this reason, it is important that *"the participants are encouraged to grapple with the content as it is presenter rather than just being passive receptables"* (Walter, & Marks, 1981). While *verbal methods* belong to the first level of Cone and are defined as passive, *illustrative methods* would belong to either first or second level which indicates greater learning. Especially, audiovisual methods which belong to this category and cause that the learning becomes more vivid, concrete, and personally real for the individual (Walter, & Marks, 1981). However, in terms of applying illustrative methods, it is important to point out that using only illustrative methods is not completely sufficient since

students need verbal support or direction when using such tools for learning to absorb the best long-term comprehension of skills (Gangwer, 2009, p. 67.

Similarly to the previous methods, also *practical methods* can be placed on the Cone of Experience, namely to the third, enactive level which corresponds with the *level of learners' participation*, and although there are differences between the two, both categories are very similar to one another, as they consider the activization of the learner. In addition, the interactive category includes situational learning. In relation to this learning method, Sawyer notes that for the participants, *"the most effective learning is situated in an authentic, real-world context and relate it to their prior knowledge and experiences, they can form connections between the new information and the prior knowledge to develop better, larger, and more linked conceptual understanding"* (Sawyer, 2006, p. 319). This statement completely corresponds with the experiential learning theory mentioned in subchapter 1.1.1. Ideally, this approach should be complemented by *verbal methods*, *dialogue* or an *interactive method* of *discussion* to support the experience, as mentioned earlier in the present subchapter and in subchapter 1.1.1. In addition to the *interactive category*, authors note that social interaction brings the best learning results (when participants work together and share *"understandings of principles and ideas through sharing, using, and debating ideas with others"* (Blumenfeld et al., 1996 in Sawyer, 2006, p 319).

For the purpose of this study, simulation methods, which belong to the *learners' participation*, are described as well, as they have a direct effect on specific teaching tools studied in this research. *"Simulations (and games) are models or representations of some facet of the human experience"* (Walter, & Marks, 1981), and combining them with other experience-based method enhances the learning experience (Walter, & Marks, 1981). According to the authors, there are 4 types of simulations:

1. games: competitive activities with sets of rules and goals; games do not represent reality or its other facet

2. simulations – *"attempts to reproduce, in simplified form, some aspects of reality so that others, by being immersed in a prescribed format, can experience a facsimile of that reality"*

3. nonsimulation games – *"games based on knowledge within a given subject area"*

4. simulations/games – are combinations of games and simulations, with specified goals and rules, and the format is designed to reflect some aspects of reality (Walter, & Marks, 1981, p. 178-179).

The immediate consequence for participants in simulations is a rather high degree of activation (Walter, & Marks, 1981, p. 181) and as authors note, simulations promote behavioral skill development, change attitudes and enhance empathy (Walter, & Marks, 1981, p. 181). This is a very important point for the purpose of this research as both simulations and empathy (clinical empathy) are studied. Above-mentioned educational methods that were further described, all have an effect on the outcomes of educational projects in this study.

1.5 Immersive and Traditional Teaching Tools

Since the present study compares two educational courses which differ by using different educational tools, the aim of this subchapter is to describe the specifics of immersive teaching and traditional teaching tools. The description enables the reader to compare immersive tools to traditional ones, therefore the fundamental theory in this chapter can be applied for the data analysis and interpretation in chapter 5.

Firstly, the chapter provides an overview of teaching tools and related functions with no distinction of immersive or traditional aspects. Secondly, the specifics of immersive and traditional teaching tools are described. The main focus is on virtual reality, immersion, interaction and sense of agency. The

chapter then describes the relation of immersive and traditional tools to aforementioned learning theories.

To begin with the types of educational tools [3] , the below displayed classification was introduced by Zormanova (2017). The author reflected classification of other theorists; therefore, this version was identified as the most suitable one for this study:

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[3] Educational tools can be also called *didactical tools* or *didactical technology* (Rambousek, 2014)

Teaching Tools		
Equipment and materials	Original objects	Natural objects (plants), creations and goods (machines, arts).
	Presentations	Models, maps, photos, movie, television, projections, sounds
	Text tools	Textbooks, work materials, additional literature
	Programs	Television programs, computer games, video programs
	Special tools	For physical education, sound tools (CD), touch tools
Technical Teaching Tools	Audio technique	School radio, CD recorder
	Visual technique	Diaprojection, reverse projection, dynamical projection, data projection
	Audiovisual technique	Movie projectors, video technique, television technique, multimedia systems based on computers
	Directive and evaluative technique	feedback systems, personal computers, teaching computer systems, simulators
Organizational and Reprographic technique	Photo lab, copier, radio studios, video studios, computer networks, computers, database systems	
Place of the activity and its equipment	Classrooms with standard equipment – boards, bookshelf, classroom designed for reproduction of audiovisual tools, technical classrooms, computer classrooms, laboratories, workrooms, gyms, music rooms, drama rooms	
Tools of the teacher and student	Writing accessories, drawing accessories, calculators, laptops, work clothes, school clothes	

Table 2: Teaching Tools inspired by Zormanova (Zormanova, 2017).

Functions of Educational Tools

This subchapter summarizes the functions of educational tools which will be evaluated in the empirical part of this study as well. The basic functions of educational tools according to Rambousek (2014) are:

1) <u>Motivational-simulative function</u>

This function is to create a positive attitude towards learning, increasing the activity, stimulation perception, eliminating the negative elements).

There are many classifications of students' motivation. The classification selected for this study was introduced by Rambousek (Ausubel, 1968 in Rambousek, 2014) and it represents the motivation based on study needs that are related to the educational process:

1. need for exploration   4. need for stimulation

2. need for manipulation   5. need for knowledge

3. need for activity   6. ago enhancement

To enhance the study motivation and the effectiveness of the class, there is a model called ARCS model (Keller, 1979 in Rambousek, 2014). The model includes categories that represent the components of motivation and shows the processes that support the motivation:
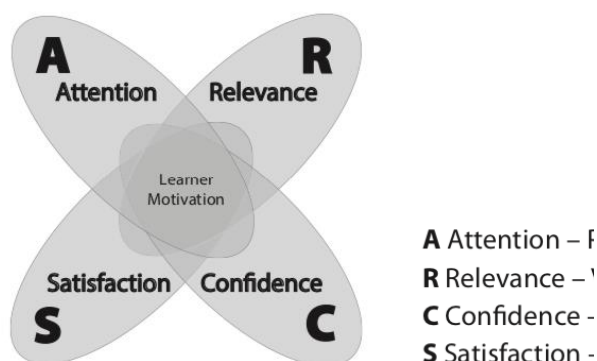

Figure 4: Keller's motivation model: ARCS (Rambousek, 2014)

Attention – motivation is encouraged by strategies targeting perceptions and questions: active work (problem solving), disagreement and conflict (discussion), questions (brainstorming, research), humor, variability, combination.

Relevance – motivation is encouraged by strategies targeting objectives and interconnection of motives: experience, future opportunity, choice (the opportunity to use variety of methods).

Confidence – motivation is encouraged by strategies targeting opportunities and control: define the objective and required performance, feedback, management.

Satisfaction - motivation is encouraged by strategies targeting rewards, justice (Rambousek, 2014).

The motivational-simulative function corresponds with one of the evaluation aspects mentioned in chapter 2.2 (Level 1 of Kirkpatrick model), thus this function of educational tools has a relation to the analyzed outcomes of this study.

2) Information-exposure function

This function described by the Cone of Experience in chapter 1.1. The lower on the cone we are, the greater is the learning.

3) Repetition-fixation function

The educational process relates to fixation methods – the student gains the knowledge and then works on exercises that helps him/her to better remember/understand the learned materials

4) Application function

The educational tools can increase the ability of applying the learned knowledge/skills/abilities in other situations

5) Control-diagnostic function

Once the teaching tools and their functions were described, the chapter continues with specifics of immersive and traditional tools. First, it is important to clearly define the difference between traditional and immersive teaching tools. Simply put, traditional teaching tools are all those mentioned in Table 2. The difference between traditional and immersive teaching tool is then the dimension of virtual immersion that can be arranged by audiovisual or directive and evaluative teaching tools. To further clarify the two tools, it is important to explain the meaning of immersive technology. As specified further in this chapter, researchers and practitioners often use similar terms, such as virtual reality, extended technologies, immersive technologies and so forth, however the terms are either used as synonyms or they stand for quite different meanings. With reference to reviewed literature, this research identifies immersive technologies as the mediation of reality as the opposite of standard physical reality. It provides an environment in which the user is isolated from the reality (Spiclova, 2017) and it is usually provided in form of virtual reality (VR), augmented reality (AR) or mixed reality (MR) (Blyth, 2018; Cummings, Bailenson, 2016; Pantano, & Servidio, 2018). In this regard, the present research also associates the immersive technologies with technologies that provide the user with mediated environment, specifically VR which will be further described later in this chapter. The mentioned terms VR, AR and MR are usually referred to as *virtual technologies* which Søraker describes as *"something real, or something real without being actual"* and *"interactive, computer-simulated"* technology (Søraker, 2011). Therefore, if immersion, as Psotka explains, means "being there" (Psotka, 1995), then immersive teaching tools mediate this feeling for the users as well. Oppositely, traditional (non-immersive) teaching tools do not provide such feelings. For better understanding of the distinction between the immersive and traditional teaching tool, the chapter further explains the terms *presence* and *immersion*, where, ideally, immersive teaching tools belong to immersion while

traditional teaching tools rather belong to presence.

A. Presence and Immersion

According to Steuer, presence can be the key of defining immersive virtual reality in terms of human experience, as author explains it as the experience of one's physical environment. It refers to one's perceptions of surroundings mediated by both automatic and controlled mental processes (Steuer, 1992). In contrast to other terms (telepresence and immersion), it can be explained as a sense of being in an environment. It refers to the natural perception of an environment (Steuer, 1992) and experience of one's existence within physical environment (Mantovani, Riva, 1999; McMahan, 2003). In this case as the user can feel completely present with no mediated environment being provided and no occurrence of immersion, thus, the presence is where traditional teaching tools take place. Further explanation of the term presence is introduced by Lee who highlights different types of presence which are important for the understanding this term and its relation to immersion – terms, that will be explained later in this subchapter.

Lee explains that there are three types of presence:

• physical presence

In relation to virtual reality, physical presence is *"a psychological state in which virtual"…"physical objects are experienced as actual physical objects in either sensory or nonsensory ways.".* It occurs when technology users do not notice the para-authentic or artificial nature of mediated/simulated objects or environments (Lee, 2004).

• social presence

"A psychological state in which virtual (para-authentic or artificial) social actors are experienced as actual social actors in either sensory or nonsensory ways." Therefore, it indicates that the technology users in virtual reality do not notice para-

authenticity or artificiality of mediated humans or simulated nonhuman social actors (Lee, 2004).

- self-presence

Occurs when the users do not notice the virtuality of either paraauthentic representation of their own selves or artificially constructed alter-selves inside virtual environments" (Lee, 2004).

As Lee further explains, representation of somebody's self can be physical (when there is a change of views according to the head movement of users/avatars), or the representation can be social (example: realistic response to user questions) (Lee, 2004).

Apart of physical and social presence, there are other terms, such as telepresence and copresence that are commonly used in terms of virtual technologies experience. Lee explains copresence as "the feeling of being in a virtual world with other people." He then explains that copresence requires mutual awareness, which only leads to two-way communication (Lee, 2004).

For better understanding of the terms and relations and differences between presence, copresence and social presence, IJsselsteijn introduced following illustration (VR is understood as virtual reality, LBE as Location-based Entertainment, SVEs as Shared Virtual Environments, and MUDs as Multi-User Dungeons):
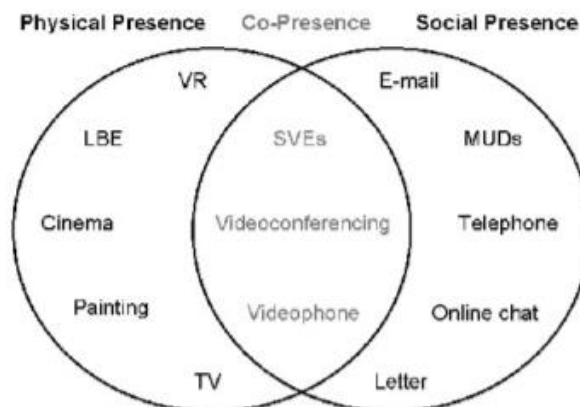

Figure 5: Physical Presence, Co-Presence and Social Presence (Ijsselsteijn, 2005)

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There is a number of researchers who highlighted the importance of relation between terms presence and immersion, (Ausburn, 2004; Brown, Crains, 2004; Brownman, de Kort et al., 2006; McLellan, 2001; McMahan, 2007; Milgram et al., 1994; Monahan et al., 2008; Slater, 1996; Slater, Sanchez-Vives, 2016) and according to Ijsselsteijn, who also distinguishes between these terms notes that immersion means "a set of physical properties of the media technology that may give rise to presence."(Ijsselsteijn, 2005).

Following number of paragraphs introduces definitions of immersion by seven different authors that describe immersion in terms of what it provides as a system and what effect is has on user's perception of presence.

Immersion includes the extent to which the computer displays are extensive, surrounding, inclusive, vivid and matching (Slater, 1996), it refers to the objective level of sensory fidelity a VR system provides (Browman, MacMahan, 2007). Accordingly, Seipel (2002) divides the levels of immersion as follows:

1) Immersive Virtual Environments - subjects are visually isolated from the real environment, virtual scene is responding to the subjects' actions, subjects are unable to perform in the real environment

2) Semi-Immersive Virtual Environments - subjects can perform both in the real and virtual environment, subjects perceive a strong involvement into the virtual environment, subjects may perform less in the real environment

3) Non-Immersive Virtual Environments - the three-dimensional scene is considered as a part of the physical environment, subjects do fully respond in the real environment, relatively little involvement into the virtual environment.

Other researchers emphasize the user's perception of being in an environment, thus, the user's perception of presence. Based on such perspective, they describe immersion as the extent to which the user of extended environment feels "involved with, absorbed in and engrossed by stimuli from the extended

environment" (Palmer, 1995 in Lee, 2004). The users believe that they are somewhere other than their physical location, and they believe to be surrounded by a completely different reality (Patrick et al., 2000 in Brown, Cairns, 2004; Murray, 1997). Similarly McLellan explains the term as *"a perceptual and psychological sense of being in the digital environment presented to the senses"* (McLellan, 2001).

To make a conclusion, immersion was described as an objective level of fidelity that extended reality provides. It causes that computer system display makes an inclusive and surrounding effect on users, who then believes that they are somewhere other than their physical location, and they feel absorbed in the environment that is presented to their senses. Familiarity with the term immersion is necessary in the present research as it will represent the main difference of teaching tools in case studies further described in the empirical section of the research. As mentioned earlier, traditional teaching tools are characterized by the term *presence* which is associated with the reality while immersive teaching tools are characterized by the term *immersion* which provides the user with mediated environment and the user believes that he/she is physically somewhere else. There are benefits of both, traditional and immersive tools. As for the benefits of immersion, Psotka lists the user's motivation and mindful engagement that derives from the novelty of the technology, interactivity and realism (Psotka, 1995). It is also more efficient regarding memory ability (Ventura, Brivio, Riva, & Baños, 2019). On the other hand, traditional tools are easier to use since the participant needs time to learn how to use the hardware and software (Pantelidis, 2010). As authors also note, traditional teaching tools might be safer since the immersion can cause motion sickness or nausea (Munafo, Diedrcik, & Stoffrefen, 2016). Other aspect that differs traditional and immersive tools is the guidance. Since working with immersive technology is more difficult for user, the lector must handle technical issues that any of the participants can experience while using the

technology. In these situations, the lector can get overloaded and the participants might receive insufficient guidance (especially when being already immersed) (Basler, & Mrazek, 2018).

B. Interactivity in immersive and traditional environment

In the present research, the immersive teaching tool that was applied in courses described in chapter 5, is determined by two aspects: full immersion and interactivity. Immersion on its own would only mediate specific audiovisual experience, however, as mentioned earlier in chapter 1.1, the goal is to provide the learner with enactive learning experience (learning by doing) which immersive teaching tools provide in form of interaction. As Psotka explains, in such immersive learning environment, the user feels that the space surrounds her or him and can interact with the objects in it (Psotka, 1995). Both traditional and immersive teaching tools can provide the user with interaction. In traditional environment, for instance, interactions can be "achieved through a balance of directing and telling; demonstrating; explaining and embedding; reflecting and evaluating; and summarizing (DfES, 2002 in Kennewell et al., 2007). For better understanding, the interactivity of traditional teaching class and its tools is displayed in the figure below (Tanner et al., 2005):

Nature of the Interaction

- Lecture

No interactivity or only internal interactivity

- Low level / funnelling questioning

Rigid scaffolding & surface interactivity

- Probing questioning

Looser scaffolding and deeper interactivity

- Focusing or uptake questioning

Dynamic scaffolding and deep interactivity

- Collective reflection

Reflective scaffolding and full interaction

Figure 6: Nature of Interaction (Tanner et al., 2005).

As indicated in the Nature of Interaction, the lecture does not mediate any interaction in the class, while collective reflection is the most interactive form. With reference to Britannica, interactive tools shift the user's role from observer to participant who can control, combine and manipulate different types of tools (Augustyn, 2019).

This chapter determined the difference between traditional and immersive teaching tools, mainly through the aspect of immersion and interactivity. Familiarity with these specifics is essential for understanding the differences between the two studied courses in chapter 4.

2 Evaluation of Educational Project

In the present chapter, several approaches of how to conduct a project evaluation are listed following with the summary of those chosen for the cases in this study (chapter 4). The evaluation methods mentioned in this chapter represent methods of evaluating the educational program.

2.1 Types of Evaluation

The aim of this chapter is to list selected types of evaluation and clarify which of these types are applied in chapter 4.

According to Bartonkova, evaluation means a comparison of educational goals with the final outcomes. It should determine whether the educational program fulfilled its purpose (Bartonkova, 2010). It also evaluates the context of educational activity, its outcomes, its organization, and finally the process of the activity itself – the experience that is the participant gaining while attending the activity (Prokopenko, Kubr, 1996). Evaluation of educational project is a complex process and there are several approaches that can be applied when designing evaluation tools. According to Dvorakova (2007) there are eight basic approaches:

1) evaluation based on time – evaluates the participants: prior to attending the project, during the activity, at the end and after the project,
2) evaluation based on purpose – ex ante and ex post,
3) evaluation based on phases and objectives – formative and summative,
4) evaluation based on the evaluator – internal and external,
5) evaluation based on levels: Kirpatrick's model,
6) evaluation based on levels: Humblin's model,
7) subjective and objective evaluation,
8) evaluation based on its length – short-term and long-term.

There are two types of evaluation based on its purpose: formative evaluation and summative evaluation. The aim of formative evaluation is an improvement and development of intervention, and it provides continuous feedback that can be applied for revising the interventions that are in the process (Hend & Remr, 2017, p. 275-277). *"Formative evaluations aim at forming the thing being studied."* The rely mostly on qualitative methods. (Patton, 2002,

p. 220). Summative evaluation is usually applied in situations when reached outcomes are measured and their succession is explained (Hend & Remr, 2017, p. 277-278). *"It serves the purpose of rendering an overall judgment about the effectiveness of a program, policy, or product for the purpose of saying that the evaluand is or is not effective and, therefore, should or should not be continued, and has or does not have the potential of being generalizable to other situations."* It mostly relies on quantitative data, qualitative data usually add depth, detail, and nuance to quantitative findings (Patton, 2002, p. 220).

Referring to chapter 4, the summative type of evaluation based on its purpose is applied in this study as the main focus is on the final outcomes and the interventions are not being formed during the process. Even though this kind of evaluation relies on quantitative data, both quantitative and qualitative methods are used in this research as the evaluation methods mentioned further in this chapter require deeper understanding of the evaluand.

Hendl and Remr (2017) determine two types of evaluation based on its objectives: process evaluation and effects evaluation. The aim of process evaluation is to evaluate the form of implementing specific intervention. It strictly focuses on the process of intervention thus it does not evaluate the relation between defined and reached goals, or effect caused by the intervention (Hendl, Remr, 2016). The aim of effects evaluation is to describe, explore and identify the changes that occurred by implementing the intervention. There are three effects of interventions:

1) outputs – immediate effects caused by the intervention; output is direct effects of intervention and particular activities

2) outcomes – changes because of the intervention; outcomes are measured once the intervention is completed

3) impacts – long-term effects of an intervention

   According to the aim of this study, effects are the selected type of evaluation based on its objectives.

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Considering the goal of the research, the outcomes of the educational project are measured in chapter 4.

Finally, Hronik (2017, p. 178-179) explains that there are methods of evaluation based on the author and time horizon. The short-term horizon is usually applied when the evaluation takes place within one month after the intervention. The long-term evaluation takes place usually within three to six months after the intervention. Considering the conditions of the interventions described in chapter 4, the short-term evaluation was applied in this study. The author of the evaluation can be either the participant of the evaluation activity (the subject, first-person assessment) or an observer who did not participate in the activity (the object, observer evaluation). There are variety of evaluation methods based on the author. In case of short-term evaluation by participant, methods of evaluation are usually a questionnaire, interview or a letter addressed to the lecturer. In case of short-term evaluation by an observer, the methods are usually pre-test and post-test, case study, project, assignment, 360 feedback, development plan or observation (Hronik, 2017). As the objective of the educational projects in this study is clinical empathy, this study reflects specific author-based methods of empathy evaluation that are widely used by health professionals. As authors note, *"empathy may be measured from three different perspectives:*

1. *Self-rating (first person assessment) – the assessment of empathy using standardised questionnaires completed by those being assessed*

2. *Patient-rating (second person assessment) – the use of questionnaires given to patients to assess the empathy they experience among their carers[4]*

3. *Observer rating (third person assessment) – the use of standardised assessments by an observer to rate empathy in interactions between health personnel and patients, including the use of 'standardised' or simulated*

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[4] In clinical settings, such patient is called Simulated patient (SP) which is further described in chapter 3

patient encounters to control for observed differences secondary to differences

between patients" (Hemmerdinger, Stoddart, & Lilford, 2007).

Given the fact that clinical empathy is measured from different perspectives and is mostly measured by questionnaires, variety of clinical empathy measurement scales was reviewed. Authors usually mention Interpersonal Reactivity Index, Jefferson Scale of Physician Empathy, Toronto Empathy Questionnaire, Affective and Cognitive Measure of Empathy, Consultation and Relational Empathy Measure (CARE), Empathic Communication Coding System, and many more (Yu, & Kirk, 2009),. Due to accessibility of mentioned scales, the CARE scale, which is the second type (patient-rating assessment), was selected as one of the evaluation techniques in this research (chapter 4):

CARE Patient Feedback Measure for

*** Type name of Practitioner here ***

Please write today's date here:

☐☐ / ☐☐ / ☐☐
D D   M M   Y Y

Please rate the following statements about today's consultation.

Please mark the box like this ✔ with a ball point pen. If you change your mind just cross out your old response and make your new choice. Please answer every statement.

How good was the practitioner at...	Poor	Fair	Good	Very Good	Excellent	Does not apply
1) **Making you feel at ease** (introducing him/herself, explaining his/her position, being friendly and warm towards you, treating you with respect; not cold or abrupt)	☐	☐	☐	☐	☐	☐
2) **Letting you tell your "story"** (giving you time to fully describe your condition in your own words; not interrupting, rushing or diverting you)	☐	☐	☐	☐	☐	☐
3) **Really listening** (paying close attention to what you were saying; not looking at the notes or computer as you were talking)	☐	☐	☐	☐	☐	☐
4) **Being interested in you as a whole person** (asking/knowing relevant details about your life, your situation; not treating you as "just a number")	☐	☐	☐	☐	☐	☐
5) **Fully understanding your concerns** (communicating that he/she had accurately understood your concerns and anxieties; not overlooking or dismissing anything)	☐	☐	☐	☐	☐	☐
6) **Showing care and compassion** (seeming genuinely concerned, connecting with you on a human level; not being indifferent or "detached")	☐	☐	☐	☐	☐	☐
7) **Being positive** (having a positive approach and a positive attitude; being honest but not negative about your problems)	☐	☐	☐	☐	☐	☐
8) **Explaining things clearly** (fully answering your questions; explaining clearly, giving you adequate information; not being vague)	☐	☐	☐	☐	☐	☐
9) **Helping you to take control** (exploring with you what you can do to improve you health yourself; encouraging rather than "lecturing" you)	☐	☐	☐	☐	☐	☐
10) **Making a plan of action with you** (discussing the options, involving you in decisions as much as you want to be involved; not ignoring your views)	☐	☐	☐	☐	☐	☐

Comments: If you would like to add further comments on this consultation, please do so here.

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Mercer, 2004

The CARE measure scale is patient-rated measure of the interpersonal quality of healthcare encounters, which has been extensively validated and is used by doctors in primary care (Bikker, Annemieke, Fitzpatrick, Murphy, & Mercer, 2015). According to Mercer, McConnachie, Maxwell, Heaney and Watt, the CARE measure is considered by most simulated patients and by most patients as being of high relevance quality to healthcare encounters (Bikker, Annemieke, Fitzpatrick, Murphy, & Mercer, 2015; Mercer, McConnachie, Maxwell, Heaney, & Watt, 2005).

Referring back to the type of evaluation based on author, the SCALE measure scale can be defined as the observer evaluation. However, it is only one of the techniques that is applied in chapter 4. Later in chapter 2.2, other techniques based on evaluation models will be described together with chosen techniques for this study.

To summarize the chapter, selected approaches of evaluation were described with the following ones chosen for the data analysis in chapter 4: summative short-term evaluation with focus on the outcomes of the intervention, CARE measure scale for observer evaluation (second person assessment).

2.2   Evaluation Models

There are specific evaluation models in education that were designed for evaluation of educational programs and their aspects. The present chapter briefly introduces some of these models which focus on these applied in the data analysis part of this study (chapter 4).

Blooms Taxonomy

Continuing with the objectives of an educational project related to competencies (cognitive, affective, psychomotor), Bloom's taxonomy, that was published in 1956, is a classification that focuses especially on the cognitive

domain (Forehand, 2011). Nowadays, revised Bloom's taxonomy is commonly applied since the original taxonomy was designed in 1956. [Bloom's original taxonomy included some aspects of behavioral psychology (Amer, 2006)].

Phillips and ROI Evaluation Model

Phillips describes the evaluation process form business perspective and adds Return on Investment level into the scale. His model includes five levels including the first two levels Reaction and Learning that matches the Kirkpatrick's model (described below).

Bramley's Evaluation of Effectiveness

Bramley's Evaluation of Effectiveness measures Changes in Knowledge, Changes in Skills and Changes in Attitudes (Sadler-Smith, 2005). These aspects correspond with Kirkpatrick's model Level 2 (described below).

Kirkpatrick Evaluation Model

There are several evaluation models that are very similar to each other. These models only differ at some levels. The original one that came with the evaluation based on learning levels was Kirkpatrick's evaluation model.

Kirpatrick model is often used as an evaluation system in the field of education by thousands of training professionals around the world. (Sadler-Smith, 2005). When describing evaluation methods in educational programs, authors usually mention Kirkpatrick's model at the first place (Bartoňková, 2010, p. 185-189; Miller & Němejc, 2014, p. 58-61; Sadler-Smith, 2005; Nickols, 2012; Phillips, 2003).

The model consists of four levels described below:

Level 1: Reaction	The degree to which participants find the training favorable, engaging and relevant to their jobs
Level 2: Learning	The degree to which participants acquire the intended knowledge, skills, attitude, confidence and commitment based on their participation in the training
Level 3: Behavior	The degree to which participants apply what the learned during training when they are back on the job
Level 4: Results	The degree to which targeted outcomes occur as a result of the training and the support and accountability package

<div align="right">The Four Levels (Kirkpatrick, 2016)</div>

Kirkpatrick's model represents the key model of evaluation in this study, more specifically, the level of reactions and level of learning. The level of behavior and level of results are not included in the evaluation as this study focuses on the immediate results of the educational program.

According to Kirkpatrick (2016), The Level 1 Reaction includes four components: customer satisfaction, engagement, relevance, and monitor and adjust:

Customer Satisfaction: *the customer satisfaction does have a positive correlation to learning, so some degree of satisfaction, is beneficial."* There are not many resources that could evaluate this dimension (Kirkpatrick, 2016) therefore, the Cambridge Dictionary was considered, which describes satisfaction as *"the act of fulfilling (=achieving) a need ow wish"* (Matsumoto, 2009) In this study "a need" is understood as an educational need. Referring to chapter 1.3, clinical empathy belongs to interpersonal skills. Therefore, the educational need was described as a need to get more practical training of these skills.

Engagement: *"Refers to the degree to which participants are actively involved in and contributing to the learning experience. Engagement levels directly relate to the level of learning that is attained."* (Kirkpatrick, 2016). Personal responsibility and program interest are both factors in the measurement of engagement. Personal responsibility relates to how present and attentive participants are during the training. Program interest is more commonly the focus, including how the facilitator involved and captivated the audience (Kirkpatrick, 2008-2016).

Relevance: *"Degree to which training participants will have the opportunity to use what they learned in training on the job."* The relevance is an important dimension to evaluate if the participant can apply what they learned in the everyday work.

The last dimension: Monitor and Adjust is not considered as it is implemented for completion of Level 3 and Level 4 which is not included in the empirical phase of this study.

The Level 2: Learning, includes five components: knowledge, skills, attitude, confidence, commitment which can be described as follows:

Knowledge: "I know it!!

"The degree to which participants know certain information."

Skill: "I can do it right now"

"The degree to which they know how to do something or perform a certain task."

Attitude: "I believe this will be worthwhile to do on the job."

"The degree to which participants believe that it will be worthwhile to implement what is leaned during training on the job."

Confidence: "I think I can do it on the job."

"The degree to which training participants think they will be able to do what they learned during training on the job

Commitment: "I will do it on the job."

"The degree to which a learner intends to apply the knowledge and skills learned during training to the job." (Kirkpatrick, 2016)

Kirkpatrick explains the methods of evaluation specifically for each level. He notes that it is important to perceive the levels as a complex model rather than separate dimensions, and he advises to design the methods of evaluation based on this perception of the model. However, only the two first levels can be considered in this study. The methods Kirkpatrick recommends for each level are listed below:

Level 1: Reaction

There are different methods for formative and summative evaluation. Earlier in this chapter, the evaluation of this paper was determined as summative. For the summative forms of Level 1 evaluation, surveys are the most common method. *"The items to evaluate should be satisfaction of the program, engagement in the program based on how the trainer taught it, relevance of the program material to the participant's job, and general view of the program quality"* (Kirkpatrick, 2016, p. 40).

The Level 1 evaluation is usually measured straight after the training event. (Kirkpatrick, 2016, p. 41).

Level 2: Learning

The most common summative methods for evaluating Level 2 Learning are:

- *knowledge test/quiz/post-test*
- *presentation*
- *teach back: After learning something during the program, participants teach portions of the material to their classmates to confirm their own understanding.*

- *action planning: At the end of the program, participants create a plan for how they will apply what they learned on the job and what they will accomplish, and then they have regular tough points on their progress.*
- *demonstration/performance test*
- *survey*
- *interview*
- *focus group/group interview* (Kirkpatrick, 2016, p. 43-44).

As the components of Level 2 Learning are knowledge, skills, attitude, confidence and commitment, Kirkpatrick describes evaluation methods for each component separately:

1) Evaluating Knowledge: using pre- and post-tests

2) Evaluating Skill: "when there is a skill to be performed, the test should involve performance of some type of simulator. For what is often referred to as soft-skills training, involving things such as communication, leadership, and interpersonal skills, it is important that during the planning phase you clearly define exactly what training graduates are supposed to DO or SAY on the job." That is the guide of what needs to be simulated and practiced during training. (Kirkpatrick, 2016)

3) Evaluating Attitude: the participants' attitude might be evaluated by the lecturer's observations (for example: "*Are the program participants actively involved in training activities and discussions, or are they multi-tasking on their phones?)* (Kirkpatrick, 2016).

4) Evaluating Confidence and Commitment: "for soft-skills training, a question or two about confidence and commitment in the post-program evaluation is wise." (Kirkpatrick, 2016).

For better understanding of how evaluation methods can be applied for the same levels, Kirkpatrick shows in the picture below:

Methods	Evaluation Level			
	1 Reaction	2 Learning	3 Behavior	4 Results
Survey, questionnaire, individual and work interview	✓	✓	✓	✓
Action plan monitoring, action learning		✓	✓	✓
Work interview, skill/behavior observation learning		✓	✓	
Case study, knowledge test/check, action learning		✓		
Request for validation			✓	✓
Key business and HR metrics				✓

Picture: Evaluation Methods (Kirkpatrick, 2016)

This study evaluates the reaction and learning which can be both evaluated by surveys, questionnaire, and individual or group interview. Other methods

applied for the Level 2: Learning, is skill observation and behavior observation. The action plan monitoring, action learning, presentation or teach back were not found as appropriate as it would be technically difficult to apply this method in virtual environment.

When designing the evaluation tools, Kirkpatrick recommends considering the subjectivity the response scales in the questionnaire. The anchors of the scale should be clearly defined therefore the respondents would interpret them with the same meaning. An example would be (Kirkpatrick, 2016, 87-89):
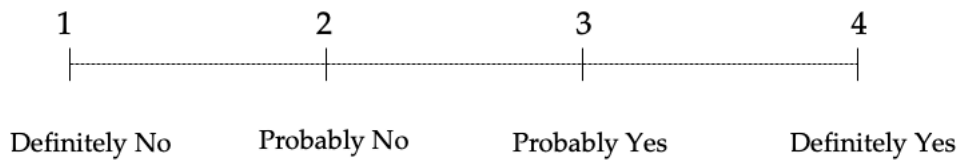
Response Scale 4 (Kirkpatrick, 2016).
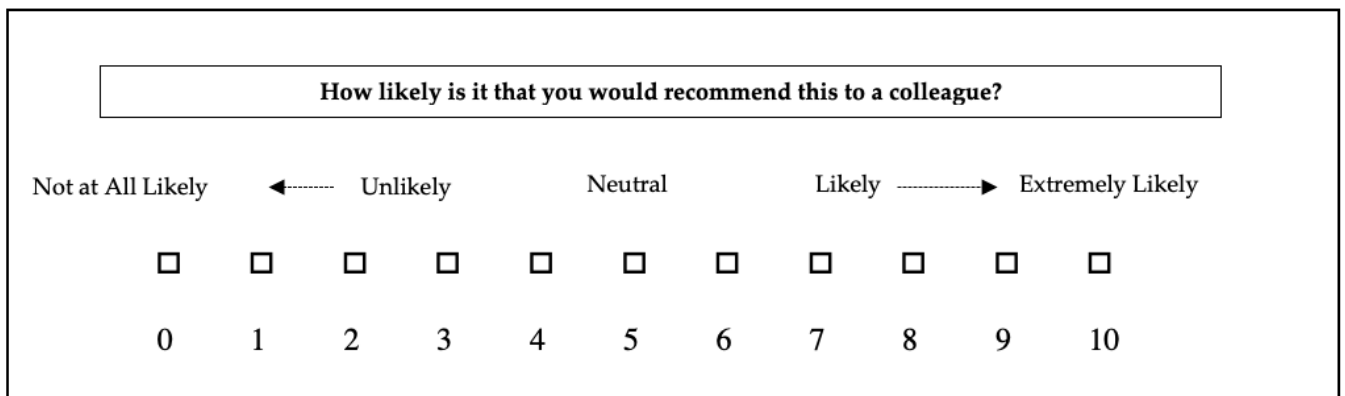
Response scale 5 (Kirkpatrick, 2016).

The "natures" of Items and Respond Scales should match. Kirkpatrick mentions four common question types with appropriate matching response scales:

Agreement	Likelihood	Frequency	Quality
Strongly Agree	Definitely Yes	Always	Excellent
Agree	Probably Yes	Often	Very Good
Neither Agree or Disagree	Probably No	Sometimes	Good
Disagree	Definitely No	Never	Fair
Strongly Disagree			Poor

Four Common Questions Types (Kirkpatrick. 2016)

Kirkpatrick also advises to be careful about lumping specific numbers into general categories. However, this point does not concern this study as the study is not evaluating how many times was a specific activity experienced. Heretofore, methods for evaluation methods of level 1 and 2 were described with focus on specific factors in each level and on examples of evaluation scales. The information is applied mostly in level 1 in chapter 4. The level 2: learning focuses on the acquirement of knowledge and skills (In case of this study), therefore, a standardized form that is used by researchers for testing the level of clinical empathy (CARE) was used as described in the previous chapter.

3 Communication Skills of Health Professionals

The aim of the research is to evaluate whether immersive learning environment helps the students to learn such a specific skill as clinical empathy. Therefore, this chapter is to provide the reader with overall understanding of this term, including the understanding of the methods which can be used for its evaluation. To properly describe clinical empathy, it

is important to explain the process of clinical encounter as that is where the patient communication and clinical empathy itself take place. Such encounter includes steps which health professionals (in this case medical students) have to complete and in this research, clinical empathy should be demonstrated throughout the whole encounter.

3.1 Clinical Encounter Structure

In the present study, clinical empathy skills of health professionals (students) from medical fields will be evaluated while they complete simulated doctor-patient encounters. Referring to medical literature, clinical encounters usually take format of the Objective Structured Clinical Examination (OSCE) (Ferrell, 1995; Sim, Aziz, Mansor, Vijayananthan, Foong, & Vadivelu, 2015; Zayyan, 2011). According to Zayyan, the OSCE can be used to evaluate health care professionals in a clinical setting through direct observations. *"It is comprised of several "stations" in which examinees are expected to perform a variety of clinical tasks within a specified time period against criteria formulated to the clinical skill"* (Zayyan, 2015). However, the disadvantage of OSCE is that simulated scenarios created for OSCE examinations might differ from situations with real patients (Zayyan, 2015). Oppositely to laboratory (simulated) examination, some of the experts refer to mini-CEX which assesses the trainee's performance at the workplace (Hejri, Jalili, Shirazi, Masoomi, Nedjat, & Norcini, 2017). Such exams usually use stations, where participants perform clinical tasks on patients while they are being observed and evaluated by the examiners. If the clinical performance assessment consists of laboratory conditions, simulated or standardized patients are substituted for real patients as a subject for student performance (Barrows, & Abrahamson, 1964 in Zayyan, 2015). Usually, simulated patient (SP) is *"a person who has been carefully coached to simulate an actual patient so accurately that the simulation cannot be*

detected by a skilled clinician. In performing the simulation, the SP presents the gestalt of the patient being simulated; not just the history, but the body language, the physical findings, and the emotional and personality characteristics as well" (Barrows, 1987 in Cleland, Abe, & Rethans, 2009). According to the authors, all SPs play roles but they can also give feedback and evaluate student performance (Cleland, Abe, & Rethans, 2009). Being familiar with the form of clinical examinations and the usage of SPs, the clinical encounter structure can be explained.

There is variety of different doctor-patient (clinical) encounters. Depending on the concrete situation with a patient, health professionals might follow different communication frameworks and the structure of the encounter might not be the same in all cases. However, as the research focuses on medical education using pre-arranged SP cases, only one basic clinical encounter structure will be explained as this structure will be applied later on in the intervention. The mentioned structure is called Calgary-Cambridge framework (Kurtz, Silverman, Benson, & Draper, 2003; Sommer, Lanier, Perron, Nendaz, Cllavet, & Audétat, 2016) for the clinical encounter, and according to the authors, it is *"one of the foremost communication models used in healthcare education"* (Sommer, Lanier, Perron, Nendaz, Cllavet, & Audétat, 2016). The model consists of five phases: Initiating the Session, Gathering information, Physical examination, Explanation and Planning, Closing the Session. A similar structure of clinical care consultation was described by Byrne and Long, although in their model, the "explanation and planning" phase was replaced by the Diagnosis and Treatment (Byrne, & Long, 1976 in Bagheri, Ibrahim, & Habil, 2015).

The details and specific use of these structures in the intervention will be explained in more details in the cases description in chapter 5.

3.2 The doctor-patient communication

Clinical empathy in this research is demonstrated through doctor-patient communication. The patient-doctor relationship comprises four main elements: knowledge, trust, loyalty, and regard (Ridd, Shaw, Lewis, Salisbury, 2009). It is determined by mutual expectations from each other. According to Vymetal, the patient expects that the doctor eliminates the symptoms, respects the medical privacy, supports the patient, demonstrates professionalism and informs the patient. In return, the doctor expects that the patient follows the doctor's instructions and collaborates (Vymetal, 2003 in Janackova, Weiss, 2008). The two basic types of patient-doctor relationship are based either on paternalism or partnership. According to Kaba and Sooriakumaran, Hellin explains paternalism as a patient-doctor relationship similar to parent-infant relationship in which the infant is dependent on the parent and his/her decision-making. The doctor acts in the patient's best medical interest, and the patient submissively accepts the passive role of the infant (Kaba, Sooriakumaran, 2007). Patient-doctor relationship based on partnership is based on mutual participation that believes that the equality between the doctor and patient is mutually advantageous (Kaba, Sooriakumaran, 2007). It is characterized by equal power, mutual independence, high degree of empathy, and equal satisfaction. The partnership model provides the patient with higher degree of responsibility and has elements of friendship (Kaba, Sooriakumaran, 2007). Patient-doctor relationship is closely associated with patient-centered care which is, in simply put, based on a perspective that Brown and Bower call the "patient-as-person" or the "doctor-as-person". (Brown, Bower, 2000). The "patient-as-person" means that in order to understand the *illness and ease the patient's suffering doctors must first understand the personal meaning of illness for the patient"* (Kaba, Sooriakumaran, 2007), meaning that each patient interprets the illness differently and it might

have a different significance for them. The illness might also represent an economic insecurity for the patient or fear of being labelled as unfit to work. The patient is perceived as *"an experiencing individual rather than the object of some disease entity. Attending to 'the patient's story of illness' involves exploring both the presenting symptoms and the broader life setting in which they occur"* (Smith & Hoppe, 1991 in Brown & Bower, 2000). According to Henbest and Steward, the goal is to understand the complaints expressed by the patient, and the symptoms found by the doctor (Henbest & Steward, 1989 in Brown & Bower, 2000). The "doctor-as-person" is described as an *"attention by the doctor to cues of the affective relationship as it develops between the parties, including self-awareness of emotional responses"* (Winefield et al., 1996 in Brown & Bower, 2000). The patient-centered cate is also understood as a clinical communication style with empathetic character of the health professional (Epstein, & Street, 2011). As authors describe, training health professionals in improving patient-centered communication helped them to improve their ability to express empathy (Levinson, Lesser, & Epstein, 2010).

Being familiar with the concept of patient-centered care, the health professional should be able to understand the patient, and what is the relationship between the patient and the health professional. Verbal and non-verbal communication skills then help the health-professionals to demonstrate their understanding to the patient and should support the patient-centered care concept.

The verbal communication means communicating the information through spoken words. Non-verbal communication means: communication through coming closer or away from someone (intimate, personal, social a public zone), communication through touch, or communication through face expressions (Janackova & Weiss, 2008). More details about non-verbal communication will be explained in the chapter Clinical Empathy.

According to Janackova and Weiss the communication skills as well help in situations of communicating specific types of patients. This study does not provide the reader with description of all specific types of patients that can be used for simulation of clinical encounter, however, the types of patients that were used in the cases in chapter 4 are described below as the understanding of their specifics is important for the data interpretation in chapter 4.

The first type of simulated patient used later in chapter 4 is an anxious patient: volatile look, huddled posture, unconfident gestures; tendencies for panic, not confident, ashamed for his/her behavior. An appropriate strategy is to wait until the patient reach to the health professional, talking slowly and calmly, avoid either-or types of questions, think of the solutions on behalf of the patient out loud.

The second type of simulated patient is an anxiously aggressive patient: reticence, feelings of injustice, fast, energetic and defensive reactions, rejection of help and care, cynicism. An appropriate strategy is to investigate the patient's face and express interest, talk calmly and understandably, communicate the information that enables the patient to decide, do not accelerate speech rate, do not raise the voice, if the patient interrupts the health professional in his/her speech, he/she should wait and then continue with the speech, use "yes, however" instead of "no".

Bing familiar with the fundamentals on doctor-patient communication and clinical encounter clinical empathy, which is the objective of courses analysed in chapter 4, will be explained.

Clinical Empathy (mostly referred to as „empathy"), is one of the communicative skills that *"contribute to the establishment of a high-quality relationship with the patient"* (Beran, Sumcovova, 2005). The communication training usually takes a form of role-play that can be undertaken by a student, an actor or by a selected patient. The role-play method provides a student with

an opportunity of acquiring better understanding of the patient (Beran, Sumcovova, 2005). From the clinical perspective, empathy is described as the act of acknowledging the emotional state of another without experiencing that state oneself (Halpern, 2003). However, acknowledgement is not enough. The health professional who deals with the patient also needs to be able to express his empathy to the level when the patient is able to distinguish it. As Halpern further describes, physicians, in this case, grasp the personal meaning of the patient's words and automatically match the patient's non-verbal style, such as vocal toners. *"When doctors attune to patients nonverbally, patients feel more comfortable and give fuller histories"* (Halpern, 2003). When evaluating students or health professionals, the common practise is to involve simulated patients, as explained earlier. Referring to the studied courses in chapter 4, simulated patients were the participants' evaluators and as the evaluated clinical empathy, its expressions described above were observed by the evaluators as well and reflected in the evaluation form as explained later in chapter 4.

4 Research Strategy

The research strategy was determined by the research goal, research questions and described theoretical assumptions mentioned earlier. The goal of this study is to evaluate and compare the outcomes of clinical empathy projects which applied either immersive or non-immersive teaching tools.

The main research question is as follows:

What are the outcomes of clinical empathy projects which applied wither immersive or non-immersive teaching tools?

The secondary research questions are as follows:

1. What are the participants' reactions according to level 1 of Kirkpatrick's model in traditional teaching environment?

2. What are the participants' reactions according to level 1 of Kirkpatrick's model in immersive teaching environment?

3. What were the differences of achieved scores in immersive and traditional courses according to Kirkpatrick's model level 2?

Mixed research approach was applied in this research considering the evaluation methods described in chapter 2 and considering the fact that *"mixed methods research is especially important because it brings together the insights of both quantitative and qualitative research"*, and in education, both qualitative and quantitative methods are important (Christensen, L., Johnson R. B., 2017). According to the authors, the combination of these methods provides understanding of the insider's perspectives (in case of qualitative method) and statistical description of some process (quantitative method).

The method selected for this research is a multicase project: *"Within a multicase project, the study of individual cases will often not be organized around the multicase research question. To some extent, sometimes entirely, each case gets organized and studied separately around research questions of its own."* (Stake, 2006)

The general purpose of this study was to evaluate and compare the outcomes of two educational projects. These projects applied traditional and immersive teaching tools which are both characterized by different aspects described in chapter 1.4 and 1.5. Therefore, the educational projects will be evaluated through comparison and evaluation of the educational method and tools. Firstly, the tools for data collection are described as these tools were used in both cases. Secondly, the data analysis and interpretation of each case will be conducted separately, followed by the comparison of cases.

Considering the ethical aspects of the research, participants' number will be used instead of their names. Students participating in traditional course used following numbers: 2, 3, 6 and 7. Students participating in immersive course used following numbers: 1, 4, 5 and 8.

4.1 Data Collection Methods

The criteria and techniques of evaluation were inspired by Kirkpatrick evaluation model and its Level 1: Reaction and Level 2: Learning. Referring to chapter 2, the Level 1: Reaction, is the degree to which participants find the training favorable, engaging and relevant to their jobs and Level 2: Learning is the degree to which participants acquire the intended skills, attitude, confidence and commitment based on their participation in the training (the knowledge aspect will not be measured as the study does not provide evaluation of learned theory).

Level 1: Reaction

There were 2 techniques used for the data analysis of the first level: in-depth semi-structured interviews and questionnaires.

In-depth interviews, as Svaricek explains aim at gaining respondent's deeper understanding (Svaricek & Sedova, 2007). Prior to conducting the interviews, the interviewer prepares a list of predetermined questions which are

understood as a "top priorities" (Newcomer, Hatry, & Wholey, 2015). The selected predetermined topics were preferred over questions as the interviews were conducted with non-native speakers and the focus was on covering all topics, rather than asking pre-arranged questions as the questions were modified individually during the interview according to the participants' language skills. In this research the topics were selected according to the research question and theoretical aspects of immersive and traditional teaching tools:

1. Participant's reaction towards the course

2. Description of and opinion about teaching tools applied in the course – this topic was selected based on the fact that the research compares 2 educational teaching tools and this topic aims accessing the participant's experience of these tools

3. Opinion about learning clinical empathy within the course – referring to chapter 1.1.3, prior to designing an educational project, its goal should be stated. As the aim of both educational projects (described further in this chapter) is to find out, the outcomes of clinical empathy courses depending on the application of specific teaching tools, the aim of this topic is to access the participants experience while learning clinical empathy.

4. Opportunities to participate – as described in chapter 1.5, the use of immersive teaching tools can enhance the learner's participation, however, due to the technical specifics of such teaching tools, the participation might be enhanced more while using traditional teaching tool.

5. Opportunities for interaction – as mentioned in chapter 1.5, there is variety of possibilities to interact in both, immersive and traditional environments. The aim of the topic is to understand the specific experience.

6. Available reflection – as described in chapter 1.1. the experiential learning in based on experience and reflection of that experience. Depending on the chosen teaching tool, the reflection of experience might differ

Once the data collection is completed, the next step is to conduct the data analysis. In the present research, open coding was applied as a technique of data analysis. According to this technique, data files were organized according to the respondents into separated files. Afterwards, technique of open coding was applied with focus on finding the indicators. Then the codes were identified, their labels were selected and the codes were divided into categories.

The second technique applied in this research, is a questionnaire as this technique is also suggested for accessing the outcomes of Level 1. According to Gillham, questionnaires are a way of getting answers to our research questions from people usually by posing direct or indirect questions (Gillham, 2008).

Both techniques, interviews and questionnaires provide different data types, the questionnaire provides a quantitative comparison, while the interviews collect answer that can provide explanations and learners insights in addition to the quantitative data. Such combination of techniques is called triangulation, and according to Svaricek, it provides a deeper insight of the data (Svaricek, et al., 2007).

The questions for the questionnaire were determined from the components of Kirkpatricks level 1: satisfaction, engagement, and relevance. These components were described in chapter 2.2. For the purposes of applying this research technique, the components were operationalized into statements.

The first component is satisfaction and according to the Cambridge description, the statements were constructed as follows:

CST1: The course provided me with a sufficient practice of profession-related competencies.

CST2: I was satisfied with the course.

The next component was engagement. Kirkpatrick describes it as: facilitator trying to involve the learner, attention of the learner, focus of the learner, therefore the questions are as follows:

CST3: I felt engaged during the course.

CST4: The facilitator made me involved in the training activities.

CST5: I was able to fully focus throughout the course.

CST6: I did not experience any distractions during the session.

The last component of Kirkpatrick level 1: relevance. According to chapter 2.2.1, relevance was described as the degree to which participants will have the opportunity to use or apply what they learned in training on the job (in this case school), the question is:

CST7: I will be able to apply what I leaned in my job or at school.

In addition, there were questions that focused on the teaching tools specifics rather than on the participants' reactions (the questions were modified based on the data collection in immersive and traditional course):

CST8: I think there was enough guidance during the video part of the course.

CST9: Working with 2D/VR video cases was easy.

CST10: The video cases allowed me to understand clinical empathy.

CST11: I found the video part of the course highly interactive.

The questionnaire was designed as described in chapter 2.2 – types of questions based on agreement with following values:

- Strongly Agree = 5

- Agree = 4

- Neutral = 3

- Disagree = 2

- Strongly Disagree = 1

Level 2: Learning

Evaluation at a learning level provides data on the degree of change to knowledge, skills or attitude stemming from the program, and is normally assessed using some type of performance tests, or by participant and line manager feedback on the extent of learning that has taken place. The measures of performance need to be taken both before and after the training event, to be able to assess gains in learning. (Tamkin, Yarnall & Kerrin, (2002). The scale for accessing the degree pf change to knowledge and skills was mentioned in chapter 2.2.1: CARE measurement scale. The scale was used as a pre-test and post-test and according to the fact that there was a low number of participants attending both courses, each question for each participant in pre-test and post-test was analyzed and compared. The questionnaire was designed as described in chapter 2.2 – types of questions based on quality with following values:

- Excellent = 5

- Very Good = 4

- Good = 3

- Fair = 2

- Poor = 1

4.2   Case study of traditional educational project

The goal of the institution was to access the project outcomes and understand the specifics of teaching clinical empathy in traditional or immersive environment. The institution provided the facilities and technical tools for the course.

There were 8 participants who enrolled to the project. They were divided into 2 groups: traditional course and immersive course. At the beginning of the course, all 4 participants completed an encounter with simulated patient (Test 1). Once the encounters were completed, the participants attended an hour-long lecture on clinical empathy which included watching one 2D video example of empathetic and non-empathetic doctor (the lecturer chose the scenario, therefore, there was no interactivity with the scenes). After the lecture, the participants continued with in interactive activity, where they watched doctor-patient scenes and made group decisions about the scene outcomes. Once all the videos were finished, each participant completed another simulated patient encounter. At the end of the project, the participants filled in the provided questionnaires and provided the lecturers with an interview.

Below is described the Level 1: Reaction that consists of in-depth semi-structured interviews, followed by questionnaires.

4.2.1   Level 1: Reaction and Traditional Tools

Questionnaire

Since there was a low number of participants attending the course, it is not the aim of this study to provide statistical conclusions. Instead, the questionnaires will be analyzed to provide an overall number or reactions which will be completed by the data acquired from interviews. Then the results will be compared to the results of immersive course.

	P2	P3	P6	P7	Total	Mean (%)		
CST1	4	4	3	4	15	3,75	Satisfaction (%)	4,125
CST2	5	5	3	5	18	4,5		
CST3	4	4	2	5	15	3,75	Engagement (%)	4
CST4	4	5	3	4	16	4		
CST5	5	4	4	4	17	4,25		
CST6	4	4	4	4	16	4		
CST7	5	5	4	4	18	4,5	Relevance (%)	4,5
CST8	4	3	3	4	14	3,5	Guidance (%)	3,5
CST9	5	4	4	5	18	4,5	Easiness (%)	4,5
CST10	5	4	4	5	18	4,5	Understanding (%)	4,5
CST11	4	3	2	4	13	3,25	Interactivity (%)	3,35
Total	49	45	36	48	178			
Mean (%)	4,5	4,1	3,3	4,4	4,1			

As for the data interpretation, the participants in overall agreed that they were satisfied with the course, they felt engaged during the educational activity, and the information/acquired skills were relevant. The participants also agreed that the technology was easy to use and they became to better understand clinical empathy. The numbers are neutral for the guidance and interactivity factors.

The analysis will now continue with interview technique. Once the interviews are described, the research can continue with further interpretation of the outcomes.

Interviews

There were 4 interviews conducted and as explained earlier in the research strategy, each interview was precisely coded. Once the coding system was created for each interview, the code categories were created:

1) Distractions

Codes included:

- Distraction
- Inability to focus

The participants described the experience with watching the videos as slightly distractive. As there was a small space for sitting and the projector was not placed in the center, the participants noted that they experienced difficulties with watching the video and some of them could not see it clearly. Participants 2 and 7 mentioned that they were disturbed by people who were passing by or by the lecturer who walked around.

2) Discussions

Codes included:

- Easy discussions

- Deciding about scenes

- Fast speed

- Teacher's guidance

All 4 participants mentioned that there was a short space for discussion in between each scene. There was not enough space for the participants to talk and when someone spoke, other participants did not want to interrupt the speech. Participants could not always express their opinions. On the other hand, the discussion was guided by the lector who described the objective of specific scene in case the participants did not contribute to the discussion. Therefore, they were provided with the "sense" of the scenes.

3) Scenes

Codes included:

- Repetitive scenes

- Interest

- Attention

There were for different outcomes (scenes) for every video. The participants mentioned that the videos were interesting at the beginning, however, when they kept watching similar scenes with different outcomes, they found it repetitive and did not pay as attention.

4) Clear objective of the video

- Clear message

- Expectations

- Preparedness for SP

As there was a lector asking specific questions about the videos *(How should the doctor react now?)*, the participants described the videos as understandable, providing a clear message. As there was a discussion after each scene, they

learned how to react to a certain type of patient which made them prepared for the second encounter with simulated patient.

4.2.2 Level 2 Learning and traditional tools

This subchapter analysis the CARE measure results before and after the completion of the course.

	Pre-test					Post-test			
	P2	**P3**	**P6**	**P7**		**P2**	**P3**	**P6**	**P7**
Q1	2	2	1	1	**Q1**	4	3	3	3
Q2	3	3	2	3	**Q2**	4	4	3	4
Q3	4	4	1	3	**Q3**	5	3	3	4
Q4	3	3	1	3	**Q4**	3	2	2	3
Q5	2	2	1	3	**Q5**	4	3	3	3
Q6	1	1	1	2	**Q6**	4	3	4	4
Q7	2	2	1	1	**Q7**	4	2	3	3
Q8	3	3	1	2	**Q8**	4	3	2	4
Q9	3	3	1	1	**Q9**	3	2	3	4
Q10	1	1	1	1	**Q10**	4	2	3	3
Total	**24**	**24**	**11**	**20**	**Total**	**39**	**27**	**29**	**35**
Median (%)	**2,4**	**2,4**	**1,1**	**2**	**Median (%)**	**3,9**	**2,7**	**2,9**	**3,5**

As displayed in the table above, all participants reached higher scores after completing the course where traditional teaching tools were used. The average improvement of the whole group in 1,28% and given the fact that the average score of the group before the competition was 1,97%, and 3,25% after the completion, the overall score of the groups changes from *"Fair"* into *"Good"*.

4.3 Case study of immersive educational project

As mentioned earlier, there were 8 participants who enrolled to the project. They were divided into 2 groups: traditional course and immersive course. Similarly to traditional course, all 4 participants in immersive course completed an encounter with simulated patient (Test 1), attended an hour-long lecture on clinical empathy which included watching one regular 2D video (traditional tool) example of empathetic and non-empathetic doctor. After the lecture, the participants continued with in interactive activity. They were provided with fully immersive virtual reality headset and haptic tools and watched interactive scenes individually. Once all the videos were finished, each participant completed another simulated patient encounter. At the end of the project, the participants filled in the provided questionnaires and provided the lecturers with an interview.

4.3.1 Level 1: Reaction and Immersive Tools

Questionnaire

The same approach of data analysis applied in the traditional case is applied in the immersive case. Therefore, an overall number or reactions will be provided and then completed by the data acquired from interviews. Finally, both educational courses will be compared.

	P1	P4	P5	P8	Total	Mean (%)		
CST1	4	4	4	5	17	4,25	Satisfaction (%)	4,1
CST2	3	5	3	5	16	4		
CST3	5	5	4	5	19	4,75	Engagement (%)	3,2
CST4	5	5	4	5	19	4,75		
CST5	3	4	2	4	13	3,25		
CST6	3	4	2	5	13	3,25		
CST7	5	4	4	5	18	4,5	Relevance (%)	4,5
CST8	5	4	3	5	17	4,25	Guidance (%)	4,25
CST9	3	3	3	5	14	3,5	Easiness (%)	3,5
CST10	5	4	4	5	18	4,5	Understanding (%)	4,5
CST11	5	4	4	5	18	4,5	Interactivity (%)	4,5
Total	46	46	37	53	182			
Mean (%)	4,1	4,1	3,4	4,8	4,1			

According to the table above, the participants in overall agreed that they were satisfied with the course, however they felt neutral about the engagement. The course was found to provide skills which can be applied at work or school after the completion of the course. The participants agreed that there was enough guidance, the course allowed them to learn clinical empathy, and they found the course to be interactive, however, they did not agree that the teaching tools were easy to use.

The analysis will now continue with interview technique. Once the interviews are described, the research can continue with further interpretation of the outcomes.

Interviews

There were 4 interviews conducted and as explained earlier in the research strategy, each interview was precisely coded. Once the coding system was created for each interview, the code categories were created:

1) Advantages of immersive teaching tools

Included codes:

- projection of self to another person
- immediate experience
- being real
- engagement
- new technology
- interactivity

The respondents described the advantages of immersive tools as enjoyable experience that provides them with "something real" or "real clinical settings", they can project themselves into the scene and feel as it is a real experience. Participants mentioned that once they got used to the technology, it was fun and engaging.

2) Limits of immersive environments

Included codes:

- technical issues

- confusion

- guidance

All respondents mentioned technical issue with the immersive tool, most of them described it as "being stuck". The technical issues caused that the lecturers were not able to assist the participants and provide them with enough guidance. At first, the participants described the tool as "confusing" as it was a new technology and they needed time to adapt.

3) Differences and combination of tools

Included codes:

- practical experience

- theoretical knowledge

- preparation for VR

- video instruction

- immersion

During the lecture part of the immersive course, the participants watched traditional 2D video, therefore, some of them compared their experience with the two tools. The respondents perceived the first non-immersive video as the preparation stage for immersive experience and they described it as gaining theoretical knowledge, instructions or learning stage in the traditional 2D video, and receiving practical experience in immersive video, where the participants could actually try what they learned from the traditional video.

4) Discussion

Included codes:

- advantages and disadvantages of discussion
- working individually
- sharing opinions

The participants were asked about the chance to actively participate during the course. In the immersive course, the participants described their experience as working individually, whereas the traditional video case at the beginning of the course provided them with a discussion. Participant 8 described the lack of discussion in immersive environment as a shortage as the learners could not share their opinions, however it was also described as an advantage as the discussion was not as constructive as expected. In overall, the learners perceived the lack of discussion as both advantage and disadvantage, as they could avoid confronting situation, however, they did not get other learners' perspectives on what was being taught.

5) Score results
- feedback
- game
- score chart

The participants were able to see their results through virtual score chart which was accessible during the immersive activity. Participants perceived the tasks as easy, however, the feedback in form of score chart made them feel like they were playing a game and they were not afraid of negative results as they could try again.

An example of coding system for one of the participants from immersive course is displayed below:

1 **What is your participation number?**

2 It's number 1. *(VR case)*

3 **Can you please tell me about your experience, how did you like the course?**

4 Yeah, so as a medical student, well, not really medical, but from the medical background, I think it is
5 quite an interesting area to work on in the future, because for example, I study dentistry, that VR, that
6 would be really nice if I can use that and apply it to, you know, like a swallowing, or thing like that, so
7 that would help us to learn more, because in most of the situations, we just look at video, and then,
8 this is like a really good experience. In VR, we mainly focus on what we can visualize, but for the video
9 case, when we watched it at the beginning, you can actually presence the whole scenario for the
10 student as an educational material and moderate it, so in this regards I think the video was better for
11 the practise, like you create a scenario, what would you do, something like that. But VR would be like
12 okay, this is where I can actually apply it VR, so the was like the preparation material at first to explain
13 the overall sense of the scenes and what to do with them, and then VR was great because you actually
14 practised this.

15 **Can you tell me more about working with VR?**

16 I think it took me some time to figure out what to do, but I think that's normal with this technology,
17 for the beginner definitely. If I just tried the VR without seeing the video first I would be confused for
18 the first attempt because of how immediate straight away experience it is. But I recon it would be just
19 like the first or first two attempts and then after I would say, okay I get it and I got used to it, and then
20 I would quite enjoy that. But definitely because this is a new technology, so like for the first time, I'd
21 be like, oh, I am so confused, I do not know how to do it. And not only the VR but the scenes were
22 interesting too and it made me feel way closer to the patients, especially funny was when I was close
23 to the mean guy, the doctor, that was funny… Because the video, it's just a really basic material to
24 learn but VR, you really experience the whole, even you know it's not real but of that technology, you
25 feel like Oh I actually get into that environment.

26 **At the beginning you said that 2D might be better but now it seems like the VR is?...**

27 I think it could be the combination. So like 2D would prepare you for this skill but with the VR it's like
28 okay, I can use these skills and I can do this one. Because with video, it's just like you look at that and
29 then I have this option and this is what I would do, but you would not get to do that in person. For
30 learning, for students, I would definitely choose VR, because it's more fun, but especially for the
31 medical or health science related profession, sometimes, the course is kind of boring, because you
32 spend a lot of time studying something like that and then even like the videos, like the scenarios would
33 you choose – it's so basic, but for VR it's like wow this is so new and you can play with it, decide on
34 your own with your time… Hmm but actually, yeah, the time made me little bit nervous in VR because
35 I wasn't able to track it and I wasn't sure if I should just take the headset off. But other than that I
36 think I could choose the outcomes of the scenes on my own and that kind of brough me to that aha
37 moment.

38 **Can you tell me more about the activity on your own? Is this something that you prefer or…**

39 I think that was nice because usually we are all together. Like with the video, it's a bit awkward
40 because the students here are quite shy so when you are supposed to share your thoughts, it usually
41 goes really slow or you don't want to interrupt anyone if they talk, I think in general here people don't
42 really open up so if you ask them what they think, they just try to avoid the discomfort of getting
43 attention by answering something very general. Like it was useful for the video anyway, because
44 Daniel was kind of in charge and he navigated us so we still talked about the videos and discussed
45 what we did or didn't notice. Well and VR that was way more comfortable because you could do it on
46 your own but I think we didn't really get too much attention from you guys because there were
47 technical issues and when it happens *(laugh)* is happens in the worst moment. The VR sometimes
48 didn't work so much, I personally didn't have many problems, but I noticed someone else had and
49 then when we needed to ask for something, especially at the beginning when you don't know what
50 to do, it was a bit inconvenient when you guys weren't around.

51 **How was your learning of clinical empathy?**

52 That was taught during the lecture, I think that the combination of this theory and then the real
53 practise in VR made a really good match because at first you can learn about it and then try it straight
54 away. The clinical empathy lecture was really nice because we actually don't get to learn about this at
55 school and I liked the video example but I told you about it before, because that gave us a good
56 preparation for the VR. I think that all this info that Daniel told us, about expressing empathy or how
57 to do it so you can make the patient feel more comfortable but you are not swallowed by his feelings
58 and I think that it helped when the presentation showed us the empathy points so then I could actually
59 notice them in VR and see how they change with different outcomes, that was cool, I think it really
60 helped for the second simulated patient because my first attempt was a complete fail *(laugh)* but this
61 helped.

62 **Did you get a feedback on your performance in VR?**

63 No I don't think there… Oh actually there was the chart in VR, true… So when you chose the right, I
64 mean empathetic, outcome, it gave you the highest score but if you chose something wrong it gave
65 you the lowest. I think the feedback chart was cool I felt like I was in a game, like it wasn't really hard
66 to solve and even if you chose incorrectly, you had a chance to try it again so that actually helped to
67 go through it again. But yeah every time I got the 100 score I felt like yeey, I guessed right *(laugh)*. No
68 but honestly I really enjoyed the whole thing.

Margin comments (Kimlova Lucie):
- Ideas for future implications
- Good experience with VR meant greater learning
- Audiovisual teaching tools were not complemented by other tools, targeting visual experience
- Whole scenario you can moderate – guidance
- Practical skills
- Video – instruction, VR – practise
- Technically difficult for first time users, confusion
- Providing immediate experience
- Immersion – closer to the patient
- Immersion
- Video – instruction
- VR – providing practical experience
- VR enhances engagement, it adds something interactive to a boring lecture
- Interactivity
- Negative effects of VR
- Could not track the time
- Interactivity
- 2D: disadvantages and advantages of discussion
- guidance
- not much guidance
- technical issues
- confusion
- not much guidance
- theoretical knowledge
- practical knowledge
- lecture – good preparation for VR – combination of tools is an advantage
- lecture – good preparation for VR – combination of tools is an advantage
- interactivity
- feedback! – game (engagement?)
- referring back to theory, you can try many times and know it's okay if fail

Further interpretation of described results is provided at the end of the chapter.

4.3.2 Level 2: Learning and immersive tools

This subchapter analysis the CARE measure results before and after the completion of the course.

	Pre-test					Post-test			
	P1	**P4**	**P5**	**P8**		**P1**	**P4**	**P5**	**P8**
Q1	2	4	2	2	**Q1**	5	4	4	5
Q2	2	4	2	3	**Q2**	4	4	4	4
Q3	2	3	1	4	**Q3**	5	5	5	5
Q4	2	3	2	3	**Q4**	5	3	4	4
Q5	1	2	1	2	**Q5**	5	5	4	5
Q6	1	2	1	2	**Q6**	5	4	4	5
Q7	2	1	2	2	**Q7**	5	5	5	4
Q8	1	2	1	3	**Q8**	5	4	4	5
Q9	1	2	1	1	**Q9**	4	5	4	5
Q10	1	2	2	2	**Q10**	5	5	5	5
Total	15	25	15	24	**Total**	48	44	43	47
Median (%)	1,5	2,5	1,5	2,4	**Median (%)**	4,8	4,4	4,3	4,7

According to the table, all participants reached higher scores after completing the course where immersive teaching tools were used. The average improvement of the whole group in 2,5%, and given the fact that the average score of the group before the competition was 1,97%, and 4,55% after the

completion, the overall score of the groups changes from *"Fair"* in between *"Very Good"* and *"excellent"*.

4.4   Project Conclusion and Discussion

As the data was analyzed in the research strategy chapter of this study, the conclusion can be made. Referring to the Level 1: Reaction of the analyzed courses, both immersive and traditional courses had advantages and limits. Based on the interviews with participants, the traditional course provided the learners with greater guidance, as in the immersive course, the participants experienced technical issues with the technology which was discussed earlier in chapter 1.5. As it is apparent from the interviews, the participants who attended the traditional course mentioned that the video cases were clear which provided them with better understanding of the scenes objectives, moreover, they expressed that they felt ready for the encounter with simulated patient. On the other hand, immersive course was, according to participant, confusing at the beginning as they needed to get adapted to the new technology. As for the advantages of immersive teaching course, the participants described the course as funny, they felt immersed in the environment and they had an opportunity to interact within the environment. For the participants from the traditional teaching course, the interaction was provided by discussions, however, at some moments the participants were hesitant to participate and the discussion needed to be guided by the lector. As for the first research question of this research *What are the participants' reactions according to level 1 of Kirkpatrick's model in traditional teaching environment?* The answer was provided by the questionnaires and interviews described earlier. The participants reactions were as follows: the course was satisfying, engaging and relevant, allowing the participants to understand the objectives of the video cases and join the discussion, however, the participants

felt distracted during the course. To answer the second research questions *What are the participants' reactions according to level 1 of Kirkpatrick's model in immersive teaching environment?* The answer is that according to the questionnaire of Level 1, the participants also felt that the course was satisfying, engaging and relevant, allowing the participants to experience full immersion and interact within the environment. The participants also described the limits of the course as a lack of discussion, technical issues and confusion. The third question was *What were the differences of achieved scores in immersive and traditional courses according to Kirkpatrick's model level 2?* The differences were mainly in the improvement of achieved scores. The participants in the traditional course improved from *fair* into *good* on the scale which is an improvement of 1 point. The participants who attended the immersive course improved from *fair* into *very good* and *excellent*. Therefore, the conclusion of this research is that on the learning level of Kirkpatrick, the participants achieved better score of improvement, however, on the reaction level, the participants mentioned advantages and limits to both teaching tools.

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